Mining and processing of the Stránská skála-type chert during the Late Neolithic and Early Eneolithic periods

Těžba a zpracovávání rohovce typu Stránská skála v období mladého neolitu až starého eneolitu

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Stránská skála represents an important geological and archaeological site. It is also known for its rich deposits of Jurassic cherts that were utilized in various ways during different stages of Moravian prehistory. The substantial Early Upper Paleolithic occupation events are of great significance and have been subject to several international research projects. Archaeological excavations targeting mining and workshop areas were resumed in the last years with a focus on Late Neolithic and Early Eneolithic activities. This paper introduces this project and summarizes recent results. Trends in the chipped industry within the Stránská skála workshop area are outlined, focusing on raw material variability, technology-typology, chronology, and socioeconomic aspects. The first indicators of the location and other aspects of post-Paleolithic mining activities in the field of Stránská skála III are introduced and discussed in the context of mining and workshop activities of similar contemporary features in the Czech Republic and neighboring regions.

Moravia – Lengyel culture – Funnel Beaker culture – chert mining – workshop – chipped industry

Stránská skála představuje významnou geologickou a archeologickou lokalitu známou také jako bohatý zdroj jurských rohovců, které byly různou měrou využívány po velkou část moravského pravěku. V několika posledních letech byl obnoven výzkum těžebního a dílenského areálu na Stránské skále, a to především se zaměřením na poznání těchto aktivit v mladém neolitu až starém eneolitu. Studie přibližuje výsledky prvních výzkumných sezón projektu. Nastíněn je zde vývoj štípaných industrií z dílenského areálu, a to jak z pohledu surovinové variability místních rohovců, tak z hlediska technologicko-typologických, chronologických a socio-ekonomických aspektů. Představeny jsou rovněž první indicie týkající se lokalizace a charakteru post-paleolitické těžby rohovců v poloze Stránská skála III, jež jsou zasazeny do kontextu obdobně datovaných težebních a dílenských areálů v českých zemích a okolí.

Morava – lengyelská kultura – kultura nálevkovitých pohárů – těžba rohovců – dílenský areál – štípaná industrie

1. Introduction

Stránská skála is one of the most important natural, geological, and archaeological sites in southern Moravia. It is located in the eastern part of the city of Brno, on the cadastral territory of Slatina (*fig. 1*). Geomorphologically, it represents one of the elevations flanking the eastern margin of the Brno Basin. While the southern part of the elevation is characterized by a gently rising slope, the northern and northwestern sections are formed by a steep rocky cliff. Geologically, Stránská skála is an isolated denudation relict of Jurassic limestone which contains nodules of chert known as the Stránská skála-type (*Přichystal 1987*; *2009*). The Stránská skála elevation and its lithic resources attracted humans from very early on as an important place for habitation and raw material exploitation of siliceous rocks

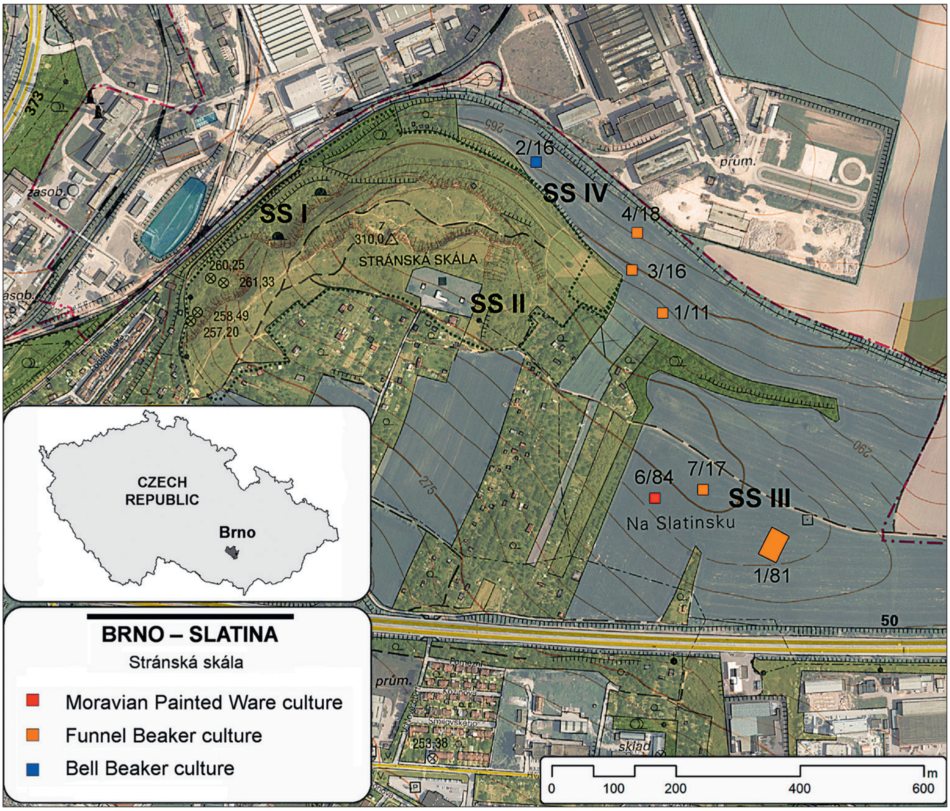


Fig. 1. Planigraphy of the Stránská skála and locations of currently excavated prehistoric sunken features.
Obr. 1. Planigrafie Stránské skály a lokalizace doposud zkoumaných pravěkých objektů.

(i.e. Stránská skála-type chert) during prehistory. The limestone was also quarried for building stone and lime during the medieval period and later (including crinoidal limestone utilized for building and ornamental stone; *Koutek 1926*; *Přichystal 1987*; *2009*; *Svoboda 2001*, 21–23). The first people who probably utilized both the geographic setting and the local lithic resources were Lower Paleolithic hunters who occupied a cave on a slope below the northwestern cliff (above the Svitava River paleochannel) of the Stránská skála rock (*Valoch 1987*; *1995*; *2003*). No human occupation has been detected at Stránská skála during the Middle Paleolithic period, however during the Middle to Upper Paleolithic transition (or Initial Upper Paleolithic period), the local cherts were intensely exploited by the Bohunician people (both specialized lithic workshop sites and habitation sites: e.g. *Valoch – Nerudová – Neruda 2000*; *Svoboda – Bar-Yosef eds. 2003*; *Svoboda 1987a*; *1987b*; *Škrdla 2017*). The significance and utilization of the local chert continued during the Early Upper Paleolithic with Aurignacian lithic workshops (*Valoch 1954*; *Svoboda – Bar-Yosef eds. 2003*; *Svoboda 1987a*; *1987b*; *Škrdla 2017*). During the Initial and Upper Paleolithic periods, Stránská skála chert was used as the principal raw material for the larger territory of the Brno Basin and its surrounds (*Svoboda 1987a*; *Škrdla et al. 2016*; *Škrdla 2017*). At Stránská skála IIa, Late Aurignacian artefacts stratigraphically located in the lower part of the loess layer overlie the Middle Aurignacian horizon (*Svoboda 1991*). Although the Stránská skála limestone cuesta attracted epi-Gravettian hunters who probably utilized its landform shape in their hunting strategy (*Svoboda 1991*), they appear not to have used the local chert. In terms of its Early Upper Palaeolithic occupation, Stránská skála has been the focus of several international PhD research projects and it is one of the richest and most important sites in Europe that has made a vital contribution to our current understanding of this period.

People began to utilize the local cherts again at the end of the Neolithic period (Lengyel culture). *J. Svoboda* (*1985b*; *2001*, 23) discovered and excavated half of a large sunken feature in 1984. One half of the remaining portion of this feature was re-excavated recently and dated to an earlier phase of the Moravian Painted Ware culture. The site was most intensively exploited (in terms of area size and volume of exploited lithic material) during the Eneolithic – i.e. Funnel Beaker culture (*fig. 1*). The rescue excavation of a large sunken structure disturbed by water pipeline construction was realized during 1981–1982 (*Čižmářová – Rakovský 1983*; *Svoboda – Čižmářová 1984*; *Svoboda – Šmíd 1996*). The excavated structure was rich in lithics (products from all reduction stages) and therefore interpreted as a primary workshop. Another Neolithic/Eneolithic sunken feature at Stránská skála III was discovered nearby in 1983 (*Svoboda 1985b*). The excavation of a recent test pit confirmed this feature to be the second large sunken Funnel Beaker culture feature (*Bartík et al. 2018b*, 145–146). Additional Early Eneolithic sunken features were discovered on the northern slope of the Stránská skála elevation (site IV) in 2011, 2016 and 2018 (*fig. 1*). Evidences of Neolithic/Early Eneolithic activities are known also from the central part of Stránská skála (Site II; surface collections of K. Valoch and R. Ondráček) and its southwestern slope (Site Podstránská Street; *Přichystal 1984*, 19).

People also returned to Stránská skála at the end of the Eneolithic period; a Bell Beaker sunken feature was excavated in the field below the northern cliff in 2016 (site IV). Preliminary results indicate extraction of low-quality cherts from the scree just above the site (*Bartík et al. 2018a*).

A new project by the Institute of Archaeology in Brno began in 2016 and aims to investigate the remains of mining and workshop activities in the course of exploitation of the Stránská skála-type chert during the Neolithic and Eneolithic periods. This is the first article introducing this project; preliminary results concerning Stránská skála-type chert exploitation during Lengyel and Funnel Beaker cultures are presented.

2. Methods

Extensive surface surveys realized by PŠ and AP beginning in the 1980s were aimed not only at collecting lithics but also at documenting the spatial distribution of finds and understanding the prehistoric chert extraction methods. Although the surface extent of the lithic cluster was successfully documented and several important finds were collected (e.g. FBC hammer axe, *Škrdla – Šebela 2003*), the artefacts relating to chert mining (extraction tools) are rare. The only evidence of possible extraction and primary processing was an area north of the Lengyel culture sunken feature, where the field surface consists of shallow depressions surrounded by clusters of limestone scree and chert artefacts in early stages of reduction (raw material with several flake negatives, cortical flakes, prepared and abandoned cores).

The most promising area of site III was surveyed using geophysical methods. The first geophysical survey aimed to document the thickness of loessic sediments and mapping the bedrock surface. Methods used include dipole electromagnetic profiling (DEMP), vertical electrical sounding (VES), and ground penetrating radar (GPR; *Hašek – Dostál – Tomešek 1998*). A subsequent geomagnetic survey attempted to identify archaeological sunken features and mapping of an area known from surface surveys as a possible extraction place (*Milo – Tencer 2017*). The authors identified several positive anomalies – possible archaeological sunken features – and subsurface dissimilarities in the area of the expected lithic extraction. One of the anomalies (the same as documented by *Svoboda 1985b*) and two areas within the identified subsurface dissimilarities were selected for test pitting.

The 1980s excavations were conducted using methodology typical for the time – mostly shovelling of the sunken feature infill, with small tools used only for selected situations. Excavated sediments were not sieved.

Since 2016, we significantly improved the excavation methodology. Excavation was organized into units and individual spits. All excavated material from the sunken feature was wet-sieved. A significantly greater number of small finds were collected using this process, which also permitted a detailed study of the lithic reduction processes.

3. Lengyel culture

3.1. History of research

The Neolithic occupation of the Stránská skála hillside was documented during J. Svoboda's survey in 1983 (*Svoboda 1985a*). Two of the trenches (test pits 3 and 4) dug by a mechanical scraper disturbed sunken features which produced non-patinated lithics and pottery sherds. Subsequently, J. Svoboda enlarged test pit 4 (10 × 10 m) in 1984 and excavated Paleolithic site SS-IIIa (*Svoboda 1985b*; *1987b*) and one half of a large sunken feature (up to 5 m in diameter) that yielded a collection of lithics and characteristic Lengyel pottery. At the bottom of the sunken feature, a hearth and a child burial were discovered (*Svoboda 1987b*, 11; *2001*, 23). The material from J. Svoboda's excavations was going to be analyzed and published (cf. *Svoboda 1985a*), however, the researchers who possessed the material (I. Rakovský and P. Koštuřík) passed away and most of the excavated material is currently reported as missing. Currently, the only materials available for study are the lithics from the sunken feature excavated in 1984 (SS-IIIa). In addition, A. Přichystal, P. Škrdla and J. Bartík collected an assemblage of surface artefacts from this area. One of the most important finds is a possible zoomorphic sculpture knapped from a local chert (*Přichystal 2019*).

The state of art as described above justified a revision excavation. In order to clarify the documented Neolithic occupation in more detail (radiocarbon dating, identification of individual phases within the Neolithic timeline, raw material, technological and typological analyses of lithics), another quarter of the SS-III sunken feature (southwestern) was excavated in 2017 (*Bartík et al. 2018b*, 145–146). The northwestern quarter was left untouched for future excavations.

The 2017 trench (S2/17) was 250 × 220 cm in size (*fig. 2*) reaching the bottom of the sunken feature at a depth of 122 cm. Visual examination of two perpendicular profiles

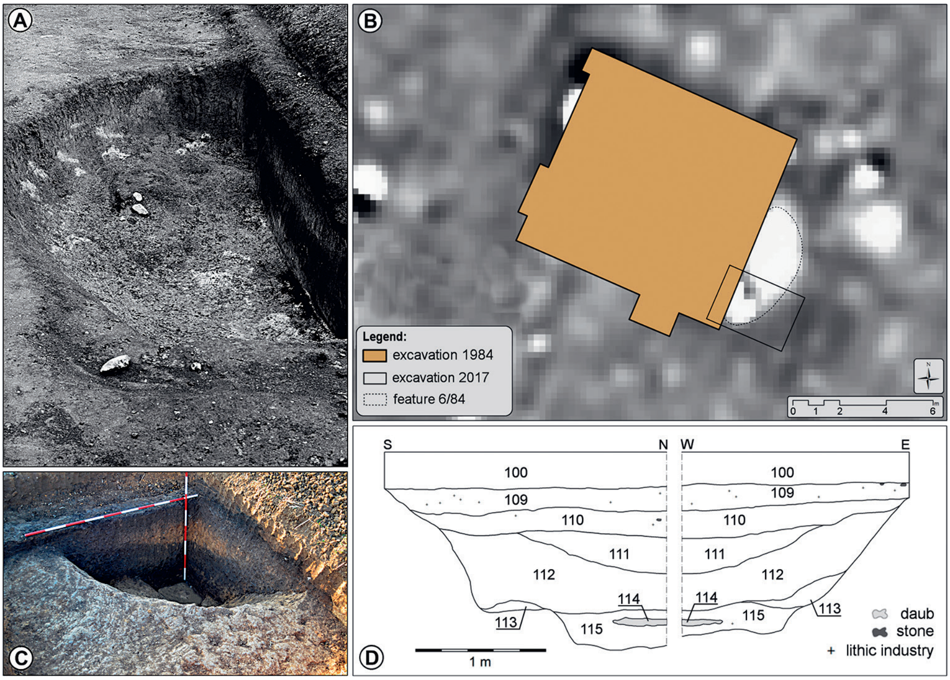


Fig. 2. The Lengyel culture feature No. 6/84. A – a view of the western part of a sunken feature excavated in 1984 (Archive of the Institute of Archaeology in Brno); B – location of the test pit No. 2/17 in the context of earlier excavation and a geophysical survey; C – a view of the south-eastern part of sunken feature excavated in 2017; D – stratigraphy of the infill.
Obr. 2. Objekt kulrury s moravskou malovanou keramikou 6/84. A – pohled na západní polovinu objektu zkoumanou v roce 1984 (archív ARÚB); B – poloha revizní sondy 2/17 v kontextu staršího výzkumu a geofyzikální prospekce; C – pohled na jihovýchodní část objektu zkoumanou v roce 2017; D – stratigrafie výplně.

allowed identification of seven separate, macroscopically distinct stratigraphic contexts. The top of the profile consisted of a 25–30 cm thick layer of plough soil (c. 100). The underlying thin, grayish-black layer was rich in archaeological finds (c. 109). The next layer (c. 110) was light grayish-brown with occasional limestone pieces. Interstratified by a wedge of soil mixed with loess ochre-yellow in color (c. 111) was dark brownish-gray sediment which accounted for bulk of the stratigraphy (c. 112). At the bottom was a dark brownish-black sediment (c. 113) and several loess lenses – possibly a collapsed wall. A 6–10 cm thick band of burnt orange clay was observed 18 cm above the bottom. The 2017 trench did not document the extent of a hearth excavated in 1984. The pit walls are conically narrowed from top to bottom with a step before the lowermost layer that is rich in charcoal (c. 115). The bottom is irregular. The prevailing part of archaeological finds was distributed within the upper part of profile and the density of finds decrease with increasing depth. Contexts 111, 113, and 114 were sterile. The finds are summarized in *tab. 1*. Several hundred lithic artefacts were obtained from wet-sieving of the sunken feature sediment infill.

In contrast to the 1984 excavation, the 2017 excavation yielded a significantly smaller amount of non-lithic material such as pottery. The 2017 pottery collection consists of

Context	Chipped industry	Pottery	Daub	Animal osteological material	Stone macrolithic tools	Stone manuports	∑
109	483	48	4	10	3	3	**551**
110	63	7	–	–	2	2	**74**
112	24	8	–	–	3	–	**35**
115	7	2	–	–	–	–	**9**
∑	**577**	**65**	**4**	**10**	**8**	**5**	**669**

Tab. 1. Distribution of archaeological materials within structure No. 6/84 infill (excavation 2017).
Tab. 1. Distribuce archeologického materiálu ve výplni objektu 6/84 (výzkum 2017).

mostly undiagnostic fragments with body fragments being most common. Only two fragments are considered significant: one with a rounded rim and a small body fragment with an indistinct, slightly flat lug. Small lumps of daub were also recovered.

Other finds include an amorphous fragment and a massive flake, both from Želešice-type metabasite. Also, quartz pebbles were used as small hammers or abrasion stones (8 pieces including the fragments). These quartz pebbles were probably used for dorsal abrasion (i.e. abrasion of a sharp edge between the core platform and the core frontal surface) before artefact removals that are visible on the artefact butts. Other finds include several small bone fragments and limestone flakes. A silicified fossil brachiopod identified as *Rhynchonella* is an interesting find. It was collected on the nearby limestone outcrops, or separated from the parent rock during the knapping process.

White patinated artefacts from disturbed Paleolithic layers (where the bottom of the sunken feature bordered the interpleniglacial soil, cf. *Svoboda 1987a*) were identified in the sunken feature infill (55 items).

As mentioned previously, the pottery from the 1984 excavation is currently unavailable for study and the material from 2017 only has undiagnostic pottery sherds so antiquity of the sunken feature cannot be determined by relative chronology. A charcoal sample collected from the bottom of the sunken feature (c. 115) produced a date of 5,740 ±40 BP (Poz-105553) placing the Lengyel occupation to the end of phase I of the Moravian Painted Ware culture (cf. *Kuča et al. 2012*).

3.2. Lengyel culture lithic industry

3.2.1. Raw material

While the 1984 excavation yielded a collection of 172 lithics, the 2017 excavation resulted in a collection of 577 lithics (*tab. 1*). The volume of excavated sediment in 1984 was double that of 2017. This disproportionate difference in yield reflects different excavation techniques (wet sieving of all excavated sediments in 2017). All artefacts were produced from local chert. Although 45 artefacts were burnt (6 % of assemblage), the characteristic features (banding, crinoids, cortex) confirm they are from the local chert. The range of individual chert sub-types based on *A. Přichystal*'s (*1987*; *2009*) division indicates the presence of almost all defined varieties. The dominant sub-type is olive-gray colored variety A with a coarse white cortex, followed by non-banded gray to bluish-gray variety D. Nine pieces were of the ocher-yellow variety E, often banded, and one piece of the red colored variety F.

No.	Technological categories	Excavation 1984 without contexts	Excavation 2017 contexts					TOTAL 1984+ 2017	%
		∑	109	110	112	115	∑		
1a	raw material	–	–	–	–	–	–	–	–
1b	raw material with testing scars	–	1	–	–	–	1	1	0.1
	∑ I	**–**	**1**	**–**	**–**	**–**	**1**	**1**	**0.1**
2a	first blank	1	–	1	–	–	1	2	0.3
2b	massive blank	2	1	–	–	–	1	3	0.4
2c	cortical blank	6	14	1	–	–	15	21	2.8
2d	blank with cortex part	13	45	6	–	–	51	64	8.5
2e	crested flake from core	1	2	1	–	–	3	4	0.5
2f	crested blade from core	–	4	–	–	–	4	4	0.5
2g	undercrested flake	–	–	–	–	–	–	–	–
2h	undercrested blade	–	1	–	–	–	1	1	0.1
2ch	trimming blade	–	–	–	–	–	–	–	–
2i	trimming flake	9	14	4	–	–	18	27	3.6
2j	pre-core	–	–	–	–	–	–	–	–
2k	prepared core	–	–	–	–	–	–	–	–
	∑ II	**32**	**81**	**13**	**–**	**–**	**94**	**126**	**16.7**
3a	reduced core	–	1	–	–	–	1	1	0.1
3b	flake with lateral cortex	–	5	–	–	–	5	5	0.7
3c	blade with lateral cortex	3	2	2	–	–	4	7	0.9
3d	microblade with lateral cortex	–	–	1	–	–	1	1	0.1
3e	final flake	4	27	4	2	–	33	37	4.9
3f	final blade	2	5	3	–	–	8	10	1.4
3g	final micro-blade	4	21	1	2	–	24	28	3.7
3h	outrepassé	–	–	–	–	–	–	–	–
	∑ III	**13**	**61**	**11**	**4**	**–**	**76**	**89**	**11.8**
4a	blank rejuvenating flaking surface	1	2	2	–	–	4	5	0.7
4b	blank rejuvenating striking platform	–	3	–	–	–	3	3	0.4
4c	secondary crested blade from core	–	–	–	–	–	–	–	–
	∑ IV	**1**	**5**	**2**	**–**	**–**	**7**	**8**	**1.1**
5a	remnant core	7	19	1	–	–	20	27	3.6
5b	core fragment	1	10	–	–	–	10	11	1.5
5c	blank fragments	106	145	21	10	1	177	283	37.9
5d	chips	12	161	15	10	6	192	204	27.3
5e	splinters	–	–	–	–	–	–	–	–
	∑ V	**126**	**335**	**37**	**20**	**7**	**399**	**525**	**70.3**
	TOTAL	**172**	**483**	**63**	**24**	**7**	**577**	**749**	**100**

Tab. 2. Dynamic clasification of the technological phases within the Lengyel culture lithic industry from feature No. 6/84.
Tab. 2. Dynamická klasifikace technologických stádií štípané industrie v objektu lengyelské kultury 6/84.

3.2.2. Technology

Technological analysis (*tab. 2*) suggests workshop elements e.g. high proportion of waste products (70.10 %) and core preparation products (16.81 %). The waste category includes amorphous raw material fragments, flake fragments, and small debris (microchips and microfragments) recovered during wet-sieving. Exhausted cores (27 items) and core

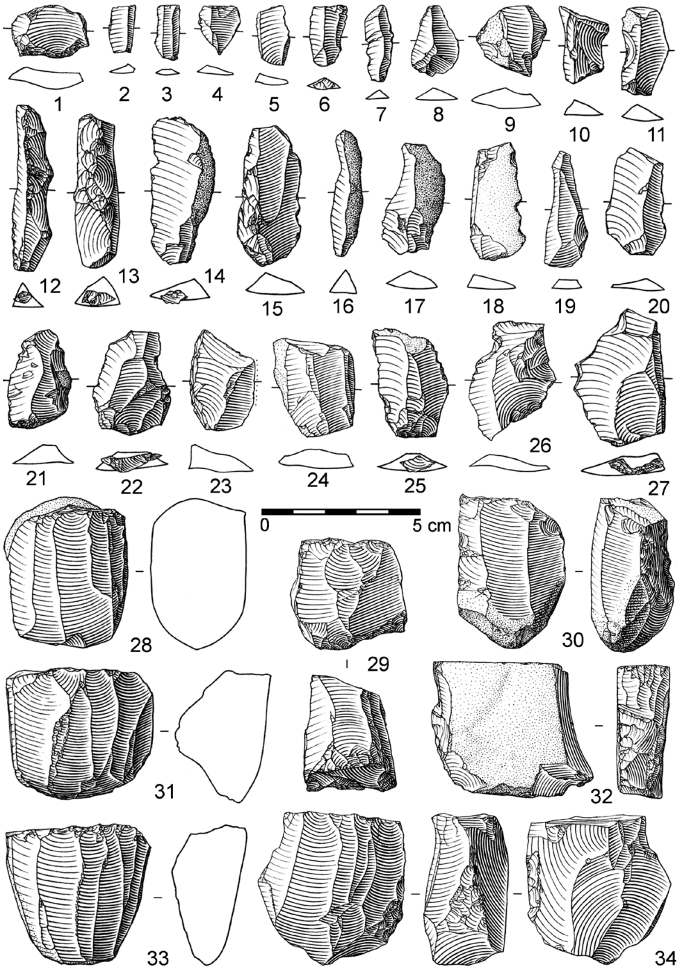


Fig. 3. Selected chipped artefacts from the Lengyel culture feature No. 6/84.
Obr. 3. Vybrané štípané artefakty z objektu lengyelské kultury 6/84.

fragments (11 items) are also included in the waste category. The information gleaned from these core artefacts made it possible to piece together the technology and to define the target products. The prevailing type (with several exceptions – pyramidal to prismatic) is a single platform (unipolar) boat-shaped core (*fig. 3*). The negative scars of final removals visible on the front (production) surface indicate that blades or microblades were the target products. While most of the cores show core back preparation (decortification), the cortical back was documented only on several (often very flat) cores. The frontal (production) core face was wide and shows 5 to 7 blade negatives. Another core type present is made on a thin plate (not nodule) and reduced from two narrow edges (*fig. 3: 32*). A similar technique is known from Bavaria and adjacent regions, where it was applied to Arnhofen type plate cherts (*Weining 1989*; *Binsteiner 1990*; *Burgert – Kapustka – Beneš 2018*). The core preparation products include decortification flakes, both fully cortical and semi-cortical, frequently occurring non-cortical flakes from different stages of production, and crested blades and flakes that indicate the use of the frontal crest preparation technique.

The proportion of (expected) target blanks (7.33 %) supports the workshop hypothesis. The production of large, straight blades is supported by corresponding negatives on cores. They were transported off-site as the target products – this is consistent with our hypothesis of workshop activities. Only a small number (often broken items, smaller items and blades with lateral cortex) were found in the sunken feature infill – probably discarded waste or the result of post-depositional processes (*tab. 2*). There were twice as many smaller microblades (<10 mm in width) as blades (29 : 17). Only 8 blades/microblades were complete. All other items were fragments. Most blade fragments were either originally longer blades with broken distal tips, or short proximal blade fragments. Detailed metrical analysis was not possible due to the high degree of breakage. An indirect method for examining the metrical characteristic of target products is measuring their negatives on cores. In this case, the cores are often exhausted and the negatives on their surfaces are negatives of the latest removals which are probably smaller than the flakes removed earlier. The average length is 39.8 mm (min: 30 mm, max: 52 mm) and average width is 10.7 mm (min: 5 mm, max: 19 mm). A small group of flakes are probably preparation or secondary products.

We can conclude that the Lengyel culture technology at this site can be described as oriented towards the production of blades from single platform cores that are triangular (boat-shaped) to prismatic in shape. The cores often possess a frontal crest and were often decorticated. The high proportion of regular blades with relatively large flat butts, semicircular shaped on their ventral surface, indicates indirect percussion with hard organic material punch (*Inizan et al. 1999*). Blade regularity is related to the aplication of dorsal reduction/abrasion determined on 25 % of target products. Small quartz pebbles were probably used for dorsal abrasion – one such complete item was discovered in the upper part of the infill.

3.2.3. Typology

The number of tools is small (9 items, 1.2 %). With the exception of two items – a wedge-shaped core reutilized for a side scraper and a laterally retouched blade (on its ventral side; *fig. 3: 14*) – the tools were made on flake blanks. They include a notch on a preparation flake (*fig. 3: 26*), two bilaterally retouched flakes (one of them triangular in shape; *fig. 3: 8*), an atypical flake end scraper (*fig. 3: 1*), a small flake end scraper with a partly broken off retouched fragment, a small flake fragment with a slight truncation (*fig. 3: 4*), and a laterally retouched flake (*fig. 3: 25*). The retouched tools also include artefacts with traces of utilization including a partly retouched flake and a flake with indistinct sickle gloss (*fig. 3: 23*).

4. Funnel Beaker culture

4.1. History of research

The hilltop site labeled Stránská skála III is situated in a large field with adjacent gardens at the summit of Stránská skála. The surface artefact cluster covers an area of 0.1 km^2. The Funnel Beaker culture site at Stránská skála III was discovered in a trench dug for water pipeline construction. Subsequently a large sunken feature was excavated over two seasons in 1981 and 1982 (*Čižmářová – Rakovský 1983*; *Svoboda – Čižmářová 1984*).

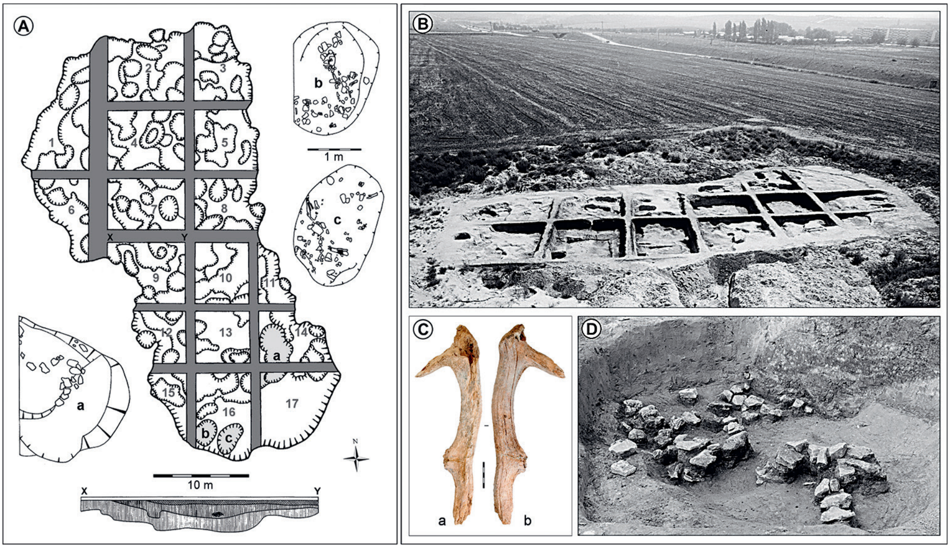


Fig. 4. Funnel Beaker culture feature 1/81. A – stratigraphy and field documentation; a–c – workshop features (modified after *Svoboda – Šmíd 1996*); B – a feature after excavation in 1982 (Archive of the Institute of Archaeology in Brno); C – a selected antler pick; D – detail of a limestone accumulation (Archive of the Institute of Archaeology in Brno).
Obr. 4. Objekt kultury nálevkovitých pohárů 1/81. A – stratigrafie a terénní dokumentace; a–c – dílenské objekty (upraveno podle *Svoboda – Šmíd 1996*); B – objekt po dokončení výzkumu v roce 1982 (archiv ARÚB); C – jeden z nalezených parohových kopáčů ; D – detailní foto kumulace vápencových bloků (archiv ARÚB).

The results of those excavations were published later (*Svoboda – Šmíd 1996*). Another large sunken feature located 150 m to the east in the same field was partly excavated in 2017. In addition, two other sunken features were excavated on the north-facing slope of Stránská skála (SS IV) – the first was a furnace excavated in 2011 and the second a large feature sampled in 2016. These features are described separately in the following chapters.

4.2. Stránská skála III

The first archaeological excavation targeting post-Paleolithic occupation at Stránská skála was realized during 1981–1982. In 1981, a trench for a water pipeline that extended across the Stránská skála elevation from south to north disturbed a large sunken feature near the 298.6 m a.s.l. elevation marker. The site was labeled Stránská skála III and excavated over two summer seasons (*Čižmářová – Rakovský 1983*; *Svoboda – Čižmářová 1984*). The uncovered sunken feature was dug into loess overlying an interpleniglacial soil containing Bohunician artefacts. The pit was elongated in shape with the long axis oriented north-south (*fig. 4: A*). It was 48.0 × 25.0 × 1.5 m in size with the shape resembling an irregular 8-figure. This was interpreted as a likely indication of two or more overlying pits. The bottom was irregular with various depressions (*fig. 4: A, B*) that the excavators interpreted as a result of "chaotic" loess exploitation. Although loess exploitation was a primary function of this feature, several secondary sunken features were subsequently dug into its bottom when the feature was already partly filled by sediments. Storage pits, furnaces,

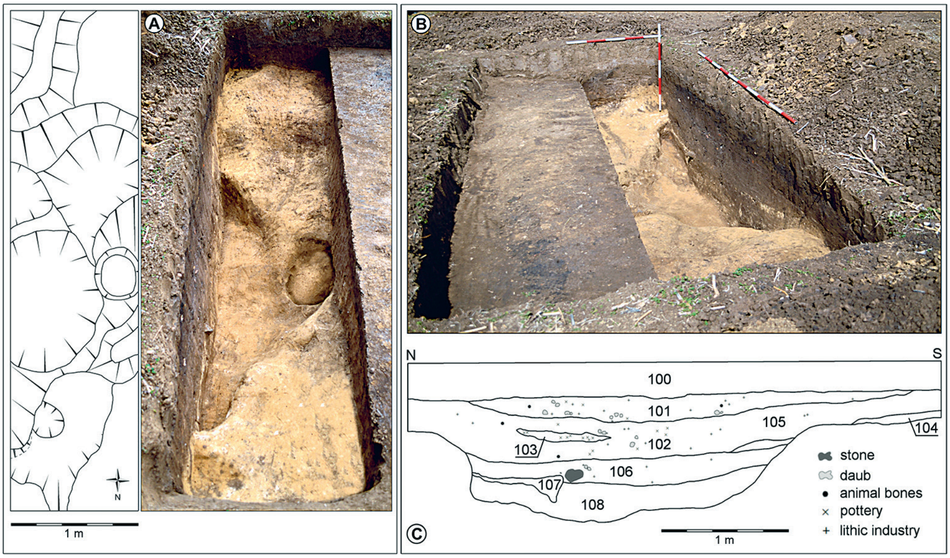


Fig. 5. Funnel Beaker culture feature No. 7/17. A, B – a view of the feature during excavation in 2017; C – stratigraphy of the infill.
Obr. 5. Objekt kultury nálevkovitých pohárů 7/17. A, B – pohled na objekt v průběhu výzkumu v roce 2017; C – stratigrafie výplně.

and workshop pits were identified. The latter were oval in shape with flat bottoms filled by archaeological material including limestone blocks (*fig. 4: D*), osteological material, and lithics that possessed a workshop character (*Svoboda – Šmíd 1996*, 79, 85–86). Although the excavators identified the feature as a "lithic workshop", its use was more complex and it served many functions over time – a lithic workshop was only one of those functions. The infill also contained child skeletal remains in the northern part of the feature (*Čižmářová – Rakovský 1983*, 21) however, details concerning its position and possible grave goods are not available. The sunken feature infill consists of three main types of sediment. At its lowermost extension it reached a brownish-gray layer with blocks of loess fallen from pit walls. The other layers – a brownish-black soil and a black humic soil – were restricted to the features in the central part only (*Svoboda – Šmíd 1996*, 79; *fig. 4: A*).

The above mentioned "workshop features" containing many of the stone artefacts made from local cherts were concentrated in the southern part of a large sunken feature (sectors 14, 16, 17) with dimensions 3.0 × 2.0 × 0.4–0.5 m. Seven red deer antler fragments interpreted as picks used for chert nodule extraction were found in the southern part of the large sunken feature (*fig. 4: C*). The excavators also described two furnaces located on two walls opposite each other and interpreted as possible heating units used to improve the efficiency of nodule separation from the limestone rock (*Svoboda – Šmíd 1996*, 79, 86, 96).

In order to clarify the cultural affinity of the sunken feature 2/83 rich in lithics disturbed by the 1983 test pit 3 (*Svoboda 1985a*), a new test pit was dug in its vicinity in 2017. The location of the 2017 test pit has moved several meters north from the 1983 test pit to avoid a water pipeline detected by the geophysical survey (*Hašek – Dostál – Tomešek 1998*; *Milo – Tencer 2017*; *fig. 7*). The test pit dimensions reached 4 × 1 m (*fig. 5: A, B*) and the

Context	Chipped industry	Pottery	Daub	Animal osteological material	Stone macrolithic tools	Stone manuports	Σ
101	2170	195	13	147	–	–	**2525**
102	1714	673	26	632	1	–	**3046**
106	66	28	8	13	1	6	**122**
108	38	25	–	8	–	–	**71**
Σ	**3988**	**921**	**47**	**800**	**2**	**6**	**5764**

Tab. 3. Distribution of archaeological materials within structure No. 7/17 infill.
Tab. 3. Distribuce archeologického materiálu ve výplni objektu 7/17.

whole area was located inside a sunken feature of unknown dimensions. The cut sunken feature was bowl-shaped along its longer axis. The bottom of the sunken feature was irregular, at a depth of 0.9–1.0 m deep below the topsoil / loess boundary. Eight distinctive contexts were identified (*fig. 5: C*) below the 30–35 cm thick layer of plough soil. The uppermost context (c. 101) consisted of a dark brown soil, grading into grayish-black sediment in places. It was rich in archaeological material including a large number of orange-colored daub lumps (*fig. 5: C*). The underlying layer (c. 102) consisted of compact, light grayish-brown sediment and represents the thickest horizon in this feature. Within the latter context, three sub-contexts were defined: a gray ashy layer (c. 103) with burnt knapped artefacts (a possible hearth), and two loess lenses (c. 104 and 105). The lower part of the infill contained two similar contexts – a light brown (c. 106) and light yellowish-brown (c. 108) sediments interstratified with a loess lens (c. 107) in the northern part of the sunken feature. A circular pit 0.3 m in diameter and 0.2 m in depth containing several fragments of a large pot / amphorae was located within the central part of the trench.

As all of the excavated sediment was screened according to the individual contexts, the collection of finds (pottery, daub, osteological material, and knapped artefacts) includes many such small items. The spatial analysis indicates a concentration of finds within the central part of the sunken feature and the analysis of vertical distribution of finds indicates a concentration within the two uppermost contexts (101 and 102) and a gradual decrease of finds with increasing depth (*tab. 3*).

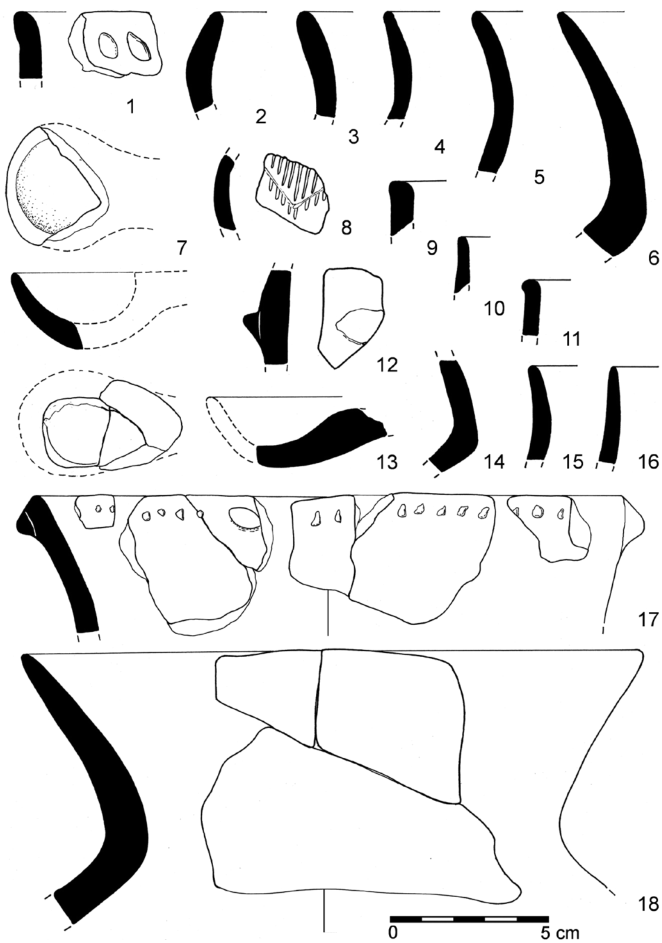
The pottery analysis places the occupation to the earlier phase of Funnel Beaker culture (*fig. 6*). This is consistent with classification of the oldest material from the sunken feature excavated in 1981–1982 (cf. *Svoboda – Šmíd 1996*, 97; *Šmíd – Bíško – Přichystal 2017*). The charcoal sample from context 102 yielded a date of 5,060±35 BP (Poz-105518).

It was not possible to document the shape and dimension of this sunken feature and its relationship to sunken feature 2/83 excavated by J. Svoboda in 1983 (part of the same sunken feature, or a different sunken feature?) due to the limited extent of the test pit itself. As the geophysical readings were partially obscured by the water pipeline (*fig. 7*), the sunken features already partially excavated in 1983 and 2017 can be directly targeted by a large-scale excavation. Observations during the surface survey suggest a darker soil present in the ca 10 × 6 m area.

4.3. Stránská skála IV

A large surface artefact cluster had previously been recorded in the field below the northern margin of the Stránská skála rock. The 2016 surface survey yielded a collection

Fig. 6. Selected pottery from Funnel Beaker culture feature No. 7/17.
Obr. 6. Výběr keramiky z objektu kultury nálevkovitých pohárů 7/17.



of 88 artefacts including 12 cores at different stages of reduction. The positions of those artefacts were recorded using GPS and the spatial distribution analysis indicates that the cluster is c. 50 m in diameter. Recently, two sunken features were excavated in this area – the first on its eastern margin (an isolated furnace, 2011 excavation) and the second on its western margin (a large sunken feature, 2016 test pit).

In 2011, P. Matějec surveyed the eastern margin of the Stránská skála IV surface artefact cluster discovering a black soil with charcoal ploughed up from the sunken feature. That same year the feature was excavated and documented. The feature was 1 m in diameter and up to 0.3 m deep, partly paved by limestone blocks and the sediment on its walls showed traces of intensive heating (orange-red in color; *fig. 8*).

The feature infill has yielded a collection of pottery shards (15 items), knapped chert artefacts (23 items), and osteological material (18 items). The pottery shards are undiagnostic except for one fragment of a Bell Beaker culture goblet, ocher-yellow in color, with incised decoration infilled with encrustation, representing contamination from a younger context (*Bartík et al. 2018a*, 191). A recently dated charcoal sample yielded a date of

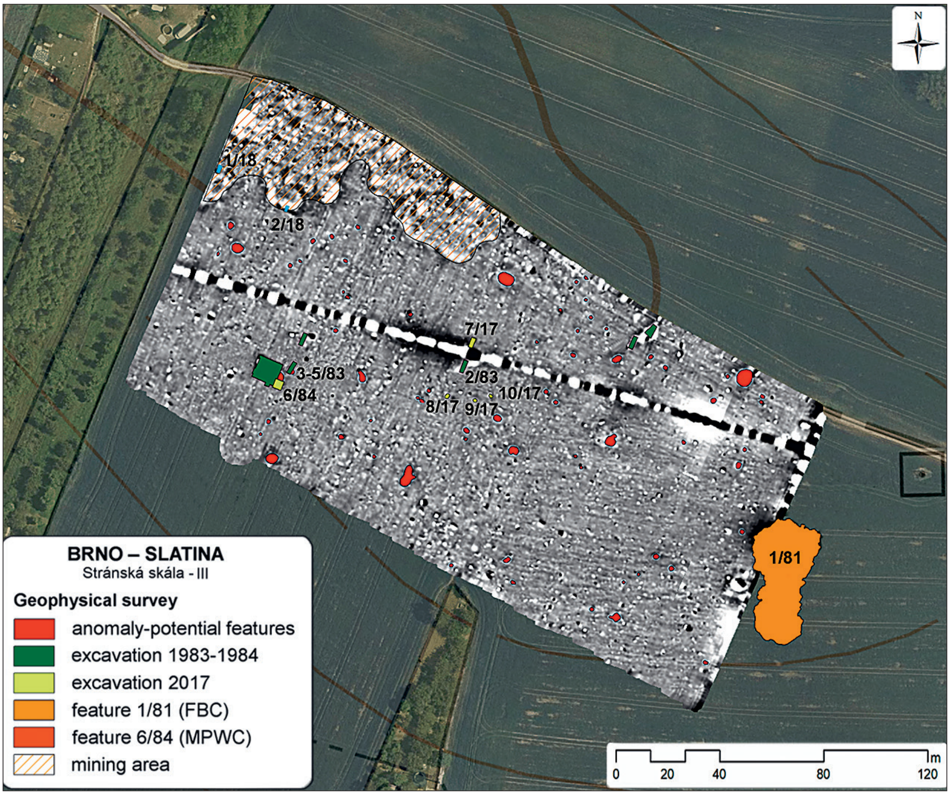


Fig. 7. Results of the geophysical survey at Stránská skála III.
Obr. 7. Výsledky geogyzikální prospekce v lokalitě Stránská skála III.

4,915±35 BP (Poz-102380). This is in agreement with a collection of lithics and indicates a Funnel Beaker classification for this unit (cf. *Šmíd 2017*).

The lithics are made exclusively from Stránská skála-type chert. They include 4 single platform blade cores (*fig. 13: 23, 24*), a pre-core, 9 amorphous raw material fragments, 3 preparation flakes, a massive semi-cortical flake (*fig. 13: 21*), a medial fragment of a burnt blade, and a large non-cortical flake with utilization retouch. The collection of chert artefacts is supplemented with a fragment of a pebble hammerstone and an unworked fragment of the Želešice-type metabasite.

The feature was interpreted as the remains of a furnace or heating installation. Similar furnaces were documented at the hilltop site Stránská skála III (*Svoboda – Šmíd 1996*, 84–86, fig. 6). Circular-shaped furnaces as isolated installations, inside dwellings, or in the walls of large sunken features, are well known from many Funnel Beaker culture sites in Moravia and Bohemia (*Kalferst – Zápotocký 1991*, 379; *Pleslová-Štiková 1981*, 64; *Vokolek 1993*, 28; *Zápotocký 2008*, 65; *Šmíd 2017*, 85–87, etc.).

A possible sunken feature was located during the 2014 surface survey on the western margin of the SS-IV surface artefact cluster discussed above. The micro test pit survey covering the western half of a large SS-IV field on the northern slopes of Stránská skála was

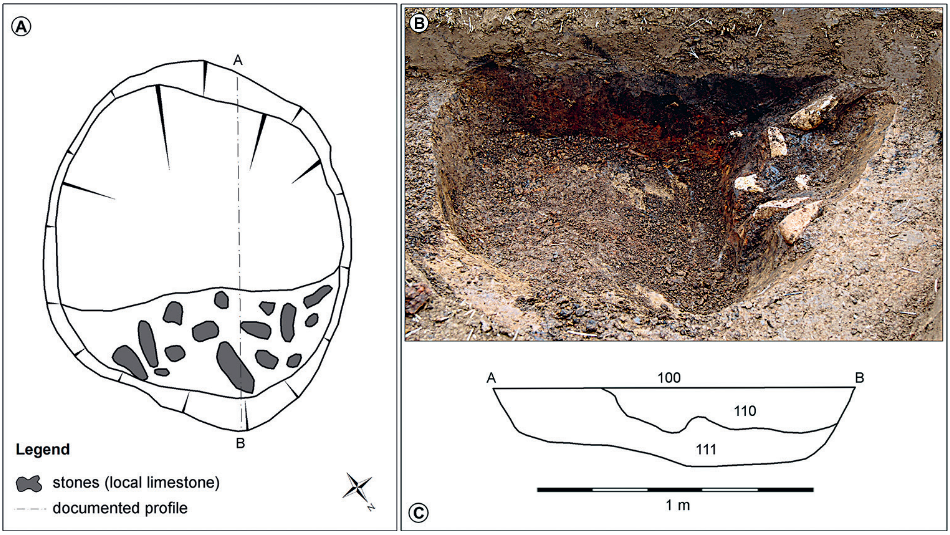


Fig. 8. Funnel Beaker culture feature No. 1/11 at Stránská skála IV. A – field documentation; B – a view of the feature during excavation; C – stratigraphy of the infill.
Obr. 8. Objekt kultury nálevkovitých pohárů 1/11 v lokalitě Stránská skála IV. A – terénní dokumentace; B – pohled na objekt v průběhu výzkumu; C – stratigrafie výplně.

conducted in 2016 and confirmed a large sunken feature in the area. The shape and dimension of that feature are currently unknown. A small trench 1 × 0.5 m in size was dug. Brownish-black sediment rich in cultural finds was uncovered below the 30 cm thick topsoil. The feature was not fully excavated. Only the upper spit 5–10 cm thick was excavated and sieved. Although the excavated volume of sediment was small, the number of finds is high and included 64 pottery shards, 122 knapped artefacts, a massive limestone flake and several burnt bone fragments. The ceramic fragments are mostly undiagnostic, but they are consistent with the Funnel Beaker culture. Some of the significant finds include an upper part of what probably was a goblet with a short neck, a slightly concave rim reconstructed from 8 fragments, a large shard from the rim of another possible goblet with a markedly elongated neck, a fragment of a strap handle, a bottom of a small pot, and two shards from the maximum dimension of the vessel (one of them has a small elongated incision). The knapped artefacts are similar to those from Stránská skála III. The local chert was used in the manufacture of almost all of the lithic artefacts. Quality and color differ between different pieces and include the banded variety. The only exception is a massive 5.5 cm long blade made from erratic flint. Twelve burnt artefacts also show characteristic features of the local chert.

The most dominant technological type is waste products such as fragments and chips. Cortical and preparation flakes are also present. Blades were the target artefacts and only several were recovered (including semi-cortical blades). Only 3 cores were identified: a single platform prismatic core (abandoned due to several hinged removals, *fig. 13: 18*) and two exhausted single platform microcores bearing both blade and microblade scars (*fig. 13: 19, 20*).

Only 4 tools were identified – a massive blade with lateral retouch and an oblique straight truncation (*fig. 13: 16*), a notch on a blade (*fig. 13: 10*), a splintered tool (*fig. 13: 9*) and a double end scraper on a blade fragment (*fig. 13: 6*). A retouched chip may represent a burin spall. Several partially retouched artefacts are also present.

An additional single radiocarbon date associated with the Funnel Beaker culture was recently obtained from a charcoal sample collected within sunken feature 4/18 infill excavated in 2018 and 2019 (preliminarily reported as the Early Bronze Age feature: *Rychtaříková – Škrdla – Bartík 2019*). This date of 4,870±35 BP (Poz-113193) belongs to the Baalberge phase of this culture and it is comparable with the date from feature No. 1/11 (*fig. 19*).

4.4. Funnel Beaker culture lithic industry

4.4.1. Raw material

The raw material spectra of all the analyzed Funnel Beaker culture collections at Stránská skála are similar to each other. They are characterized by almost exclusive use of the local chert with a very small number of artefacts made from other rocks – one specimen of Krumlovský les type chert, one Cretaceous spongolite chert, and two artefacts from an unidentified chert. Two erratic silicite artefacts were recovered from feature 1/81, two from feature 7/17, and one erratic silicite artefact from feature 3/16. Only the local chert was used as a raw material in feature 1/11. An exception to the rule is represented by the discovery of a hoard consisting of 44 artefacts inside a small vessel found in feature 1/81 – almost a half of these artefacts are made from Krumlovský les type chert. However, these cherts were sourced in the vicinity of Stránská skála i.e. they were not collected at the primary source in Krumlovský les.

The raw material spectra are similar to each other also in the case of the Stránská skála chert varieties used (i.e. A-I defined by A. Přichystal for feature 1/81; cf. *Přichystal 2009*, 65–67). Recently, a new variety labeled J was identified in the Funnel Beaker culture collection in Brno – Maloměřice. The J variety accounted for almost 70 % of the collection (cf. *Šmíd – Bíško – Přichystal 2017*, 18–20). Generally, all Funnel Beaker culture lithic collections at Stránská skála are characterized by prevailing olive to yellowish gray variety A. A detailed analysis of individual varieties is available for the collection from feature 1/17, where variety A accounts for 88.9 % of the chert used, variety B accounts for 1.3 %, C – 0.2 %, D – 0.5 %, E – 1.1 %, F – 0.4 %, G – 0.5 %, H – 0.1 %, I – 1.9 %, and J – 0.9 %. Also, 168 (4.2 %) artefacts were burnt. Only banded variety B and whitish-gray variety I are present in slightly higher proportions. As in feature 1/81, all recognized varieties including colorful (red and yellow) were documented, as well as the recently defined variety J known from Brno – Maloměřice (but not as numerous as in Brno – Maloměřice, cf. *Šmíd – Bíško – Přichystal 2017*, 20).

To compare the individual Stránská skála chert varieties as defined by A. Přichystal, it will be necessary to reanalyze other collections that were classified using other criteria (e.g. qualitative criteria, cf. *Kaňáková-Hladíková 2018*). However, the subjective analyses need be replaced by more objective definitions using physical methods (e.g. x-ray spectrometry – the project is currently under realization).

4.4.2. Technology

The technological aspects of Stránská skála III and IV lithic collections are also similar to each other. Although small assemblages from Stránská skála IV cannot be compared in greater detail, the assemblages from Stránská skála III, both rich in lithics, allow study of the technological sequence (dynamic approach) and their comparison. The most significant difference between the 1/81 and the 7/17 assemblages is the number of finds related to the excavated area – while 1/81 yielded 6,933 artefacts (includes items collected from the backfill) from an area of c. 618 m^2, 7/17 yielded 3,988 artefacts from an area of 4 m^2. Given that both features have similar depth and a similar artefact density was expected, it is surprising that the density of finds is 89× higher in 7/17 than in 1/81. Similarly, the average dimension of artefacts is higher in 1/81 as small artefacts (7/17 was wet sieved) are missing due to the different excavation methodology.

The material from 1/81 is not suitable for refitting due to many absent elements (small items are often not present). Although trench 7/17 covered a relatively small area, it was possible to refit several artefacts resulting in three refitted sequences (two refitted preparation products and one set of joined core fragments). It was not possible to refit broken blades, or a production sequence of several blades, or refit blades to core negatives. However, similarities in raw material suggested connections between blades and specific cores in several cases. These observations suggest a workshop character of this assemblage and intensive off-site transport of blades – the expected target products. The 7/17 feature did not function as a workshop itself – it rather appears that the original pit (of unknown function) was filled with lithic workshop waste (and other objects) from an area nearby.

Unworked chert nodules recovered from the exploitation and workshop areas of Stránská skála III were most often globular or slightly flattened (loaf) in shape with an average length of 10–15 cm although *A. Přichystal* (*2009*, 65) described several nodules measuring up to 40 cm. The 1/81 feature has yielded 13 unworked nodules and 48 nodules with some test removal(s) (61 items in total for both categories – 0.9 % of the collection). The 7/17 feature yielded 4 nodules with test removals (0.1 % of assemblage). Similar artefacts were noted in the Stránská skála IV stratified assemblages as well as in the surface collections.

Regardless of reduction stage, cores are the most informative artefacts for resolving questions about intended products. The 1/81 feature has yielded 886 items (12.8 %; *tab. 5*), feature 7/17 39 items (including core fragments, cf. *tab. 4*), and many cores are present in the surface collections. Almost 60 % of cores in both collections are either exhausted, or in a very advanced stage of reduction. The remaining cores (40 %) are pre-cores, prepared cores, and undifferentiated core fragments. The prepared cores often have prismatic, cubic, and trihedral shapes, in some cases with a prepared frontal crest (*Svoboda – Šmíd 1996*, 92). The abandoned pre-cores and exhausted cores were frequently reutilized for hammerstones.

The cores are mainly various single platform cores intended for the production of blade blanks. Several cores with only a few flake removals are often failed attempts, or exhausted cores. The analysis of blade blank removals on cores revealed the use of two separate techniques – a more common 'wide front mode' and a 'narrow front mode' (cf. *Svoboda – Šmíd 1996*, 92). The wide front mode was applied to prismatic, cubic, and trihedral forms with up to 10 removal scars visible on the core front (*fig. 9: 17, 18*; *11: 42*; *12: 21–23*; *13: 23*). The second, narrow front mode was applied to flattened cores with a prepared frontal crest (*fig. 12: 24*; *13: 18, 24*). Many cores (*fig. 9: 16, 19*; *11: 37*) show a combination of both modes – the exhausted wide front core flat in shape was turned approximately 90° around the long axis and reduced from the narrow front (the same technique has already been documented in Bohunician technology, e.g. *Škrdla 2003*, fig. 9.7: a, b). Core rejuvenation was not a frequent occurrence. As in the Lengyel culture, the core back is often prepared.

No.	Technological categories	Context					
		101	102	106	108	∑	%
1a	raw material	–	–	–	–	–	–
1b	raw material with testing scars	3	1	–	–	4	0.1
	∑ I	**3**	**1**	**–**	**–**	**4**	**0.1**
2a	first blank	–	–	–	–	–	–
2b	massive blank	–	7	1	–	8	0.2
2c	cortical blank	36	33	2	–	71	1.8
2d	blank with cortex part	87	67	8	8	170	4.2
2e	crested flake from core	2	1	–	–	3	0.08
2f	crested blade from core	4	2	–	–	4	0.1
2g	undercrested flake	–	–	–	–	–	–
2h	undercrested blade	–	1	2	–	3	0.08
2ch	trimming blade	2	–	–	–	2	0.05
2i	trimming flake	55	29	7	3	94	2.4
2j	pre-core	–	6	–	–	6	0.15
2k	prepared core	1	–	–	–	1	0.03
	∑ II	**187**	**146**	**20**	**11**	**364**	**9.09**
3a	reduced core	–	–	–	–	–	–
3b	flake with lateral cortex	15	8	1	–	24	0.6
3c	blade with lateral cortex	21	10	4	–	35	0.9
3d	microblade with lateral cortex	16	16	–	–	32	0.8
3e	final flake	92	45	5	3	145	3.5
3f	final blade	112	77	8	5	202	5.1
3g	final micro-blade	163	163	3	–	329	8.2
3h	outrepassé	–	–	1	–	1	0.03
	∑ III	**419**	**319**	**22**	**8**	**768**	**19.13**
4a	blank rejuvenating flaking surface	6	6	–	–	12	0.3
4b	blank rejuvenating striking platform	2	4	1	–	7	0.18
4d	secondary crested blade from core	–	2	–	–	2	0.05
	∑ IV	**8**	**12**	**1**	**–**	**21**	**0.53**
5a	remnant core	30	17	8	2	57	1.7
5b	core fragment	8	5	–	2	15	0.4
5c	blank fragments	527	413	10	13	963	24.1
5d	chips	988	797	5	2	1792	44.85
5e	splinters	–	4	–	–	4	0.1
	∑ V	**1553**	**1236**	**23**	**19**	**2831**	**71.15**
TOTAL		**2170**	**1714**	**66**	**38**	**3988**	**100**

Tab. 4. Dynamic clasification of the technological phases within the FBC lithic industry from feature No. 7/17.
Tab. 4. Dynamická klasifikace technologických stádií štípané industrie v objektu KNP 7/17.

The high proportion of debitage products is consistent with the workshop character of the assemblage, both in the preparation stage (preparation flakes and blades, cortical and semi-cortical flakes, crested blades and flakes, etc.) and targeted products (blades). The proportion of blades and flakes is 41 % in the 1/81 assemblage and 28.8 % in the 7/17 assemblage (*tab. 4, 5*). The analysis of production reveals blades dominating over flakes despite off-site transport. The higher proportion of microblades (up to 10 mm in width) possibly reflects a selection of wider and bigger blades for off-site transport and further use. Only 23 blades were complete (at 10.7 %, the second highest fragmentation rate). Microblades

Technological categories	northern part		southern part		surface		∑	
	pc.	%	pc.	%	pc.	%	pc.	%
Raw material and raw material with testing scars	40	0.9	15	1.4	6	0.4	**61**	**0.9**
Cores	582	13.0	180	16.8	124	9.0	**886**	**12.8**
Blanks (preparation flakes and final blades)	1910	42.7	353	32.8	592	42.9	**2857**	**41.0**
Blanks with utilizing retouch	92	2.1	25	2.3	27	2.1	**144**	**2.1**
Tools	133	3.0	48	4.5	47	3.4	**229**	**3.3**
Raw material and blanks fragments	1636	36.5	417	38.3	566	41.0	**2616**	**37.9**
Hammerstones	81	1.8	42	3.9	17	1.2	**140**	**2.0**
∑	**4474**	**100**	**1080**	**100**	**1379**	**100**	**6933**	**100**

Tab. 5. Techno-typological stucture of the FBC lithic industry from feature No. 1/81 (modified after *Svoboda – Šmíd 1996*).
Tab. 5. Technologicko-typologická stuktura štípané industrie z objektu KNP 1/81 (upraveno podle *Svoboda – Šmíd 1996*).

on the other hand, have the lowest fragmentation rate as almost one quarter (23.4 %) are complete. Microblade blanks were selected for retouch infrequently so they can be considered as secondary products. The most common types of fragments of broken blades and microblades are distal fragments (24.5 %) and longer blades with a broken proximal end (28.2 %).

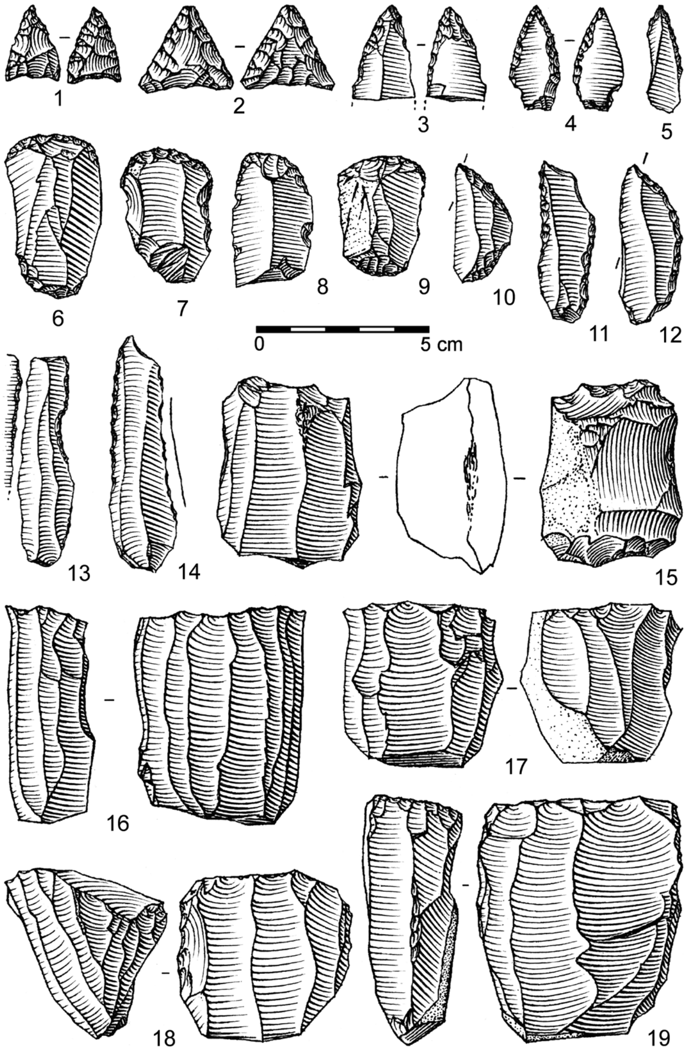
Blade negatives on cores are frequently larger than blade blanks recovered from the excavated assemblages – this observation is consistent with the off-site transport hypothesis. It is also a characteristic feature of workshops described by other authors (e.g. *Dzieduszycka-Machnikova – Lech 1976*, 125). Although the longest blade in the 7/17 assemblage was 60 mm in length, the average blade length is only 39.5 mm. The average length of blade scars measured on cores from 7/17 is almost 50 mm. The cores from 1/81 possess negatives indicating production of blades up to 70 mm in length while the average blade length in the excavated assemblage is 44.5 mm (*fig. 10*). The decision making process involved in off-site transport (for use elsewhere) probably also included the blank width and the regularity of lateral edges (i.e. straight). Width analysis can incorporate broken blades; the increased sample size increases the statistical significance of the results. The average blade length is 14.1 mm, and 6.7 mm for microblades. In addition, the length/width ratio for complete blades is 2.45 and 2.81 for microblades. These values indicate that blades were almost over 2.5 times longer than wide, in the case of microblades slightly longer. The analysis of blade curvature reflecting core preparation and blade removal technique indicates prevailingly S-shaped blades (in side-view) with a distinct bulb of percussion (*fig. 14: 39–44*). The core striking platforms were plain as indicated on both cores and blade butts. The percentage of plain striking platforms reached 60 % in the 1/81 assemblage (*Svoboda – Šmíd 1996*, 93) and 66.4 % in the 7/17 assemblage. The proportions of other butt types differ between individual assemblages. Cortical butts are more frequent in the 1/81 assemblage (23.5 %). In the 7/17 assemblage, cortical butts account for only 5.7 % of butts. Punctiform, dihedral and linear butts were documented but they are not common. Facetted striking platforms occur sporadically and almost a half of them display a pronounced lip. Flakes possessed similar proportions of butt types as blades and microblades. Traces of abrasion of the sharp edge between the core platform and the core front are visible on both cores and blades. The presence of small pebbles that were probably used as

No.	Technological categories	∑	%	g	%
1a	raw material – chert nodules	11	3	1910	17.2
1b	half nodule	13	3.6	2160	19.5
1c	nodule fragments	52	14.3	2560	23.1
1d	raw material with testing scars	18	4.9	2300	20.7
	∑ I	**94**	**25.8**	**8930**	**80.5**
2a	first blank	–	–	–	–
2b	massive blank	1	0.3	5	0.05
2c	cortical blank	2	0.6	10	0.096
2d	blank with cortex part	16	4.4	110	1
2e	crested flake from core	–	–	–	–
2f	crested blade from core	–	–	–	–
2g	undercrested flake	–	–	–	–
2h	undercrested blade	–	–	–	–
2ch	trimming blade	2	0.6	1	0.009
2i	trimming flake	25	6.9	44	0.4
2j	pre-core	2	0.6	248	2.2
2k	prepared core	–	–	–	–
	∑ II	**48**	**13.4**	**418**	**3.755**
3a	reduced core	1	0.3	71	0.6
3b	flake with lateral cortex	–	–	–	–
3c	blade with lateral cortex	1	0.3	20	0.2
3d	microblade with lateral cortex	4	1.1	1	0.009
3e	final flake	–	–	–	–
3f	final blade	9	2.4	2	0.018
3g	final microblade	4	1.1	2	0.018
3h	outrepassé	–	–	–	–
	∑ III	**19**	**5.2**	**96**	**0.845**
4a	blank rejuvenating flaking surface	–	–	–	–
4b	blank rejuvenating striking platform	–	–	–	–
4c	secondary crested blade from core	–	–	–	–
	∑ IV	**–**	**–**	**–**	**–**
5a	remnant core	–	–	–	–
5b	core fragment	–	–	–	–
5c	blank fragments	184	50.6	1640	14.8
5d	chips	18	5	11	0.1
5e	splinters	–	–	–	–
	∑ V	**202**	**55.6**	**1651**	**14.9**
TOTAL		**363**	**100**	**11095**	**100**

Tab. 6. Dynamic clasification of the technological phases within the lithic industry from the exploitation pit (test pit No. 1/18).
Tab. 6. Dynamická klasifikace technologických stádií štípané industrie z těžební jámy v sondě 1/18.

abrading tools was recorded. Approximately 50–60 % blades have visible traces of abrasion and 20 % have non abraded, sharp edges, or edges with notches. These technological characteristics predominantly suggest the use of indirect percussion in knapping blades (cf. *Inizan et al. 1999*). Some authors consider pressure flaking to be the main knapping technique used in this assemblage (*Svoboda – Šmíd 1996*, 93); however, the long and narrow blades with indistinct butt – the characteristic products of pressure flaking technology –

Fig. 9. Selected chipped artefacts from the Funnel Beaker culture feature No. 1/81.
Obr. 9. Vybrané štípané artefakty z objektu kultury nálevkovitých pohárů 1/81.



are rare. Based on current analysis, we can surmise that technology varied during reduction, i.e. hard hammer during decortications, soft hammer or punch during core reduction, and pressure flaking for small cores.

4.4.3. Typology

The 1/81 feature yielded the greatest number of tools at the Stránská skála III workshop. 229 items (3.3 % of assemblage) were documented, supplemented by 144 (2.1 % of assemblage) partly retouched artefacts and artefacts with traces of utilization (cf. *Svoboda – Šmíd 1996*, 100–101, tab. 2). The nearby partly excavated 7/17 feature yielded a collection of 30 retouched tools and 6 partly retouched or glossed artefacts (altogether 0.9 % of assemblage). Test pit 3/16 at Stránská skála IV yielded 4 retouched tools and several

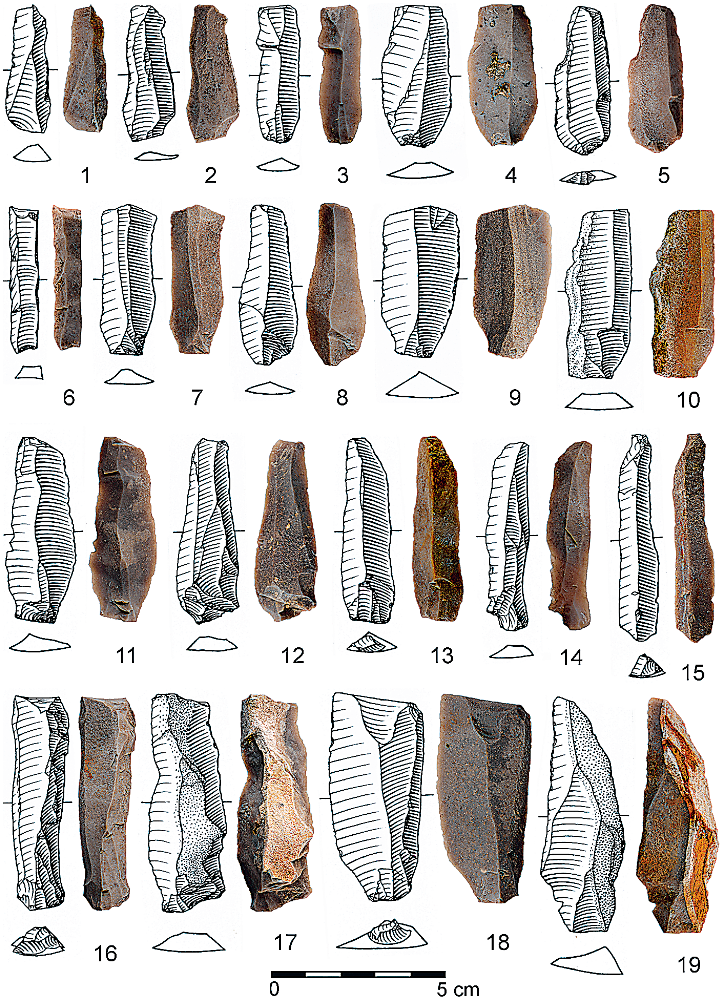
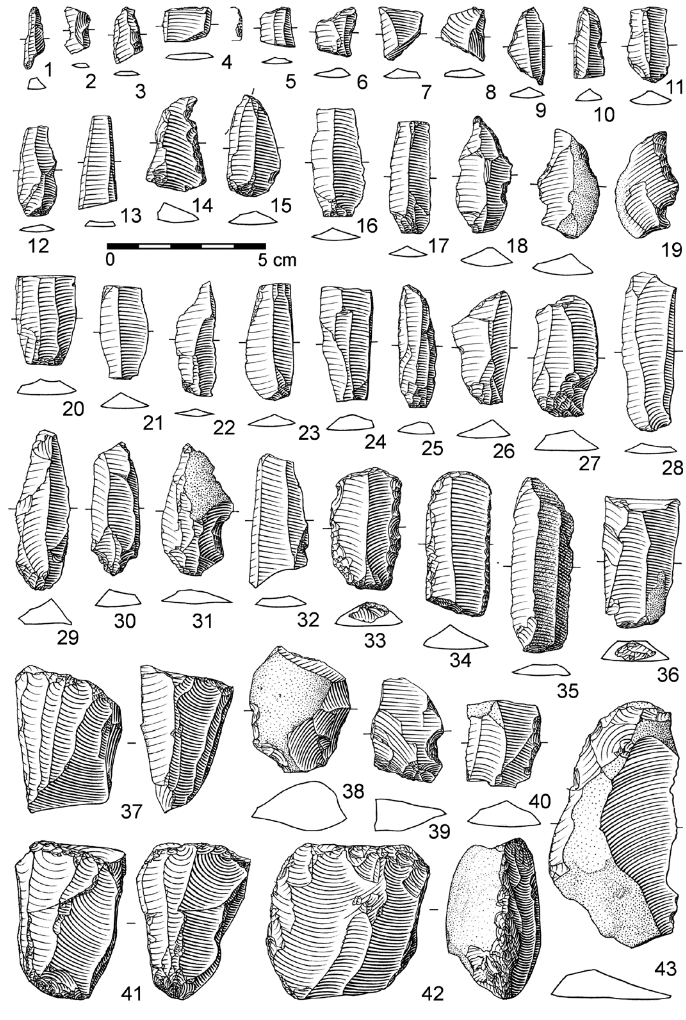


Fig. 10. Selected blades from the Funnel Beaker culture feature No. 1/81. Obr. 10. Vybrané čepele z objektu kultury nálevkovitých pohárů 1/81.

partly retouched blades. Similar items were found on the surface across the entire Stránská skála site complex.

Typological spectra of the early Funnel Beaker culture assemblages are relatively variable. The four most frequent tool types are retouched blades, notches, end scrapers and side scrapers. Blades were retouched laterally, bilaterally, or truncated (straight or oblique) (*fig. 9: 13, 14*; *11: 3, 18, 23, 25, 26, 40*). The blades include sickle blades, blades with an oblique truncation at one end (*fig. 11: 15*), trapezes (*fig. 9: 10*), and crescents (*fig. 9: 12*). Small dimensional artefacts including geometric microliths – small trapezes (*fig. 11: 4–7*) and surprisingly triangles (*fig. 11: 8, 9*) were recovered during wet-sieving of the 7/17 feature. The latter type has not previously been documented in Moravian Funnel Beaker culture assemblages – only one such item has been reported (surface find) from Hlinsko (*Šebela – Škrdla – Schenk 2007*, 359–361, obr. 7: 4), which the authors considered to be Mesolithic. Although the above mentioned blades and microliths were intended as inserts

Fig. 11. Selected chipped artefacts from the Funnel Beaker culture feature No. 7/17.
Obr. 11. Vybrané štípané artefakty z objektu kultury nálevkovitých pohárů 7/17.



for compound tools (most probably sickles), only a small number display characteristic sickle gloss (*fig. 9: 10–12*; *11: 15*). We can hypothesize that unused tools were produced for off-site transport.

Other common tools include notches and denticulates that are often made on flakes, some of which were broken (*fig. 11: 14, 31, 39*), and end scrapers made on both flakes (*fig. 11: 38*) and blades (*fig. 9: 6–9*). Double end scrapers made on blade blanks are often retouched unilaterally (*fig. 9: 7*; *11: 34*) or bilaterally (*fig. 11: 33*). The number of side scrapers increase in the 1/81 feature and single concave side scrapers are more common than double concave side scrapers. One item was bifacially thinned. Only one single concave side scraper made on a massive semi-cortical flake (*fig. 11: 43*) was found in the 7/17 feature.

Borers/perforators (*fig. 11: 1*), burins, splintered pieces, steeply retouched fragments, and points are also present. While the 1/81 feature yielded 3 burins (angle and a multiple

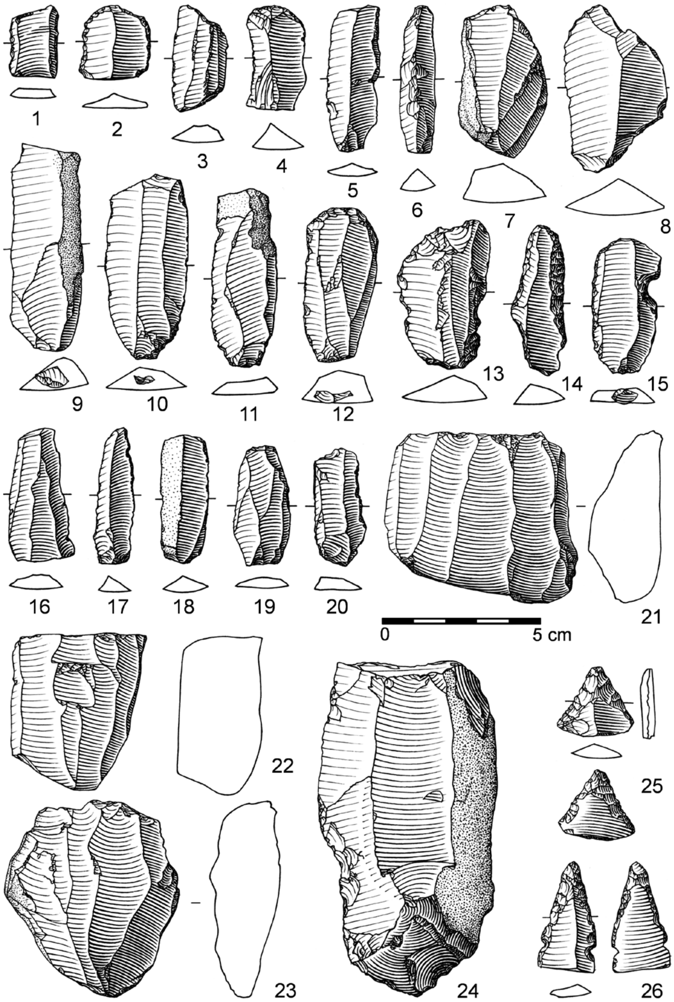
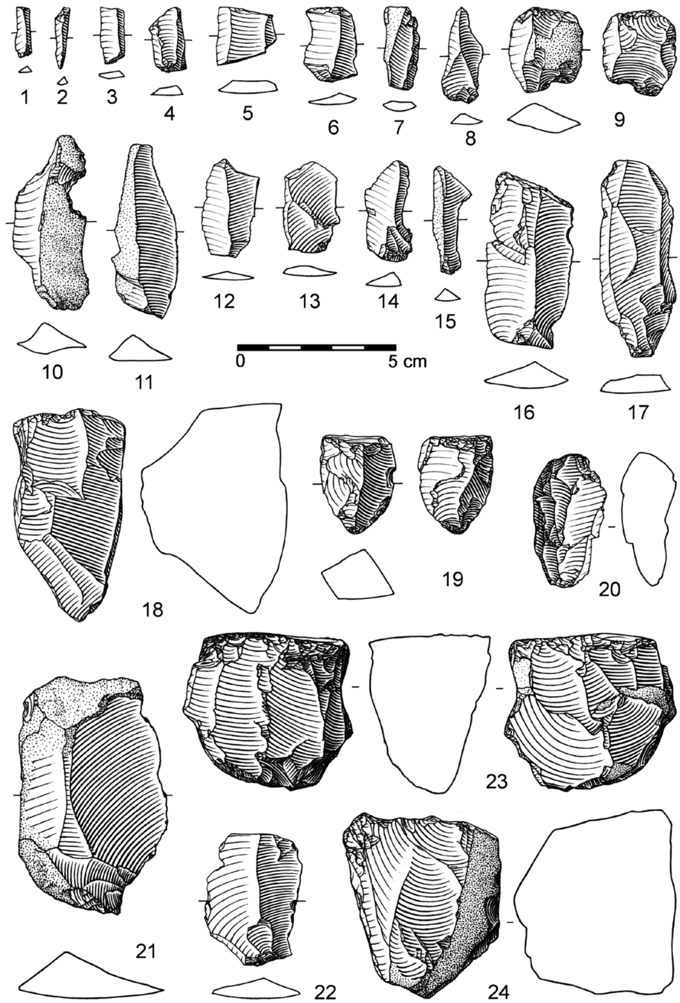


Fig. 12. Selected chipped artefacts from the surface survey at Stránská skála III.
Obr. 12. Vybrané štípané artefakty z povrchových prospekcí v lokalitě Stránská skála III.

angle), 3/16 (1 item) and 7/17 (4 items) features yielded only indirect proof for the presence of burins – burin spalls. Thirteen splintered pieces were documented in the 1/81 feature and one in feature 3/16. No splintered pieces are present in the 7/17 feature. Points are present only in the 1/81 feature (*Svoboda – Šmíd 1996*, 94). Although the point shapes are highly variable, two basic groups can be distinguished. The first group consists of 2 arrowheads triangular in shape with a slightly concave base (*fig. 9: 1, 2*). A similar-shaped arrowhead (*fig. 12: 25*) was collected on the surface in the same area. The second group has been labeled as Štramberk-type (*Klíma 1960*), or Štramberk – Krnov-type (*Diviš 2001*; *Struhár 2014*) arrowhead. These points have bilateral convergent retouch and two opposed notches near their base. The notches can form a wide tang (*Struhár 2014*). There were 3 items in the 1/81 feature – one complete arrowhead (*fig. 9: 4*) and two fragments (*fig. 9: 3, 5*). In one case, the retouch is located on the ventral face (*fig. 9: 3*). A similar Štramberk-type arrowhead made from Stránská skála-type chert (*fig. 12: 26*) was collected on the surface

Fig. 13. Selected chipped artefacts from the Funnel Beaker culture feature No. 3/16 (1–20) and feature No. 1/11 (21–24).
Obr. 13. Vybrané štípané artefakty z objektů kultury nálevkovitých pohárů 3/16 (1–20) a 1/11 (21–24).



in the Líšeň-Čtvrtě field ca 1.7 km to the northeast from the 1/81 feature. Feature 7/17 did not yield any points, only a convergent retouched bladelet (*fig. 11: 10*).

The artefact hoard found in a vessel in feature 1/81 was analyzed separately. Blade blanks are the most common element, six artefacts are retouched tools and include 2 blade end scrapers (*fig. 14: 3, 20*), a flake end scraper (*fig. 14: 17*), 2 crescent-shaped sickle blades without traces of utilization (*fig. 14: 16, 30*) and a bilaterally retouched pointed blade (*fig. 14: 28*). In addition, several blades are partly (indistinctly) retouched (e.g. *fig. 14: 12, 23, 27, 32, 33, 43, 44*).

Lithic tools found in the 1/81 feature are made on broken flakes (38.1 %) and flake blanks (34.6 %) more often than on blade blanks (25 %). The remaining pieces are core residuals re-utilized as splintered tools (*Svoboda – Šmíd 1996*, 93). In the smaller 7/17 feature 36.1 % tools are made on blades and 25 % on microblades i.e. blade/microblade blanks (in total 61.1 %) prevail over flake blanks (27.8 %) and fragments (11.1 %).

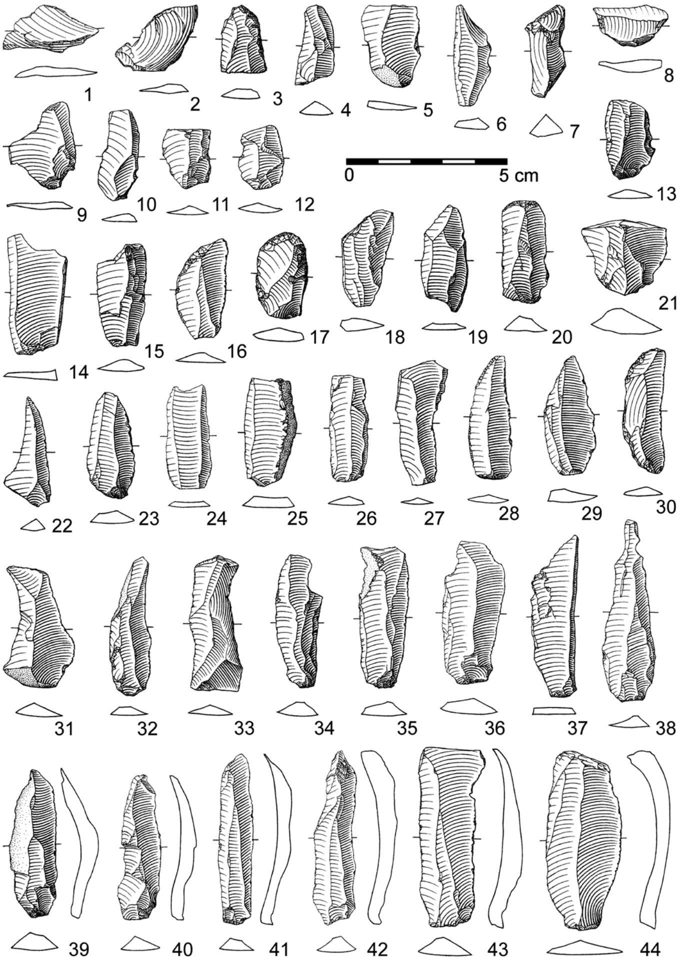


Fig. 14. Hoard of chipped artefacts discovered within feature No. 1/81.
Obr. 14. Depot štípaných artefaktů objevený na okraji objektu 1/81.

5. Chert mining area – excavation 2018

Although prehistoric mining of chert certainly took place at Stránská skála, the evidence has not been detected on the present day surface. This is partly due to subsequent mining of limestone and agricultural activities (some of the land surface is now utilised for agriculture and private gardens). The most important indirect proof of chert extraction is the workshop consisting of limestone blocks with chert nodules and antler picks in the Funnel Beaker culture structure excavated in 1981–1982 (*Svoboda 1986*; *1987b*; *Oliva 1999*; *Svoboda – Šmíd 1996*). The search for remains of mining activities was not successful until 2018.

Evidence for cultural activities was already apparent during surface surveys – shallow depressions flanked by clusters containing limestone scree with chert rock and artefacts (often at an early stage of reduction, i.e., pre-cores, abandoned cores, and cortical flakes) in the area north of the Lengyel culture sunken feature excavated in years 1984 and 2017. These features can be interpreted as partly filled extraction pits with mine dumps.

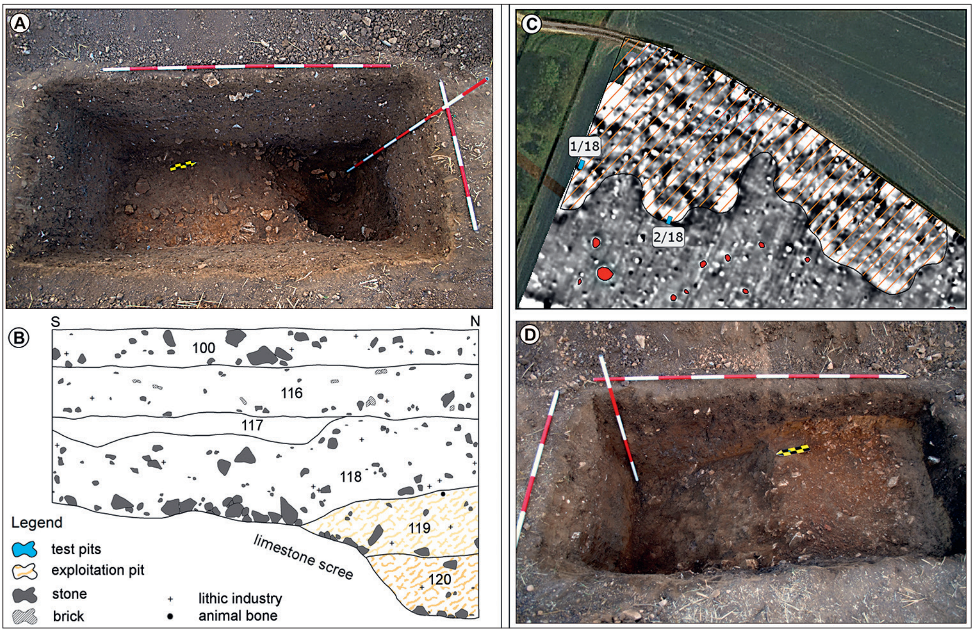


Fig. 15. Testing the existence of an exploitation area at Stránská skála III. A, B – a test pit 1/18; C – a location of test pits in the large geophysical anomaly; D – a test pit 2/18.
Obr. 15. Ověřování existence exploatační oblasti v lokalitě Stránská skála III. A, B – sonda 1/18; C – lokalizace zjišťovacích sond v rámci velké geofyzikální anomálie; D – sonda 2/18.

The 2017 geomagnetic survey over this area showed a large sub-terrain inhomogeneity (*Milo – Tencer 2017*) which is also somewhat detectable on the remote sensing orthophotos (aerial and satellite, e.g. *Google Earth* – a photo taken on 4/4/2016). This information led to the decision to excavate two test pits labeled 1/2018 (GPS coordinates: 49.187361° N; 16.680949° E) and 2/2018 (49.187259° N; 16.681411° E).

Test pit 1/2018 was located in one of the above mentioned shallow depressions (*fig. 15: C*). Its dimensions were 250 × 120 cm and the maximum excavated depth was 166 cm (measured from current surface) in its western part (*fig. 15: A*). A collection of pottery shards (consistent with Neolithic – Eneolithic), several quartz pebbles that were used as hammerstones and chert artefacts were recovered during a surface survey immediately preceding the excavation. The uppermost 25 cm consisted of plough soil with frequent limestone fragments and chert artefacts (c. 100). Immediately underlying the plough soil was a 25–30 cm thick layer of dark brown, compact sediment containing pottery shards dating to 15th–18th centuries, brick fragments, and small limestone fragments (c. 116). The following layer was a compact yellowish brown soil, 34–53 cm thick (c. 118). The proportion of limestone and chert fragments increased compared to the layer above. Several pottery sherds indicate that this layer was deposited during the early modern period. The overlying sub-recent layers were interstratified with a greyish brown soil, rich in secondary calcium carbonate up to 16 cm thick (c. 117). When the sub-recent layers were removed and the surface cleaned, the bottom of the trench exposed the limestone scree removed by the pit structure in the northern part of the trench. Indications of a larger feature are readily

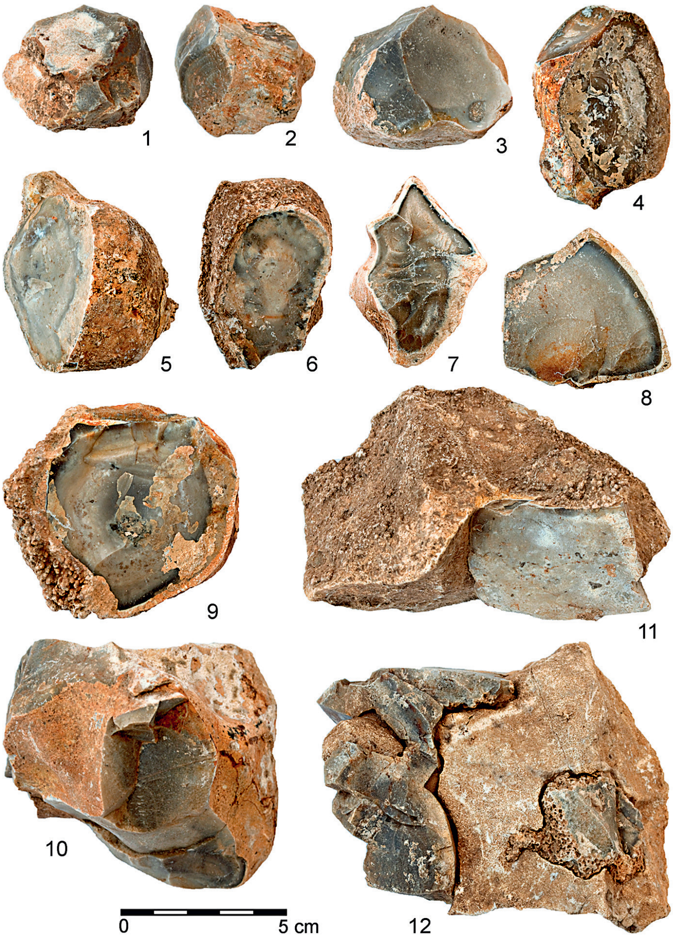


Fig. 16. Findings of the Stránská skála chert-type from exploitation pit within test pit 1/18 (broken chert nodules, nodules with testing scars and limestone blocks containing chert nodules).
Obr. 16. Nálezy rohovcové suroviny z exploatační jámy v sondě 1/18 (půlky hlíz, zkoušky, vápencové bloky s nodulemi rohovců).

observable on the trench walls. The pit is conical in shape, with a bowl-shaped bottom and it appears the mining continued into the pit wall along the scree layer in the southeastern part. Two macroscopically similar layers (*fig. 15: B*) were present in the pit – a dark brownish gray sediment (c. 119) and a compact dark brown sediment (c. 120). In contrast to the overlying layers, the number of larger limestone clasts decrease while the number of chert fragments, nodules and artefacts increase. An isolated bone from the interface of context 118 and 119 yielded a recent date which is consistent with sub-recent ground levelling. Therefore, the pit can be generically classified as Neolithic – Eneolithic. Given that the most intensive workshop activities took place during Early Eneolithic, the excavated pit is most probably Eneolithic. The partly excavated pit yielded 363 chert items. This collection contains chert fragments (55.6 %), several limestone fragments with chert nodules inside (*fig. 16: 11, 12*; largest is 12.5 × 10.5 × 5.3 cm), numerous chert nodules (some of them intentionally broken), nodule fragments, nodules with several test scars, cortical flakes, and preparation flakes. The proportion of blanks with potential for further use was low (5.2 %). This is consistent with nearby workshops, where production of blanks (blades)

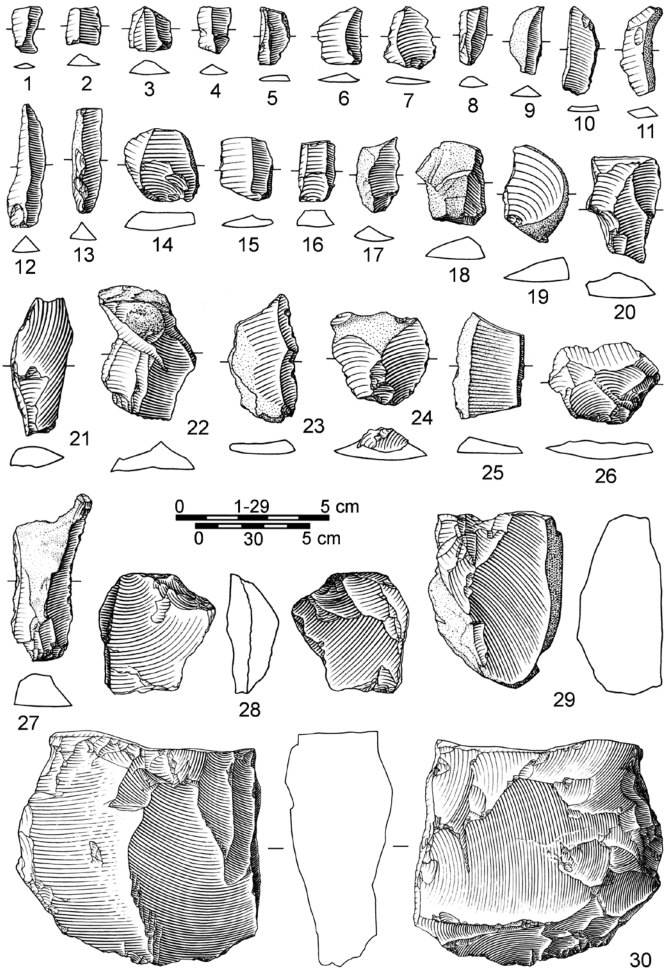


Fig. 17. Selected chipped artefacts from the exploitation pit within test pit No. 1/18.
Obr. 17. Vybrané štípané artefakty z těžební jámy zachycené v sondě 1/18.

and their modification into tools took place. Some of the blades and microblades possess cortex and they are often fragmented. The number of cores is also small and includes two pre-cores (*fig. 17: 29*) and a large (dimensions: 10.9 × 12.2 × 5.1 cm, 710 g) rejuvenated core (with changed platform). Both reduction surfaces possess negatives of large blade removals (*fig. 17: 30*). The latter core indicates the presence of nodules up to 15–20 cm in length. The largest nodule was 13.5 × 10.9 × 5.1 cm in size and has been reconstructed from three fragments. Most excavated nodules ranged from 4 to 10 cm in length (*fig. 16*). In at least one case, a chert nodule was used as a hammerstone. Two quartz hammerstones and 6 flakes from quartz hammerstones indicate on-site knapping. A small pebble was probably utilized for dorsal abrasion. The use of antler or other extraction tools was not documented. Tools are not present in the extraction pit except for one preparation flake that was used as a splintered piece (*fig. 17: 28*). It is not clear whether a large flake with partial retouch is artefactual or natural. The prevailing chert type is olive-gray coloured variety A, supplemented by a banded variety B and a whitish variety I (e.g. *Přichystal 2009*, 65–67). Two chert artefacts and a limestone flake were burnt. The limestone flakes and fragments can be interpreted as byproducts from chert nodule extraction from limestone blocks (e.g. *Svoboda – Šmíd 1996*, 91–92). A small fragment of hematite (dimensions: 5.2 × 2.7 × 3.3 cm, weight: 50g) with traces of smoothing on its surface is considered to be a significant find.

Test pit 2/2018 has cut the southern margin of a geomagnetically determined sub-terrain anomaly, i.e. the margin of a darker area visible on the aerial map. This small trench (2 × 1 m) was intended to expose the boundary area of the anomaly. While the southern part of the profile (*fig. 15: D*) consists of intact loess as expected, the limestone scree layer angles down in the northern margin of the trench (while the current field is levelled). The limited dimensions of this trench did not permit a deeper excavation terminating in a layer consisting of chert fragments, artefacts and medieval or modern age pottery shards (similar to context 116 described in test pit 1/18).

The 2018 excavation revealed a chert mine and it completed a long campaign aimed at better understanding of the Neolithic – Eneolithic chert extraction processes at Stránská skála. The traces of prehistoric mining have been gradually erased since the medieval period, continuing into the present (construction of residential houses, transformation of previously accessible areas to private, fenced gardens and recreational facilities). The results of recent work and previous excavations allow reconstruction of the original morphology of the Stránská skála III Neolithic – Eneolithic mining site: the southern slope of the rocky hilltop was formerly covered by loess while the limestone scree layers (targeted by mining) extended from the rocky hilltop. On the lower southern slopes, the scree layers were overlain by loess. The loess layer thickens downslope (*Hašek – Dostál – Tomešek 1998*). The miners probably dug their first mines in the area without loess cover, where the chert nodules were available on the weathered limestone surface and followed the scree layer downslope – the area covered by loess. The anomaly documented by the geomagnetic survey is in fact part of a large mining complex. It is currently known to cover c. 2000 m^2, but it could be significantly larger. The 3rd Military survey map from 19th century still indicates a depression and a stable cadastral map indicates specific plots that do not follow the shape and direction of other parcel plots. The area was transformed by agriculture during the first half of the 20th century and currently much of it is a ploughed field.

6. Distribution networks

6.1. Neolithic distribution network

We can conclude that occupation, chert extraction, and processing at Stránská skála hillside has only been documented for the MPWC, FBC and BBC (Find group II/III) periods. The following paragraphs summarize the current data about Stránská skála-type chert distribution and attempts are made to trace the ancient distribution networks (Late Neolithic and Early Eneolithic in particular).

While the Stránská skála-type chert appears not to have been utilized during the Early and Middle Neolithic – i.e. the Linear Band and Stroked Pottery cultures (e.g. *Kuča 2008*, 97), the situation radically changed in the subsequent Lengyel culture that (in contrast to the preceding cultures) occupied the Stránská skála hillside directly, and local cherts were

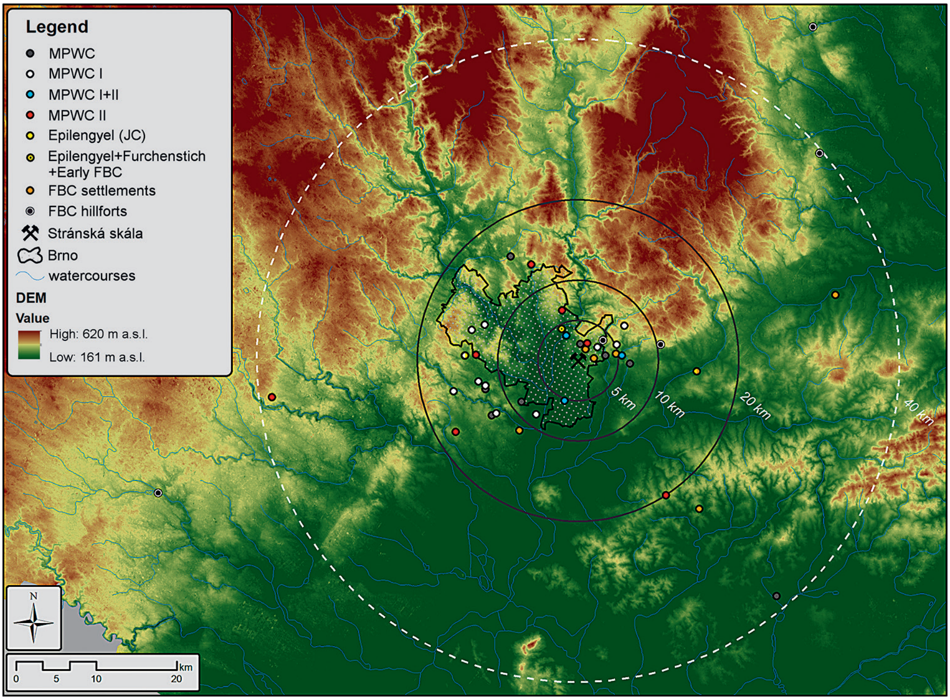


Fig. 18. Distribution network of the Stránská skála-type chert during the Late Neolithic and the Early Eneolithic periods.
Obr. 18. Distribuční síť rohovce typu Stránská skála v mladém neolitu a časném až starém eneolitu.

both extracted and processed not only for local use, but also for export. It was the first time the Stránská skála-type chert distribution network was re-established since the Early Upper Paleolithic.

Over two dozen MPWC sites utilizing the Stránská skála-type chert are currently known (*fig. 18*). The Stránská skála-type chert dominates raw material assemblages only at sites located within a radius up to 5km from the outcrop. These sites include Brno-Líšeň, Zadní kostelíček field (*Kuča – Matějec 2010*) and Breicetl Street (*Čižmářová 1983*; *Rakovský 1980*, 24–25; *Kuča 2011*, 163).

A significant proportion of Stránská skála-type chert was determined in assemblages recovered from Brno suburbs including Brno-Bystrc (*Přichystal 1988*), Brno-Maloměřice (*Adámek 1940*, 298–306; *Somorovská 1980*; *Svoboda – Šmíd 1996*, 95; *Kuča 2011*, 163), Brno-Obřany (*Adámek 1945*; *Kuča 2011*, 162–163; *Oliva 1990*, 27), Brno-Holásky/Tuřany (P. Gada's unpubl. collection), Brno-Bosonohy (*Kuča 2000*, 95; *Kuča – Žákovský 2001*, 129; *Kuča 2008*, 96), and Brno-Žebětín (*Trampota – Kuča 2011*, 94).

In the Brno surroundings, the Stránská skála-type chert has been documented in Horákov (sites: Čtvrtky – *Lech 1987*, 245; *Oliva 2010*, 272; *Kostihová 2011*, 30 and Nová pole/Zukalův kopec – *Šebela – Svoboda – Přichystal 1984*, 16–17), Mokrá (pers. comm M. Kuča), Tvarožná (R. Ondráček's collection), on the eastern outskirts of Velatice (*Rebrošová et al. 2012*, 77–78), and in the western part of Modřice (*Hrbáčková 2007*, 64–65;

Oliva 2010, 272). Isolated implements made from Stránská skála-type chert were identified in several collections from the Bobrava River micro-region (e.g. *Bartík et al. 2015*) and the adjacent Střelice basin (Popůvky u Brna – *Lečbychová – Kuča – Vokáč 2013*; Střelice – *Trampota et al. 2012*), i.e. to the west and southwest of the primary outcrop. Occurences (in dozens of percent in analyzed assemblages) continue in the northern direction where this raw material was documented at Lelekovice (*Kuča et al. 2006*) and Kuřim (*Mateiciucová 2001*, 219). Only isolated items from unclear chronological contexts are known further to the north in the densely occupied micro-region of Boskovice Furrow (e.g. *Kuča 2007*; *Vích 2013*).

The analysis of above-mentioned site locations shows that over 85 % of those sites are distributed in a concentric pattern (30 km in diameter) with Stránská skála outcrop in the center (*fig. 18*). Only three sites are more than 30 km (but less than 40 km) away from Stránská skála. Two of those sites are located to the southeast – Bošovice (Vyškov District; *Kuča – Škrdla 2011*; 22 % of the raw material is Stránská skála chert) in Klobouky area and Šardice in the Hodonín area (*Trampota 2015*, II, 496–497). The third site is southwest of Stránská skála – Mohelno, Padělky field (Třebíč District; *Vokáčová 2013*, 149; the raw material type was not confirmed microscopically). In his analysis of Neolithic raw materials utilized in southwestern Moravia, *M. Vokáč* (*2003*) claims that Stránská skála-type chert was not broadly utilized (but individual pieces of Stránská skála chert may have been grouped in the broad category 'Moravian Jurrassic cherts'). Here we must also mention published data (*Kalábková – Cheben – Moník 2007*, 52) from several younger MPWC sites at Kostelec na Hané (Prostějov District). Recent re-analysis using a microscope (by A. P.) has rejected the previous identification, concluding that probably none of the pieces were made from Stránská skála-type chert.

In the list of sites with Stránská skála-type chert, more sites from the older stage contain this chert than younger stage sites. Focussing on the earlier stage, the utilization of Stránská skála-type chert is strongly connected to phase Ib, however, it was also recognized in several sites where both phases – Ia and Ib are documented together (Popůvky, Brno-Žebětín). The Stránská skála-type chert was not identified at any site classified as exclusively belonging to the Ia phase. Two Ic phase sites have yielded Stránská skála-type chert.

Although the presence of Stránská skála-type chert has been documented also in the later stage of the Lengyel culture, and its distribution was geographically broader than in the earlier phase (*fig. 18*), the traces of corresponding occupation directly at the Stránská skála hillside have not been found yet.

6.2. Eneolithic distribution network

The Early Eneolithic period represented by early and classical phases of the Jordanów culture has not yet been documented at Stránská skála. Findings from Brno-Maloměřice (cf. *Šmíd – Bíško – Přichystal 2017*) permitted reevaluation of the beginning of the Funnel Beaker culture that was originally placed into its IA to IB1 phases (cf. *Svoboda – Šmíd 1996*, 97–98). Therefore, the oldest material from the sunken feature excavated during 1981–82 (*Čižmářová – Rakovský 1983*; *Svoboda – Čižmářová 1984*) is currently dated to the very end of the Early Eneolithic, which is characterized by fewer Epi-Lengyel elements, earliest Funnel Beaker forms and *Furchenstich* pottery (*Šmíd – Bíško – Přichystal 2017*, 15–21). This period should be synchronized with the development of the late Jordanów culture in

Bohemia where jugs of the Schussenried type appear (*Šmíd – Bíško – Přichystal 2017*, 5; *Šmíd 2017*, 15–29). The earliest material excavated from sunken feature 7/17 most probably relates to the same horizon. The activities at Stránská skála continued during the subsequent Baalberge phase of FBC and based on the pottery finds from sunken feature 1/81, occupation of the upper layer was terminated in the Boleráz phase of FBC (*Svoboda – Šmíd 1996*, 97; *Šmíd 2017*, 199).

The raw material quarrying and processing reached its peak during the Funnel Beaker culture. This is also reflected in the maximum extent of its export. The chert was being moved up to 15 km (in various directions from the source) during the earliest phase of the Eneolithic (*fig. 18*). The Stránská skála-type chert was only of local importance during this phase and has been documented primarily from lowland sites including Brno-Maloměřice, U Stavu field (c. 4 km from Stránská skála), where several excavated sunken features (*Šmíd – Bíško – Přichystal 2017*, 5–8; *Kos 2018*, 154), yielded artefacts (including raw material items) made from Stránská skála-type chert. The 70 % of artefacts were made from a dark brownish-gray chert which led A. Přichystal to define a new variety (cf. *Šmíd – Bíško – Přichystal 2017*, 18–20).

Technological analysis of this assemblage indicates export of Stránská skála-type chert artefacts not only as target blade blanks, as documented, for example, by the blade hoard placed inside a Baalberge jug at Stránská skála III (*Svoboda – Šmíd 1996*, 94–95; *Svoboda 2001*, 23), but also in the form of unworked raw material and its fragments. Similar Stránská skála-type chert nodules were documented also in several assemblages located in the vicinity of Brno (cf. *Kos – Šmíd 1993*, 30–31; *Šmíd 2001*; *2003*; *2017*, 200).

Although the artefacts made of Stránská skála-type chert were reported from Popůvky – Panské nivy (Brno-venkov District; a distance c. 14.0 km; *Bálek – Koštuřík 1998*) sunken features, a *Furchenstich* pottery shard may indicate a connection to the same complex together with Stránská skála or Brno-Maloměřice (cf. *Šmíd – Bíško – Přichystal 2017*, 17).

One of the important sites that intensively utilized Stránská skála-type chert is Rousínov – Rousínovec (Vyškov District, a distance 13.5 km), where 80 sunken features attributed to the Jordanów culture and subsequent Funnel Beaker culture were excavated (*Čižmář – Geisler 1987*, 66; *Kaňáková-Hladíková 2018*; *Šmíd 2017*, 305). The Stránská skála-type chert is represented by almost all of the defined varieties (cf. *Přichystal 2009*, 65–66). Variety A prevails in both Jordanów culture and Funnel Beaker culture assemblages; while in Jordanów culture assemblage was missing variety I, the Funnel Beaker culture assemblage missing varieties D and F was supplemented by erratic flint and Krumlovský les-type chert (varieties I–III). An alternative approach employing its knapping quality rather than petrographic observation (varieties) was applied by *Kaňáková-Hladíková* (*2018*, 45, fig. 3) to the 2006 assemblage.

The distribution area increases in the following Baalberge phase of the Funnel Beaker culture. Velatice is a lowland site (5.5 km from Stránská skála). P. Kos excavated two Funnel Beaker sunken features (IB1 phase) at this site. The proportion of Stránská skála-type chert reached 90.2 % and the industry consisted of target blades supplemented by chert nodule fragments, cores and a hammerstone (*Kos – Šmíd 1993*, 31; *Svoboda – Šmíd 1996*, 95). Other contemporaneous sites include Podolí – V Hlavách (*Kos 2012*, 150) and Brno-Líšeň, Klicperova street (*Šmíd 2003*, 48–50; *Čižmář – Geislerová eds. 2006*, 161; *Kuča – Stuchlík 2011*, 177; a distance of c. 1.5 km). Líšeň yielded a collection consisting of unretouched blades, cores and flakes (including cortical items), and a quartz hammerstone.

The prevailing Stránská skála-type chert was supplemented by three artefacts made from Krumlovský les-type chert (varieties II and III). In addition, a small collection of Stránská skála-type chert artefacts (including a Štramberk-type arrowhead; the same arrowhead made from Stránská skála-type chert was found in Želešice I – Za lesem), and is attributed also to Funnel Beaker culture supplemented with a fragment of a flat battle axe edge from porphyritic microdiorite, collected in nearby Brno-Líšeň, Čtvrtě field (*Šebela – Přichystal 1983*, 32; *Kuča – Matějec 2010*, 306).

A general pattern of imported raw material volumes decreasing with increasing distance from the outcrop is documented in Funnel Beaker, phase IB1 assemblage from Ivanovice na Hané, Za střediskem field (a distance 35.0 km; *Bálek et al. 2003*; *Šmíd 2017*, 287–289), where only one of the five artefacts was made from Stránská skála-type chert and in Dambořice – Spálený in the Hodonín area (a distance 26.0 km; *Šmíd 2017*, 200).

Knapped artefacts made from Stránská skála-type chert were documented also in collections from hillforts up to 60km from the Stránská skála outcrop. The most distant site is the southwestern Moravian site Starý Zámek u Jevišovic, where an artefact from C2 layer (dated to Funnel Beaker culture; *Šebela et al. 2015*, plate I: 9) and an artefact without cultural classification were reported. In the northeasterly direction, the distribution network continued through the Vyškov Gate to Haná lowland area, as documented at the Prostějov-Čechovice (Prostějov District) elevated fortified site, where 17 (2 %) artefacts made from Stránská skála-type chert were identified in a surface collection numbering 758 stone artefacts (erratic flint prevails; *Šmíd – Přichystal 2015*, 148; *Šmíd 2017*, 200, 202, Graph 3). Another site in the area is the hillfort Rmíz u Laškova, where in a C2 layer (dated to Baalberge phase of the Funnel Beaker culture) a collection of 5 sickle blades was found, one of which was made from Stránská skála-type chert (*Šmíd 2007*, 59). In contrast to the above mentioned sites, Stránská skála-type chert is not present in central Moravian hillforts (where lithics were petrographically identified) Hrad u Bílovic and Hlinsko near Lipník nad Bečvou (cf. *Přichystal 2007*; *2010*).

Closer to the Stránská skála oucrop is the hillfort Hlásnica (cadastral territory Jezera u Pozořic, Brno-venkov district; a distance of 10.0 km), where a significant part of a collection rich in stone artefacts is made from Stránská skála-type chert (*Šmíd 2001*, 74; *2003*, 51; *Oliva 2010*, 276). Brno-Líšeň, Staré Zámky hillfort (a distance 4.0 km), where only a brief determination of A. Přichystal's surface collection (the data from stratified Funnel Beaker finds are not available) indicated that most of the artefacts are made from Stránská skála-type chert (*Oliva 2010*, 276).

7. Discussion and concluding remarks

Renewed archaeological research at Stránská skála, focused on the post-Paleolithic occupation, has produced new data over the last several years. Methods employed include non-destructive magnetometry combined with surface surveys and excavation of test pits dug at selected places. The new observations concern spatial dimensions and inner structure of the Late Neolithic (Lengyel culture) / Early Eneolithic (Funnel Beaker culture) site complex, its chronology and chert extraction activities.

The main improvement in excavation methodology is the introduction of wet sieving of the excavated sediments. Compared to the assemblages excavated in the 1980s, consistent application of wet sieving has resulted in a significant increase in artefact numbers recovered, as well as in an increase in the understanding of the technological (greater number of small artefacts) and typological (e.g. identification of small tools) aspects. This fact is illustrated by the discovery of microlithic triangles in feature No. 7/17 of the Funnel Beaker culture assemblage. Such artefacts were not discovered in the unsieved feature No. 1/81.

The earliest post-Paleolithic activities hitherto documented on the Stránská skála hillside are dated to the Moravian Painted Ware culture (a single radiocarbon date places this feature at the end of an earlier stage of MPWC, or to the very beginning of the MPWC II stage). The sample was collected in a large sunken feature (a soil extraction pit, No. 6/84) in a field labeled III. This sunken feature, rich in lithics, is located within a large surface artefact cluster. The 2017 geomagnetic survey has detected other similar features in the immediate surroundings so it appears that occupation of this area was more intensive. The rich lithic assemblage is characterized by proportionately large numbers of waste products, including exhausted cores, in comparison to the small number of target products – regular blades that were exported off site. The extraction activities probably continued also during the later stage of the Moravian Painted Ware culture (as indicated by the wider distribution networks, cf. *fig. 18*). The related features have not been discovered on the Stránská skála hillside yet.

The subsequent Funnel Beaker culture occupation covered a larger area and extended downslope in a northerly direction towards a field labeled IV (a large surface artefact cluster and two sunken features). The surface artefact clusters were also documented in sites labeled II, IIa, and the southern and southwestern slopes of Stránská skála. If the individual surface clusters are connected, the Stránská skála artefact cluster extends over a large area of c. 35ha.

In a similar vein to the Moravian Painted Ware culture, the lithic industry of the Funnel Beaker culture is characterized by an evolved blade technology. Although blades were probably the main artefacts taken off site as suggested by the blade blank hoard deposited in a jug that was discovered in a sunken feature (*Svoboda – Šmíd 1996*, 94–95), export in the form of raw material nodules and prepared cores was documented at several sites in the vicinity of Stránská skála. We can conclude that while the Stránská skála extraction and processing site was specialized in blade blanks as the target products, other specializations are also known for this culture – e.g. flint axe blanks in the Polish Krzemionki (*Budziszewski – Michniak 1984*; *Sałaciński – Zalewski 1987*; *Borkowski 1995a*; *1985b*).

The Funnel Beaker occupation of Stránská skála began in its earliest (pre-Baalberge) phase and continued up to the Baalberge, respectively Boleráz phase (documented only in the uppermost part of the 1/81 feature infill; *Svoboda – Šmíd 1996*, 97; *fig. 19*). Occupation and raw material extraction activities have been documented for this whole period. Settlement features identified include furnaces, storage and extraction pits and daub fragments with wooden construction imprints from structures that did not survive. Numerous archaeological, paleobotanical (cereal grains; cf. *Svoboda – Šmíd 1996*, 102–103) and osteological finds identify a permanent settlement at the site. The evidence for intensive chert processing can be found across the whole site. Apart from numerous lithic artefacts, one of the sunken features yielded limestone blocks and antler picks – the latter has numerous recorded analogies at other extraction sites (e.g. *Shepherd 1980*, fig. 19, 21; *Neustupný 1988*, fig. 1: 9; *Oliva 2017*, fig. 8, 9).

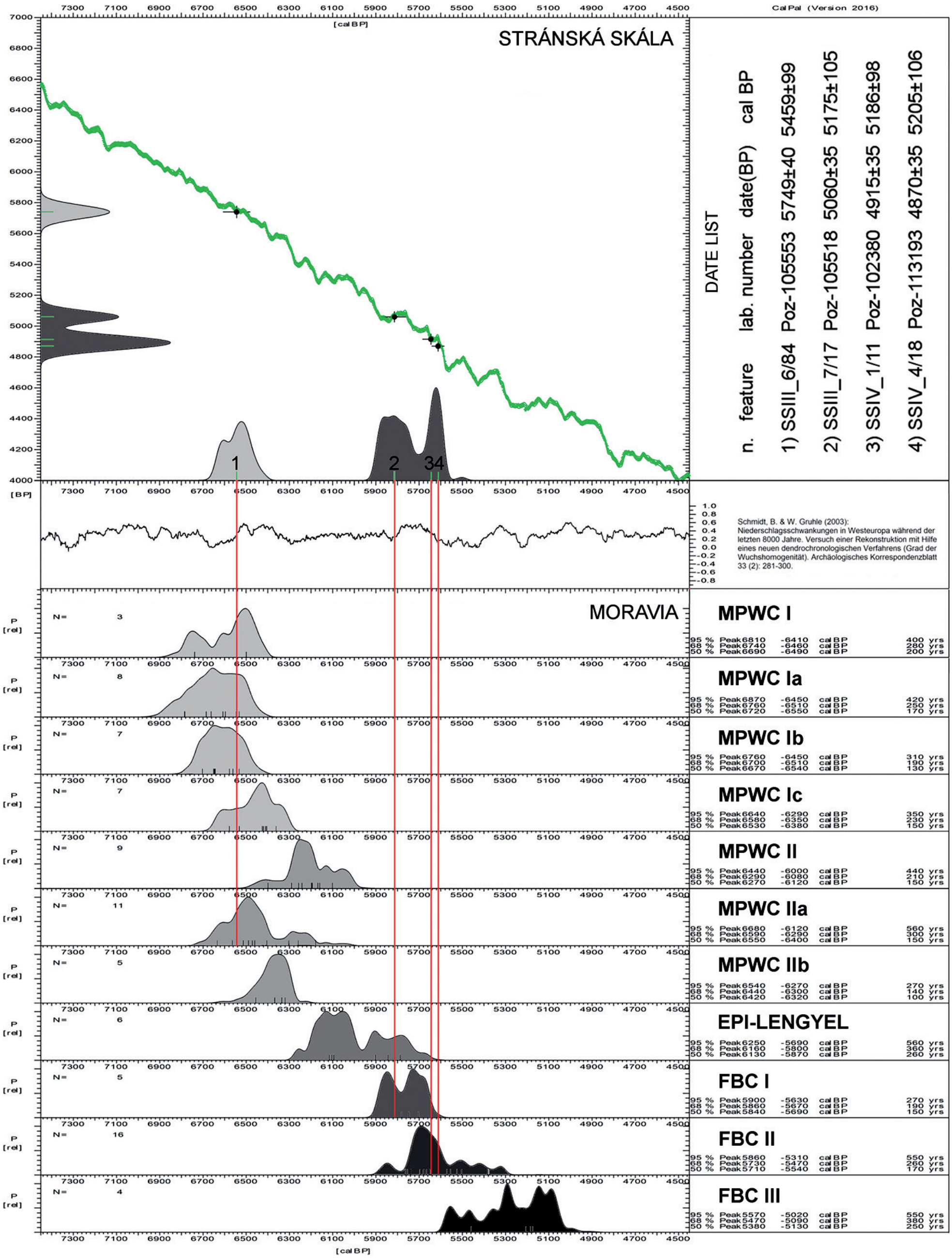


Fig. 19. Radiocarbon dates from Stránská skála in the context of the absolute chronology of the Late Neolithic and the Early Eneolithic in Moravia.
Obr. 19. Radiokarbonová data ze Stránské skály v kontextu aktuální absolutní chronologie mladého neolitu až starého eneolitu na Moravě.

A preliminary reconstruction of the extraction process assumes that people extracted chert nodules from shallow pits in the limestone scree deposited close to the surface (as indicated in trench No. 1/18), rather than from deep extraction shafts that are known from other chronologically comparable sites. The scree includes naturally separated chert nodules – both fully separated and only partly separated (still connected to limestone blocks). The latter mentioned extraction is suggested by the presence of limestone flakes, including burnt limestone flakes that may indicate the use of fire during this process (*Weisgerber – Willies 2000*). The previous hypothesis of chert extraction directly from the limestone massif (cf. *Svoboda – Šmíd 1996*, 91–92) can be rejected in light of the new discoveries.

There are numerous analogical sites (to the Stránská skála extraction and processing site) in Moravia and neighboring countries. These sites differ in the extent and method of extraction. The most important similar site is situated in the Krumlovský les extraction area, where Neolithic quarrying reached its maximum intensity during the younger stage of the Moravian Painted Ware culture as documented by a series of radiocarbon dates from the bottoms of the shafts (*Oliva 2010*, 29–50). A series of workshop sites utilizing the local Krumlovský les-type chert were also located in the vicinity of the extraction area (*Oliva 2001*; *2014*). The most significant one is Jezeřany-Maršovice (*Košturík et al. 1984*). Although Funnel Beaker culture chert extraction has recently been recognized in the Krumlovský les extraction area (*Oliva 2017*), a direct comparison of the Krumlovský les material (excavated from shaft infills and dump piles) to the Stránská skála assemblage (prevailing workshop character) is not possible.

Extraction of the Krumlovský les-type chert, variety II, was documented also outside the Krumlovský les area where the Funnel Beaker culture extraction pits were excavated in Němčičky (*Oliva 1999*, 10; *2010*, 292). A large workshop site dated to the Moravian Painted Ware culture that suggests nearby raw material extraction is located at Ořechov / Silůvky / Mělčany – Tikovská hora (*Rychtaříková – Škrdla 2012*, 137–138).

The extraction of siliceous weathering product of serpentinite – plasma type – in the form of shallow pits in weathered bedrock was documented in western Moravia in the Jevišovice area (*Kovárník 1977*; *1992*; *1993a*; *1993b*; *2011*, 22–23; *Oliva 1999*, 10) and more recently at Dukovany (J. B. and P. Š., unpublished research) during a similar time period.

In discussing the possible remnants of Neolithic – Eneolithic raw material extraction activities, we cannot omit Olomučany-type chert quarrying in the Moravian Karst (*Přichystal – Přichystal 2004*) and White Carpathian (western Slovakia) radiolarite extraction and processing sites (*Cheben et al. 1995*; *Cheben – Cheben 2005*; *2010*; *Oliva 2012a*; *2012b*). The exact antiquity of the lithic raw material extraction activities at these sites is not clear.

Looking further abroad, the Tušimice quartzite extraction and processing in Bohemia is generally associated with the Funnel Beaker culture (*Neustupný 1963*; *1966*; *Malkovský – Vencl 1995*; *Lech – Mateiciucová 1995*). Numerous exploitation and workshop sites have been reported from all across Europe (cf. *Weisgerber – Slotta – Weiner eds. 1981*; *Kobyliński – Lech eds. 1995*; *Oliva 1999*).

We can conclude that chert extraction, processing and exporting activities at Stránská skála have been conducted since at least the early stage of the Moravian Painted Ware culture to the beginning of the Middle Eneolithic. Although several related phases have not been documented yet, the existence of chert distribution networks indicates continuous utilization of the Stránská skála outcrop during this period. After a short hiatus, the Stránská skála chert again appears in the Jevišovice culture assemblages (*Valoch – Šebela*

1995; *Kopacz – Přichystal – Šebela 2014*). This culture itself has not been documented at Stránská skála yet. The settlement and extraction activities resumed at Stránská skála at the end of the Eneolithic (the Bell Beaker culture; *Bartík et al. 2018a*).

The Stránská skála chert outcrop has been attracting people since the Paleolithic times and people returned and used this site (in varying intensities) during later periods (similar to the lithic raw material extraction activities recorded in Krumlovský les). New excavations will be aimed at locating extraction sites, investigating their spatial extent, and reconstructing the extraction activities, processing and export of Stránská skála-type chert during various periods. Questions relating to the contentions concerning large-scale extraction activities versus limited export of products off site, and the meaning of economic and symbolic aspects of extraction will also be explored.

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Těžba a zpracovávání rohovce typu Stránská skála v období mladého neolitu až starého eneolitu

Stránská skála u Brna představuje jednu z nejvýznamnějších přírodních, geologických a archeologických lokalit na jižní Moravě. Jedná se o výrazný útvar tvořený jurskými vápenci rozprostírající se v nejsevernější části katastru městské části Brno-Slatina (okr. Brno-město). Pestrá geologie tohoto místa přitahovala člověka od nepaměti, ať už pro svůj tvar, zdroje vápenců jakožto stavebního kamene, či pro výskyt jurských rohovců (*Koutek 1926*; *Přichystal 1987*; *2009*), které byly v pravěku využívány jako surovina pro výrobu štípané kamenné industrie (*Svoboda 2001*, 21–23). Po archeologické stránce sehrála lokalita svůj význam zřejmě již ve starém paleolitu (*Valoch 1987*; *1995*; *2003*), největší intenzita lidských aktivit zde však byla prokázána pro období počátku mladého paleolitu. V rámci několika archeologických výzkumů zde byly identifikovány dvě vrstvy s početnou štípanou industrií spadající do bohunicienu a aurignacienu (*Valoch et al. 2000*; *Svoboda – Bar-Yosef eds. 2003*; *Svoboda 1987a*; *1987b*; *Škrdla 2017*). Pro oba zmíněné technokomplexy se rohovec typu Stránská skála stal také majoritní surovinou v celé oblasti brněnské kotliny a jejím blízkém okolí (*Svoboda 1987a*; *Škrdla et al. 2016*; *Škrdla 2017*). V poloze Stránská skála II byl stratigraficky doložen rovněž horizont pozdního aurignacienu (*Svoboda 1991*). V letech 1985–1986 bylo na severním úpatí Stránské skály v poloze IV částečně prozkoumáno epigravettské loviště koní. V tomto období však byly místní rohovce doplněny významnou měrou importovanými surovinami ze zdrojů vzdálených až několik stovek kilometrů (*Svoboda 1991*).

Lidské osídlení a s ním spojené těžební a dílenské aktivity se na Stránskou skálu vrátily až na konci mladého neolitu a na počátku eneolitu. První doklady o aktivitách v tomto období se podařilo získat v 80. letech 20. století. V letech 1981–1982 zde proběhl v souvislosti s budováním vysokotlakého vodovodu záchranný archeologický výzkum, při kterém byl zdokumentován rozsáhlý multifunkční objekt s doklady zpracovávání místních rohovců (*obr. 4*) datovaný do kultury nálevkovitých pohárů (*Čižmářová – Rakovský 1983*; *Svoboda – Čižmářová 1984*; *Svoboda – Šmíd 1996*). Další neolitické či eneolitické objekty se na temeni Stránské skály (poloha III) podařilo zachytit při sondážních řezech v roce 1983 (*Svoboda 1985a*). O rok později byl v poloze IIIa objeven a částečně prozkoumán také objekt lengyelské kultury (*obr. 2*) s bohatou kolekcí štípané industrie (*Svoboda 1985b*; *2001*, 23). V téže době se při povrchových sběrech v prostoru Stránské skály IV podařilo objevit první objekt, který zde doložil lidské aktivity v pozdním eneolitu. K jeho řádnému výzkumu však došlo až v roce 2016 (srov. *Bartík et al. 2018a*).

V průběhu několika posledních let došlo k obnovení archeologického výzkumu, zaměřeného na poznání post-paleolitického osídlení na Stránské skále, což vedlo k získání velkého množství nových dat a také k otevření nových výzkumných otázek. Ty se týkaly zejména rozsahu a struktury celého areálu, jeho vnitřní chronologie, ale také způsobu získávání rohovcové suroviny a technologie jejího následného zpracovávání. Na tomto místě jsme se zaměřili na chronologický úsek mladého neolitu (lengyelská kultura) až staršího eneolitu (kultura nálevkovitých pohárů), přičemž kombinovány jsou výsledky získané jak nedestruktivními archeologickými metodami, tak povrchovými prospekcemi a menšími zjišťovacími výzkumy.

Z metodického hlediska se ukázalo při analýze získaných kamenných industrií jako zásadní proplavování výplní exkavovaných objektů. Touto metodou se totiž podařilo získat ve srovnání s výzkumy z 80. let 20. století poněkud odlišná data, a to zejména z pohledu metriky štípaných industrií, kdy neunikají ani velmi drobné artefakty, ale i z typologického hlediska. Příkladem může být objevení geometrických mikrolitických nástrojů (trojúhelníků a trapézů – nový element v rámci KNP) v objektu 7/17, které by běžným překopáváním zeminy unikly pozornosti. V tomto ohledu je nápadná absence těchto typů v objektu 1/81, jehož výplň proplapována nebyla.

Aktivity spojitelné s nositeli kultury s MMK se prozatím podařilo prokázat pouze v poloze Stránská skála III, kde byl v roce 2017 revizně prozkoumán větší hliník s bohatou kolekcí štípané industrie zhotovéné z místních rohovců. Industrie obdobného charakteru se pak nachází i ve výrazném povrchovém clusteru v jeho okolí. Geofyzikální průzkum polohy III (*obr. 7*) v roce 2017 dokládá přítomnost dalších tvarově a velikostně podobných zahloubených objektů, které vytvářejí obraz běžného sídlištího areálu (což podporují i pro sídliště charakteristické nálezy hmotné kultury), který je ovšem v případě Stránské skály doplněn o doklady intenzivního zpracovávání místních rohovců. Štípaná industrie jednoznačně vykazuje dílenský charakter projevující se přítomností velkého množství odpadu a vytěžených jader a naopak nízkým zastoupením cílových polotovarů (pravidelných čepelí), které byly z dílny odneseny. Radiokarbonové datum z objektu 6/84 spadá do závěru staršího stupně kultury s MMK, popř. na samotný počátek mladšího stupně (*obr. 19*). Osídlení zde však pravděpodobně pokračovalo v celém průběhu mladšího stupně MMK, o čemž svědčí rekonstrukce distribuční sítě RSS (*obr. 18*), která se navíc oproti staršímu stupni i mírně rozšiřuje.

Osídlení kulturou nálevkovitých pohárů dosahovalo zřejmě větší rozlohy než v předešlém období. Kromě nálezů KNP z polohy SS III byl identifikován výskyt zahloubených objektů (1/11, 3/16) a velké množství štípané industrie také v poloze SS IV. Další prozatím kulturně nezařazené povrchové soubory post-paleolitické štípané industrie pocházejí z poloh SS II, IIa, jihozápadního úbočí a jižních svahů Stránské skály. Po propojení všech poloh s nálezy vznikne obrovský areál o rozloze ca 35 ha.

Industrie KNP na Stránské skále je charakterizována vyspělou čepelovou technologií. Čepele a nástroje z nich byly zřejme hlavním artiklem redistribuce či směny. Na formu, v jaké mohla být surovina ze Stránské skály šířena, ukazuje i depot cílových polotovarů uložených v nádobě, jež se podařilo nalézt ve výplni jednoho z objektů (*Svoboda – Šmíd 1996*, 94–95). Z několika lokalit v blízkém okolí Stránské skály ovšem pocházejí doklady svědčící o tom, že distribuována byla i neupravená surovina a počátková jádra. Zaměření dílny na Stránské skále vedlo k produkci pravidelných čepelí, v rámci rozšíření KNP však existují i jiné formy specializací. Příkladem mohou být doly v polských Krzemionkách, jež se specializovaly ve starém a středním eneolitu na výrobu polotovarů silicitových seker (*Budziszewski – Michniak 1984*; *Sałaciński – Zalewski 1987*; *Borkowski 1995a*; *1995b*).

Po chronologické stránce zde začíná osídlení KNP již ve své nejranější předbaalberské fázi (*obr. 19*) a pokračuje zřejmě až do bolerázské fáze KNP (identifikována prozatím jen v nejsvrchnější části výplně objektu 1/81). Pro toto období máme na Stránské skále rovněž doloženy typické sídlištní struktury v podobě pecí, zásobnicových jam a hliníků (včetně nálezů fragmentů mazanice ze zaniklých konstrukcí), které jsou doplněny o doklady intezivní extrakce a zpracovávání místních rohovců. V rámci výplně jednoho z objektů KNP se podařilo objevit v kontextu s bohatou štípanou industrií a bloky vápenců také několik parohových kopáčů či rypadel, které lze i na základě četných analogií (např. *Shepherd 1980*, fig. 19, 21; *Neustupný 1988*, obr. 1: 9; *Oliva 2017*, obr. 8, 9) spojovat s těžbou rohovců. Přestože byla v době KNP v několika lokalitách doložena těžba suroviny formou hloubení šachet, v případě Stránské skály toho nebylo zřejmě zapotřebí. Domníváme se, že k získávání suroviny docházelo přehrabáváním vápencových sutí, popř. do nich byly hloubeny pouze mělčí jámy (příkladem by mohla být jáma objevená v sondě 1 z roku 2018). Uvedené sutě zde obsahují nejen uvolněné konkrece rohovců, ale i bloky vápenců, v nichž se nacházejí ulpělé nodule rohovce, které z nich byly následně vyštípávány (doloženy jsou úštěpy z vápence, včetně přepálených kusů – uvolňování po nahřátí ohněm). Dříve uznávaný názor, že surovina byla získávána vylamováním z vápencového masivu, se proto ve světle nových výzkumů jeví jako málo pravděpodobný (cf. *Svoboda – Šmíd 1996*, 91–92).

Pro exploatační a dílenský areál na Stránské skále v mladém až starším eneolitu můžeme najít řadu analogií po celé Evropě. Případ od případu se však odlišuje rozsah a způsoby těžby. Nejvýznamnější areál tohoto typu na Moravě se nachází v Krumlovském lese, kde neolitická těžba vrcholila v mladším stupni MMK, do něhož bylo radiometricky datováno několik zahloubených šachet (*Oliva 2010*, 29–50). Z jeho blízkého okolí je pak známo několik dílenských areálů (k nejznámnějším se řadí Jezeřany-Maršovice, *Košturík et al. 1984*) a celá řada sídlišť využívajících tamní rohovcovou surovinu (*Oliva 2001*; *2014*). V nedávné době zde byla prokázána extrakce rohovců také v období KNP (*Oliva 2017*). Komparace se Stránskou skálou je po technologické stránce ovšem obtížná, jelikož zde byly hodnoceny industrie pocházející ze sídlištně-dílenského prostředí, zatímco nálezy z Krumlovského lesa byly získány z výplní těžebních šachet, odvalů a náhozů rubanin v jejich okolí. V této době docházelo k těžbě rohovců typu KL-II také mimo oblast Krumlovského lesa. Svědčí o tom řada povrchových dílen datovaných do MMK (největší taková se nachází např. na pomezí katastrů obcí Ořechov, Silůvky a Mělčany; *Rychtaříková – Škrdla 2013*, 137–138) a rovněž několik částečně prozkoumaných těžních jam v Němčičkách, spojovaných s nositeli kultury KNP (*Oliva 1999*, 10; *2010*, 292). V témže období jako na Stránské skále probíhala také extrakce křemičitých zvětralin typu plazma na západní Moravě, a to zřejmě jámovou metodou a rozhrabáváním povrchu navětralých serpentinitů. Tyto aktivity jsou doloženy např. z Jevišovic (*Kovárník 1977*; *1992*; *1993a*; *1993b*; *2011*, 22–23; *Oliva 1999*, 10) a Dukovan (nepubl. výzkum J. B. a P. Š.). Opomenout nelze ani doklady pravěké těžby u Olomučan v oblasti Moravského krasu, i když zde je prozatím problematická jejich datace (*Přichystal – Přichystal 2004*). V kulturách s MMK a KNP však olomučanské rohovce nedosahovaly takové obliby jako v mezolitu, starším a středním neolitu nebo později v průběhu mladého eneolitu (*Přichystal 2009*, 71). V období mladého neolitu a časného eneolitu fungoval pravděpodobně také těžební a dílenský areál zpracovávající bělokarpatské radiolarity na moravsko-slovenském pomezí, odkud jsou známé relikty neolitických/eneolitických dobývek, prozatím však zůstává problém s jejich jednoznačným datováním (*Cheben et al. 1995*; *Cheben – Cheben 2005*; *2010*; *Oliva 2012a*; *2012b*). V Čechách jsou s nositeli kultury KNP spojovány pravěké doly v Tušimicích, jejichž produkce byla zaměřena na získávání místních křemenců (*Neustupný 1966*; *Malkovský – Vencl 1995*; *Lech – Mateiciucová 1995*). Po Evropě je známo velké množství dalších exploatačních a dílenských areálů ze zájmového období, míra jejich prozkoumání však bývá různá (cf. *Weisgerber – Slotta – Weiner eds. 1981*; *Kobyliński – Lech eds. 1995*; *Oliva 1999*).

Za pozornost stojí také chronologické a socio-ekonomické otázky spojené s významem tohoto typu areálu v rámci fungování tehdejší společnosti. Přestože prozatím nebyly doloženy přímo na Stránské skále některé relativně-chronologické fáze z mladého neolitu a časného eneolitu, doklady distribuce mimo Stránskou skálu dovolují předpokládat kontinuitu zdejších sídelně-dílenských aktivit od staršího stupně kultury s MMK až do počátku středního eneolitu. Poté následoval zřejmě krátký hiát, ale již z období jevišovické kultury známe několik příkladů využívání rohovcové suroviny ze Stránské skály (*Valoch – Šebela 1995*; *Kopacz – Přichystal – Šebela 2014*). Stabilní osídlení, opět doprovázené intenzivním zpracováváním místních rohovců, se na Stránskou skálu vrátilo v pozdním eneolitu, reprezentovaném kulturou se zvoncovitými poháry (*Bartík et al. 2018a*).

Závěrem tedy můžeme konstatovat, že Stránská skála přitahovala jako významný zdroj rohovcové suroviny člověka už od počátku mladého paleolitu a stejně jako v případě industriálně-sakrální krajiny v Krumlovském lese se sem vracel v mnoha dalších epochách pravěku. Cílem dalších výzkumů bude snaha o přesnou lokalizaci pravěké těžby a jejího rozsahu, stejně jako pochopení významu zdejších aktivit v jednotlivých epochách. Stále totiž není spolehlivě objasněna motivace extrakce a zpracovávání místních rohovců, které mělo převážně jen lokální význam. Po interpretační stránce tak proti sobě stále stojí motivy praktické (ekonomické) a motivy kultovně-symbolické, jejichž působení se s velkou pravděpodobností v průběhu času měnilo.

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