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MESOLITHIC SETTLEMENT AND ACTIVITIES IN ROCKSHELTERS OF THE KAMENICE RIVER CANYON, CZECH REPUBLIC

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Abstract

This paper introduces a group of newly discovered Mesolithic rockshelter sites, clustered at the confluence of two rocky canyons in the sandstone region of North Bohemia, Czech Republic. Whereas the rockshelter of Okrouhlík, representative of the Early Mesolithic stage, is located higher above the valley floor and has only shallow sediment coverage above the cultural layers, the rockshelter of Dolský Mlýn, representing the Late Mesolithic stage, is located almost on the valley floor level, with a massive income of sediments from above. A network of smaller rockshelter sites was recorded. Thanks to its shallow position, the Okrouhlík rockshelter was excavated almost completely, demonstrating internal within-site patterning: a central hearth, system of surrounding kettle-shaped pits, and two large, stone-filled, marginally located hearths. This site structure may be compared to other hunter-gatherer sites such as Dolní Věstonice II. Analyses of the environmental data, fauna, and use-wear on lithic artifacts are included.

INTRODUCTION

Before leaving the Bohemian Massiv through a broad valley cut into the sandstone plateaus of the Bohemian-Saxonian "Switzerland", Elbe, one of the largest central European rivers, recieves a small tributary from the east, named Kamenice. Kamenice passes through a sequence of narrow and steep sandstone canyons, some of which recently provided relatively (i.e., on a Bohemian scale) rich evidence of Mesolithic occupation (Svoboda (ed.), 2003). Of special importance was the area of confluence of Kamenice and Jetřichovická Bělá rivers, where the excavations in 2001 and 2005 unearthed a system of early and late Mesolithic sites (Figs. 1–3).

RESEARCH HISTORY AND ACTUAL GOALS

Several limited areas of sandstone plateaus with canyons and rockshelters are scattered from Luxembourg over western and central Germany to the northern part of the Czech Republic. In most of these regions, archaeological research has shown that the sandstone areas, being unattractive for agriculture, were mainly occupied by foragers during the Mesolithic period. In this manner, these sites contribute essentially to the knowledge of a relatively little known period of central European prehistory.

The fact that the sandstone formations of northern Bohemia, and especially the pseudokar-

Fig. 1. Map of Europe showing location of Northern Bohemia and the Kamenice river sites

stic rockshelters, may potentially provide important evidence concerning the last hunter-gatherers' lifestyles, is one of the important recent discoveries in Czech prehistoric archaeology. However the recently accumulated evidence also results from a long and complex research history.

By the end of the nineteenth century, the first generations of Czech researchers focused on the exploration of karstic caves and suspected a kind of transitional period somewhere between the Diluvial and Aluvial layers, but without a solid stratigraphic background. The result was a general scepticism shared by the leading research authorities on the very existence of the Mesolithic in both Bohemia and Moravia. More systematic research of Mesolithic open-air sites was initiated after World War II (Valoch, 1978; Sklenář, 2000). Simultaneously, a methodological improvement in cave archaeology brought to light Late Paleolithic/Mesolithic layers from karstic caves – first from the large Kůlna cave (Valoch, 1988) and then from a number of smaller, episodically settled caves (Horáček *et al*., 2002). The karstic caves may provide important biostratigraphic and environmental evidence, but as a result of intensive early research in the karstic regions, the sedimentary fillings of these caves was largely dug out, and little remained for modern investigations.

For several reasons, the northernmost part of Bohemia has been neglected by previous archaeological research. First, the distance from the national capital, Prague, and second, the population exchange and the interruption of local research traditions at the end of the World War II. The advantage of this situation is that the sandstone rockshelters, if not destroyed by quarrying, dwellings, working areas, and tramping, remained undisturbed by earlier archaeological excavations. Surprisingly, the Mesolithic represents the most important time period recorded in the rockshelter sedimentary fillings.

Systematic exploration of sandstone rockshelters started in the late 1970s and was conducted in several stages. Until 1998, the Mesolithic survey projects concentrated on the regions more to the south, such as the Polomené Mountains and the Peklo Valley (Svoboda *et al*., 1983, 1998; Hardy and Svoboda, in preparation). Since 1999, as part of a project funded by a National Geographic grant, this research achieved a higher level of systematic collaboration and expanded into new subregions – namely the newly founded Bohemian Switzerland National Park. At this stage, the main aim was to establish a representative network of sites over the northern Bohemian landscape rather than to explore them in totality (Svoboda *et al*., 2000; Svoboda (ed.), 2003). Actually, within the frame of the present exploration stage, the project concentrates on a more detailed analysis of a selected settlement area. As such, we chose the group of rockshelters on confluence of the Kamenice and Jetřichovická Bělá rivers in the Bohemian Switzerland National Park, around the ruin of an old mill house called "Dolský Mlýn" or "Grundmühle" (Figs. 2, 3).

GEOGRAPHIC AND GEOLOGICAL POSITION

Northern Bohemia is a part of the Bohemian Cretaceous Basin, namely its Lusatian lithofacial zone, with typically cubical desintegrated, kaolinitic-clayish sandstones. In the microregion under study, the lower part is formed by quarzitic sandstones of the Bílá Hora formation (Lower to Middle Turonian) and the upper part by petrographically analogous deposits of the Jizera formation (Upper Turonian). The above plateaus are covered by Upper Pleistocene loess or loessic derivates. Actual elevations of the plateaus range between 250–300 m a.s.l., and are cut by a number of volcanic bodies of about 500 m in elevations. However, the highest elevations of about 750 m

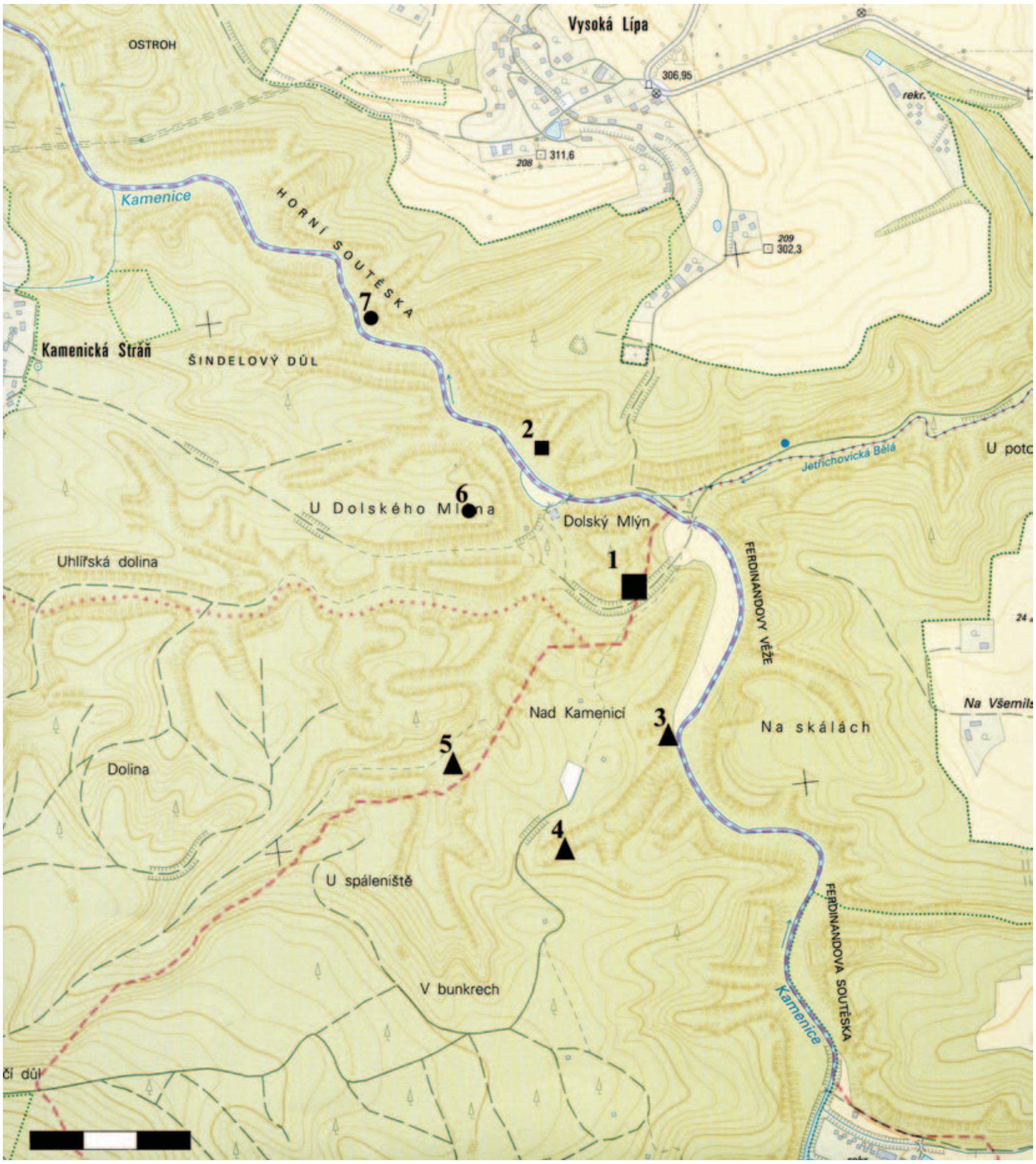

Fig. 2. Map of sites at the confluence of Kamenice and Jetřichovická Bělá rivers: 1 – Okrouhlík; 2 – Dolský Mlýn; 3 – Ferdinand's Canyon; 4 – Prasečí kámen; 5 – Shaman´s Canyon; 6 – Magdalenian artifact; 7– Kostelní Canyon

a.s.l. are reached by the Lusatian Mountains chain, bordering the area to the north. Thus, northern Bohemia separates the lowlands of the Bohemian Basin in the south (Czech Republic) from the North European Plain (Germany, Poland). From the viewpoint of Mesolithic cultural typology, Northern Bohemia also separates the zones of the Beuronian in the south from the Maglemosian in the north, but the geographic boundary between these two entities is difficult to draw precisely, especially if we are limited to lithic typology.

Fig. 3. Area of the confluence of Kamenice and Jetřichovická Bělá rivers. The isolated rock of Okrouhlík ("rounded rock") is in the center. The rockshelter is located below the rocks

The Central Bohemian Basin provided a network of smaller and middle-sized Mesolithic open-air sites, the largest of which are Hořín (Sklenář, 2000) and Chržín (Fridrich, 2005), both undated by radiocarbon, but indicating an earlier Mesolithic age on the basis of microlith typology. In the karstic caves of Bohemia, the scarce and rather episodic archaeological evidence of the ephemeral foragers' occupation after the Magdalenian is being supplemented by a relatively complex record from several sedimentary sequences that document climate and landscape changes after the Pleistocene/Holocene boundary (Horáček *et al*., 2002). In the adjacent southern part of the North European plain, larger open-air sites were surveyed, excavated and radiocarbon-dated, both in Saxonia (Geupel, 1985; Vollbrecht, 2001) and Silesia (Masojc, 2005). One Mesolithic rockshelter was recently recorded in the Kirnitz valley behind the national boundary (Abri Buschmühle near Ottendorf) and the nearest open-air site lies at Pratschwitz near Pirna (collections of the Antiquities Department at Dresden).

The quantity of artifacts recorded at the individual rockshelter sites varies from tens to thousands of pieces, but our comparative studies show that there is no direct correlation between the size of the rockshelter, the complexity of features, and the number of artifacts. The richest rockshelter sites are located in the northern subregion (Okrouhlík, Arba, Švédův rockshelters) near the German border, suggesting possible relationships north of the modern border, into the North European Plain. Some of the southern sites, as demonstrated in the Peklo valley (the Pod zubem rockshelter), offer better conditions for organic preservation, thus providing a better environmental record, faunal evidence, and bone industries, but smaller lithic assemblages.

RAW MATERIALS

Determining the lithic raw materials was difficult because of the small size of the artifacts and and intensive burning that affected up to 30–40 % of the pieces. Nevertheless, the dominant raw materials were the erratic flints from glacial or glacifluvial sediments. Based on the remaining preserved surfaces on the artifacts, the original nodules were predominantly small, up to 5–7 cm large and well rounded. Although the erratic flints were partly transported by rivers into northern Bohemia, south of the southern limit of the continental ice sheet ("Feuersteinlinie"), most of them were only isolated pebbles, with sizes between 3–5 cm (exceptionally 10 cm; Müller, ed., 1998), and as such, probably insufficient for collecting for further knapping.

North of the continental glacier's boundary (R. Grahmann in Pietzsch, 1962; Brause (ed.), 1975), the nearest area of occurence of flint nodules is the Labe river valley west of Schandau (15 km NW from the Kamenice river valley), vicinity of Neustadt (22 km from our sites), or Varnsdorf (20 km from our sites).

The second important raw material, frequently selected for the production of larger flakes and blades, represent the quartzites. Visually and by their whitish-to-grayish coloration, the quartzites recall the well-known Bečov-type quartzites from northwest Bohemia, but several differences are visible on microscopic examination. The quartz grains are more clearly visible, not as much dissolved in the basic mass, and the whitish areas are fine-grained. It is therefore probable that they do not correspond to the Bečov type, but rather to the Eocene quartzites of the Profen/Zauschwitz-type, with outrops located about 20 km south of Leipzig in Saxony/Anhalt (Elburg 2001), or to similar quartzite occurences at various findspots in the area of Dresden. In any case, the both main raw materials may originate from the broader area of the Labe river in Germany, between Dresden and Leipzig, and not from inland Bohemia.

Additional raw materials are represented by grayish-to-greenish porcelanites, glass-clear chalcedony, chalcedony-opal mass, and whitish opal. These materials may originate from the direct vicinity of the sites, from cavities and fillings of the nearby Tertiary vulcanites. The pebbles of basaltoid rocks were collected from secondary position in the rivers.

CHRONOLOGY

The network of Mesolithic sites excavated thus far provided a series of ^{14}C readings thanks to J. van der Plicht of the Isotope Research Laboratory of the Groningen University. The dates are correlated with the microlith typology, and with comparative samples from the other North Bohemian sites (Svoboda (ed.), 2003), Saxonia (Vollbrecht, 2001) and Silesia (Masojc, 2005). As a result, the Mesolithic sites and layers of North Bohemia may be separated into two major stages (Table 1).

The Earlier (Boreal) Mesolithic. The (Boreal) Mesolithic, dated 8000 to 6500–6000 cal. BC, shows a dominance of microlithic triangles, segments and, rarely in this region, backed microblades and Tardenoisian points. From Okrouhlík, there is a series of four dates: 7300 ± 60 (the central hearth); 7940 ± 70 (the peripheral hearth), 8680 ± 70 and 9170 ± 70 BP (fillings of the two kettle-shaped pits). Comparable dates are from other North Bohemian rockshelters, namely Pod zubem (lower layers), Pod křídlem, Šídelník, Máselník, Černá Louže, Pod Černou Louží, Nízká Lešnice, Vysoká Lešnice, Uhelná Rokle, Švédův převis, and Jezevčí převis.

The Later (Atlantic) Mesolithic. The (Atlantic) Mesolithic, dated 6500–6000 to 5500 cal. BC, is predominantly characterized by geometric trapezes, accompanied by a more regular, rectangular blade production. These dates are from the section at Dolský Mlýn, where charcoal layers and hearths were dated at the depths of 175 cm, 210 cm, 240 cm, and 260 cm, providing four data from 6720 ± 120 BP to 7770 ± 70 BP. Comparable dates were obtained from the North Bohemian rockshelters of Bezděz and Pod zubem (upper layers). The Late Mesolithic is overlain by a horizon of the Late Neolithic (Aeneolithic) at Dolský Mlýn, and by the Middle Neolithic Stroked Pottery horizon at the Bezděz and Pod zubem sites. The Early Neolithic Linear pottery is absent in all these sequences.

The deep canyon at the confluence of Kamenice and Jetřichovická Bělá is an area of several

Table 1

C14 datings for Okrouhlík in context of other earlier Mesolithic rockshelters of Northern Bohemia. All from charcoal. Calibration after the CALIB.REV.4.3. programme (Stuiver and Reimer 1993)

Rockshelter	Context	Depth (cm)	Layer	Sample No.	Date (BP)	Interval (2 sigma)	Date (cal. BP)
Okrouhlík I	hearth	cca 30	6	GrA 19158	7300 ± 60	7970–8276	8151
Okrouhlík II	hearth	60-70	5	GrA 19161	7940 ± 70	8590–9012	8927
Okrouhlík I	pit 5	80	–	GrA 19162	8680 ± 70	9531–9910	9624
Okrouhlík I	pit 6	80	–	GrA 19163	9170 ± 70	10211–10547	10357
Šídelník I	charcoal deposit	76-79	4	GrA 11456	7120 ± 80	7758–8147	7941
Šídelník I	charcoal deposit	90	5	GrN 24213	7830 ± 170	8335–9227	8596
Černá Louže	charcoal deposit	cca 230	8	GrN 21558	7950 ± 80	8545–9027	8929
Pod Č. Louží	charcoal deposit	cca 150	7	GrA 11455	7620 ± 80	8212–8588	8405
Vys. Lešnice	charcoal deposit	cca 240	4	GrN 24217	7930 ± 160	8393–9267	8925
Pod zubem	charcoal deposit	115-120	4b	GrN 23335	7660 ± 130	8182–8748	8412
Pod zubem	charcoal deposit	115	4b	GrN 23334	8110 ± 240	8408–9545	9025
Pod křídlem	charcoal deposit	50-70	4	GrN 23331	8160 ± 80	8815-9401	9124
Švédův převis	charcoal deposit	120-130	8	GrN 25170	8180 ± 110	8778-9470	9228
Šídelník III	hearth	80	5	GrN 24214	8300 ± 150	8818-9547	9397
Uhel. rokle II	hearth	70	7	GrN 25776	8410 ± 65	9137-9911	9529
Jezevčí převis	hearth 3	cca 240	7c	GrN 25170	8530 ± 150	9160-9532	9469
Máselník I	charcoal deposit	cca 110	6	GrN 21556	8560 ± 70	9438-9682	9533
Máselník I	charcoal deposit	cca 130	7	GrN 21557	8790 ± 70	9553-10154	9888
Níz. Lešnice	charcoal deposit	120	5	GrN 24210	10160 ± 190	11195-12802	11901

km^2 where this cultural sequence is fully represented. The location, and as a result, the stratigraphic situation of the two main sites, Okrouhlík and Dolský Mlýn rockshelters, is different. Dolský Mlýn lies low, only 3 m above the river bed, and at the mouth of a dry and steep side fissure that continuously supplied sediments and formed a 3 m thick stratigraphy below the rockshelter. Okrouhlík lies higher, 9 m above the valley floor, in a position with limited sediment supply, so that the Mesolthic layer mostly is just below the surface. These sites represent the two extreme cases while different situations were recorded in other rockshelters.

In sum, the cultural chronology of the area, is unique, with possible Magdalenian artifacts found on the top plateau immediately above the canyon, followed by the complex layer in the Okrouhlík rockshelter that resulted from a long-term occupation during the Early Mesolithic. Finally, the stratigraphic record in the Dolský Mlýn rockshelter with well-stratified repeated occupations during Late Mesolithic, as well as later prehistoric and historic periods. Other sites in the direct vicinity complete episodically this sequence, as the Ferdinand´s Canyon rockshelter, for example, which provided typically Late Mesolithic artifacts, however, in a disturbed stratigraphic position (Tables 1, 2).

THE OKROUHLÍK ROCKSHELTE

(cadastre Kamenická stráň, distr. Děčín)

Okrouhlík is a line of rockshelters more than 30 m long and maximally 3 m wide in the southern wall of an isolated rock (“Okrouhlík” in Czech; Fig. 3), 9 m above the floor of a dry valley adjacent to the Kamenice river canyon. The site was excavated during two seasons, 2001 (trenches I–II) and 2005 (trenches III–V). The trench

Table 2

C14 datings for Dolský Mlýn in context of other later Mesolithic rockshelters of Northern Bohemia. All from charcoal. Calibration after the CALIB.REV.4.3. programme (Stuiver and Reimer 1993)

Rockshelter	Context	Depth (cm)	Layer	Sample No.	Date (BP)	Interval (2 sigma)	Date (cal. bp)
Dolský Mlýn	charcoal deposit	175	9	GrN 26557	6720 ± 120	7422–7788	7581
Dolský Mlýn	hearth	210	12	GrN 26558	7020 ± 50	7699–7942	7838
Dolský Mlýn	hearth	240	12	GrA 19156	7770 ± 70	8407–8699	8584
Dolský Mlýn	charcoal deposit	260	12	GrA 19157	6910 ± 60	7614–7916	7719
Pod zubem	hearth	75	4a	GrN 23332	6790 ± 70	7510–7785	7656
Pod zubem	charcoal deposit	80	4a	GrN 23333	6580 ± 50	7421–7570	7461
Bezděz	charcoal deposit	140	9	GrN 25772	6930 ± 120	7571–7970	7745

dimensions were: I: 4–4.8 m × 2 m; depth: 0.3 m (upper plateau) – 1.3 m (slope); II: 2 m × 1.5 m; depth: 0.8 m; IIa: 2 m × 1.25 m; depth: 1.6 m; III: 2 m × 2 m; IV: 2.5 m × 2 m; IVa: 3 m × 3 m.

The sheltered part of the settled area has a leveled floor where the supply of sediments from the plateau was very limited, from the western part. Therefore, the Mesolithic layers appear right below the surface in the eastern and central part of the rockshelter, while in the west the stratigraphy is thicker, and reaches 40–70 cm. In the center, a small cave was formed in the rock wall and filled by archaeologically sterile, whitish-yellow coarse-grained sand, mostly from weathering of the bedrock. Given its shallow position below the surface, several pits of recent or subrecent origin disturbed the cultural layer in front of this cave. In this situation, and with respect to repeated activities of modern transients who used the place as a shelter, a complete excavation of this site was in fact a salvage action, protecting the Mesolithic evidence from further damage.

Stratigraphy (Fig. 4)

East: Trench I (2001)

1. black forest humous soil; below the shelter (1a) finely layered, clayish, with thin charcoal layers
2. brown, sandy-clayish layer (also as filling of subrecent pits)
3. light brown (partly greenish), fine-grained sand
4. orange to yellow sand
5. brownish gray, sandy-clayish layer
6. under the shelter mostly dark brown to black, sandy-clayish layer; outside the shelter light in color (6a)
7. white or yellowish, coarse–grained sand, horizontally penetrated by thin iron bands

West: Trench II (2001)

1. forest humous soil
2. gray to brownish layer, with finer sandy and clayish horizons
3. gray, fine-grained sand
4. yellow, coarse-grained sand
5. black, sandy-clayish filling of the hearth, with interlayers of red-burnt sand
6. yellow to whitish, fine-grained sand

Planigraphy and features (Fig. 5)

The central part of the area protected by the rockshelter is dominated by an oval-shaped hearth, 300 cm long and 150 cm wide. The hearth was lying on an irregular surface, with several shallow pits below. The filling of the hearth, about 30–40 cm thick, was finely layered into horizons of charcoal and red burnt sand.

An adjacent pan-shaped depression of 170 × 110 cm was located in the area between the central hearth and the rock wall behind the hearth. The depression was filled by larger blocks and pebbles of basalt and sandstone, some of them burnt. Two adjacent pits, filled by microlayers of fine grayish sand, red-burnt sand, and charcoal, were located at the left edge of the hearth; a few basalt pebbles laid between these pits and the rock wall.

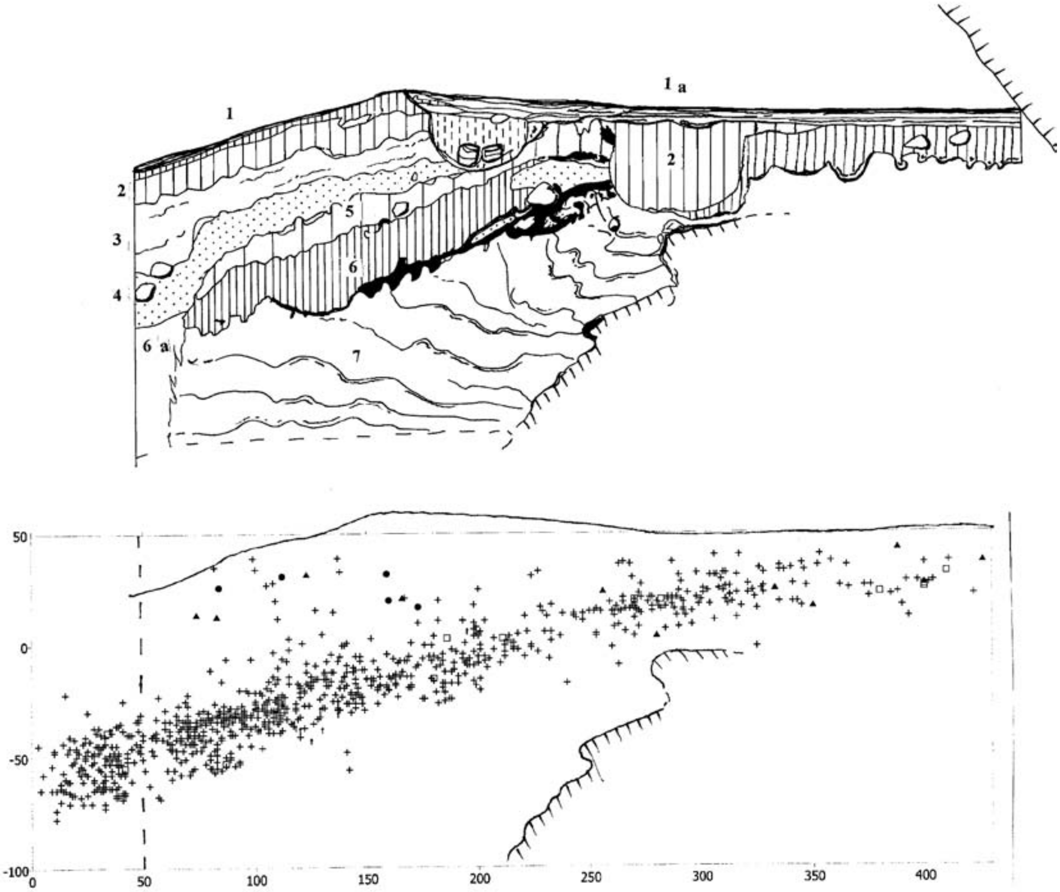

Fig. 4. Stratigraphy of the Okrouhlík rockshelter: Above – the section (description of layers 1–7 in text); below – vertical distribution of artifacts

Smaller, kettle-shaped pits were clustered on the slope below the central hearth, forming a semicircular area about 200 cm in diameter. Their relatively standard sections varied in size between 20–30 cm, and their depths reached 10–20 cm. An exceptionally well preserved deeper pit was found at the eastern periphery of this area (Fig. 6): this one is about 35 cm wide and 40 cm deep. The filling of this pit was composed of two differently colored sediments, brownish-gray at the base and brownish-green at the top, probably from repeated use. Thick charcoal deposits surrounded the mouth of the pit, and a group of burnt basal pebbles were lain at one side of it. We interpret this arrangement as a boiling pit, the last one to be used, and therefore best preserved, with the used heating stones left along side of it. It is probable that the other kettle-shaped pits, some of which were also associated with heating stones, served a similar purpose.

Lithic artifact distribution shows a remarkable concentration on the moderate slope in front of the central hearth. We interpret this space as the main area of domestic activities. The variability of ^{14}C dates, taken from the central hearth and from two adjacent pits, shows that the recorded features may not be contamporaneous, but have accumulated during a longer time-span.

In the western part of the rockshelter we found two massive hearths composed predominantly of basalt pebbles, accompanied by a few blocks of burnt sandstone (Fig. 7). The basalt pebbles were collected from the nearby Kamenice river gravels, where they form abundant deposits.

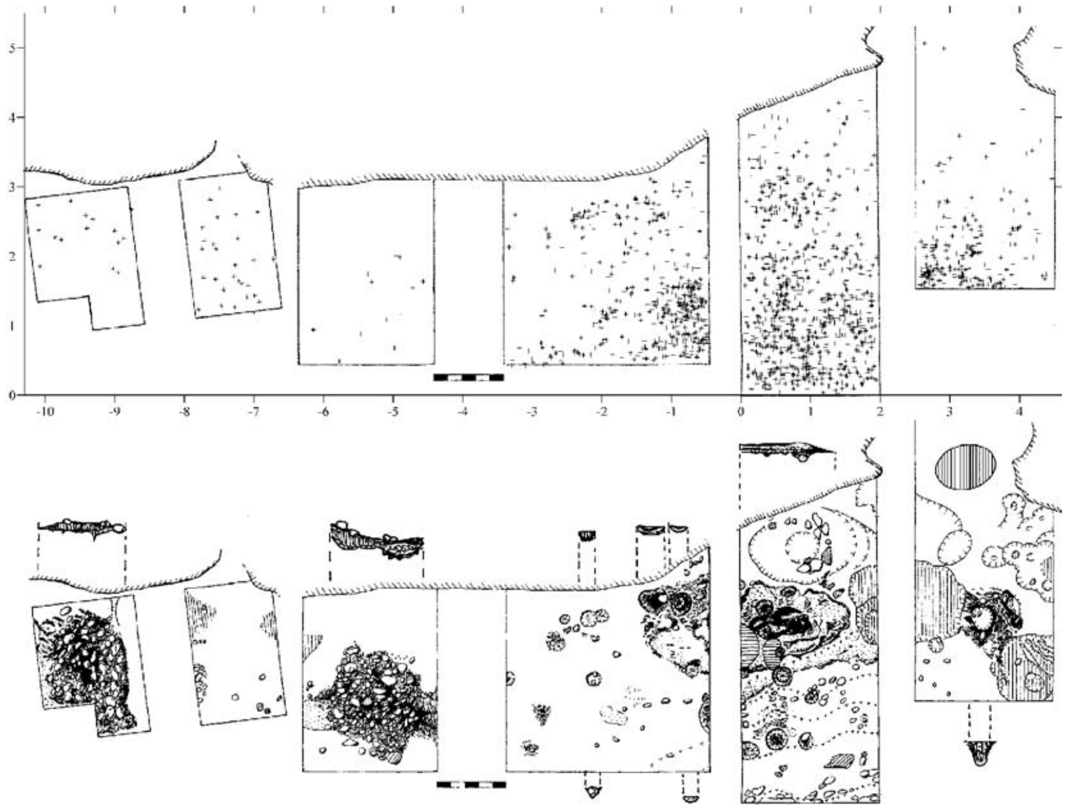

Fig. 5. Planigraphy of the Okrouhlík rockshelter: Above – horizontal distribution of artifacts; below – spatial organisation (hearths, pits)

The left hearth was located at a depth of 0.8 m on a surface of whitish-yellow basal sand; its ^{14}C date is 7940 ± 70 BP. The basalt pebbles covered an area 120 × 150 cm, lying on and between a thick charcoal layer. The right hearth was similar, measuring 160 × 150 cm, but the pebbles in this case covered two shallow depressions, 20–30 cm deep, filled by charcoal, ash, and red-burnt sandstone blocks; shallow depressions below the pebble layer contained red-burnt sand (Fig. 8).

Lithic industry from this context was poor, compared to the central part of the rockshelter, and activities at the western periphery area were probably more specialized.

Archaeobotany

Excavated in 2005, the 16 m^2 area of the rockshelter platform, has been sampled for the recovery of plant macro-remains. From the assemblage of 67 samples, processed by water flotation in the Kamenice river, 26 have been studied to date. Samples chosen for the preliminary archaeobotanical analyses presented here were selected to represent various depths and contexts (layers, hearths, and pits at the bottom of the hearths) in all but 4 m^2.

The analyses have shown that material processed by water floatation consists of charred and uncharred plant macro-remains, charred and uncharred bones, sclerocia of *Fungi* and soil *Micromycetes* and various archaeological artifacts.

Generally, the archaeobotanical analysis is influenced by the above-mentioned shallow location of the cultural layer at Okrouhlík. The occurrence of uncharred modern plant remains (such as the needles of lately introduced coniferous species (*Pinopsida*)), uncharred wood fragments and modern seeds deep in the soil profile most likely result from three different bioturbation processes:

Fig. 6. Okrouhlík: Section through one of the boiling pits, with burnt basalt pebbles lain at the margin

1) the natural gravitation and downward movement of water that would carry seeds (in sandy sediments like those present at the site) and small wood fragments deep into the soil; 2) the action of the roots of plants that were commonly found in the flot fractions of all samples (in several samples taken from the hearths or pits at the depth of 50–60 cm, roots accounted for up to 95% of the flot fraction volume); 3) the horizontal and vertical movements of small animals (rodents, worms, insects) the remains of which were also commonly found in the flot fractions. Based on the good state of preservation and the species recovered, it is assumed that uncharred plant material is likely of modern origin, does not reflect ancient human activities or environments, and therefore it is not discussed here in any further detail.

On the other hand, the charred remains of wood, seeds and tubers/bulbs present in the hearths, layers and/or clusters of archaeological artifacts are most probably (and as confirmed by the radiocarbon dates) connected with the ancient human activities at the site.

The most abundant among the fragments (99) is charred hazel wood (*Corylus avelana*) that occurred in 11 samples of various depths, from 10 to 60 cm, in five squares (310, 312, 415, 419, 2001/II). It has been observed that 69 charred fragments of hazel nutshells occurred more frequently in the sediments from trench IV, rather than trench III (308, 407, 412, 413, 415, 418) and come not only from the hearths or pits, but also from the surrounding layers. Pine (*Pinus* sp.) with 87 fragments in 13 samples (squares 307, 310, 312, 415, 418, 419, 2001/II) has also been found in all depths.

The remaining species were much less numerous: Oak (*Quercus* sp. – 24 fragments) was found in three squares (307, 312 and 2001/II); elm (*Ulmus* sp.) in two squares (312, 415); and birch (*Betula* sp.), beech (*Fagus* sp.), and *Viburnum* sp. were found as single occurrences in three

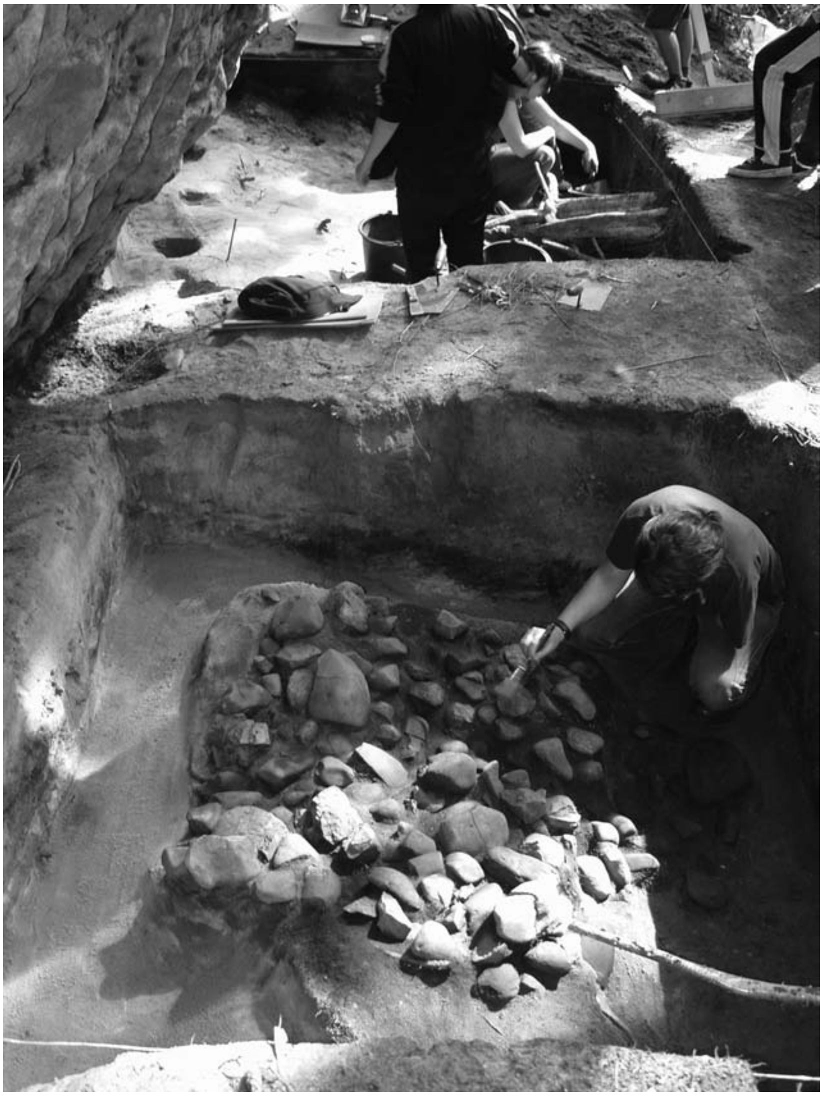

Fig. 7. Okrouhlík: One of the two hearths filled with basalt pebbles

separate squares (310, 307 and 312 respectively). Over 350 charcoal pieces were, due to their small size of less than 3 mm, impossible to determine.

Seeds of wild plants were rarely identified to species level. The only exceptions were the seeds of a synanthropic plant, *Chenopodium album* aggr. It is a common species that grows on disturbed land and often accompanies human dwellings. Its leaves are edible as greens and are an important source of vitamins in early spring. The seeds, rich in starch, could also be consumed. Among the other recorded taxa were *Galium* sp., *Carex* sp., cf. *Tilia* sp., *Caryophyllaceae*, cf. *Ericaceae*, cf. *Fabaceae*, and cf. *Rosaceae*. Due to the very broad determination, any detailed environmental or ethnobotanical information of these cannot be drawn.

A specific group of charred remains from the site represents fragments described as "charred organic matter of unknown origin (food/resin?)" and "charred tuber/bulb/root". Closer determination of these remains would require scanning electron microscopy (SEM) or similar methods of analyses, but if results are positive, they could

Fig. 8. Okrouhlík: Section through the hearth shown on Fig. 7; showing a depression with red-colored sandy filling below the pebble coverage

greatly add to our, still rather limited, knowledge of the local Mesolithic diet from other sites in North Bohemia (Pokorný, 2003; Hardy and Svoboda, in preparation).

It can be concluded that the wood species occurring as charcoal in the excavated sediments are typical of mixed deciduous forests of warmer climates and those same species are found in the area still today. The pine and birch are pioneer and light loving species, which grow on the exposed slopes, rocky outcrops, or screes. Oak, hornbeam and hazel prefer warmer, more fertile and sunny stands, while elm and beech are found in cooler and wetter areas. Due to inversion processes within the deep canyons, such stands are often found in low elevations, in the vicinity of the streams or in deeper gullies. Of interest is the absence of trees and shrubs such as willow and poplar nowadays bordering the watercourses.

Based on the obtained data we have made an attempt to draw a simplified picture of the local past "forest" environment. However one must bear in mind the selective nature of the assemblage. All wood was brought to the site and burned in the hearths by humans. For various reasons they might have chosen to select those particular species and neglect others.

Further questions, which still remain to be answered are: 1) how do we explain the absence of residues of plant foodstuffs in the environment which must have been bountiful? 2) does this absence of residues indicate a full dependence on a meat diet (as suggested by the abundance of burned bones) only sporadically "seasoned" by hazelnuts (the fragments of nutshells found would account for not more than 15 hazelnuts)? 3) does it indicate the consumption of soft plant parts like leaves, stems, and fruits? 4) did the method of consumption – eaten raw or cooked in water, without direct contact with fire – lessen the possibility that these remains would be charred and thus preserved?

Table 3

Composition of the major technological groups at Okrouhlík and Dolský Mlýn

	Okrouhlík		Dolský Mlýn							
	Trech I–IV		Layer 9, 10		Layer 12		Redeposited		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Cores	31	0.4	0	0.0	1	0.3	1	0.5	2	0.2
Fragments and chips	5,364	72.5	252	71.2	264	73.3	154	82.8	670	74.4
Flakes	565	7.6	30	8.5	47	13.1	12	6.5	89	9.9
Blades	1,253	16.9	63	17.8	41	11.4	12	6.5	116	12.9
Retouched tools	184	2.5	9	2.5	7	1.9	7	3.8	23	2.6
Burin spalls	1	0.0	0	0	0	0	0	0	0	0
Total	7,398	100	354	100	360	100	186	100	900	100

Archaeozoology

Osteological material obtained by floation was quite abundant and includes about 2,000 items. However, due to its poor degree of preservation it is unsuitable for further analyses. In most instances these are very small fragments (less than 1 cm in diameter), which were apparently affected by burning. Most of them can be identified as long bones of larger mammals (about the size of a deer), and no identifiable elements such as epiphyses or cranial bones are included, except for two items tentatively identified (by their size) as roe deer and red deer, and a long fragment of a diaphysis of a bird of *Pica* size. The taphonomic conditions at the site exclude bone fragmentation by natural processes. Rather, they suggest intentional breakage by humans, probably in the context of thermal food preparation and consumption. Bone remains of foraging activity by non-human predators, are apparently absent.

Lithic technology and typology

The total number of 7,398 lithic artifacts was classified according to the major technological groups such as cores, fragments and chips, flakes, blades, retouched artifacts, and burin spalls (Tables 3, 4).

The **cores** are represented by a small number of pieces and they are the least numerous technological group. Only 31 cores have been recorded in the assemblage and comprise only 0.4% of all artifacts. A total of 15 pieces are cores in the advanced reduction stage, an additional 15 cores represent small exhausted residual pieces and one more initial core was found. Single-platform cores predominate (27 pieces; Fig. 9: 1, 2) and there are four cores with changed orientations. Nearly all cores are made from flint and only one core is quartzite.

The **fragment and chip** category is the most numerous, with 5,364 pieces (72.5% of all artifacts). The majority are small chips or irregular flakes, representing the fine waste from core processing or tool retouching. The remainders are undetermined flake fragments (the majority of them are burnt) and flakes smaller than 1.5 cm. Flint is the dominant raw material, followed by undetermined burnt materials.

Flakes are represented by 565 pieces (7.6% of all artifacts). Most of them are without cortex, from advanced stages of core reduction. The flakes have largely unidirectional scars on the

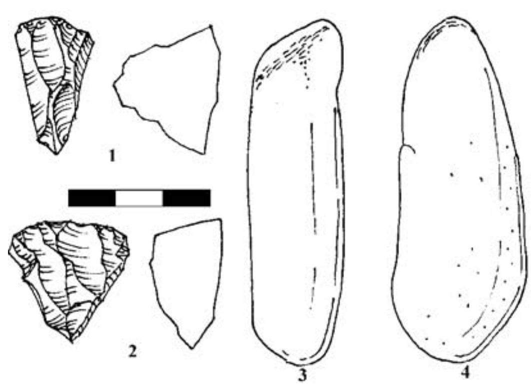

Fig. 9. Okrouhlík: Cores and retoucher

Table 4

Composition of the individual types of retouched artifacts in Mesolithic assemblages of the lithic industry from rockshelters Okrouhlík and Dolský Mlýn

	Okrouhlík	Dolský Mlýn		
	I–IV	9, 10	12	red.
Triangles	18			
Triangles elongated	33			
Trapezes	1	2	2	2
Microlithic backed points	27			
Microlithic backed pieces	22		2	
Microlithic pieces with transversal retouched truncation	6			
Microlithic backed pieces with transversal retouched truncation	4			
Other retouched microliths	1		1	
Microburins	2			
Endscrapers	4			1
Burins	6			
Notched pieces	12	1		
Borers		1		
Unilateral and bilateral retouched blades and flakes	18	2	1	1
Blades with transversal retouched truncation	7	1		1
Points	2			
Other tools	2	1		
Partially retouched pieces	19	1	1	2

dorsal face, from unidirectional reduction; others have transverse, opposed or centripetal scars.

Blades, numbering 1,253 pieces (complete pieces or fragments), compose the second largest category in the lithic assemblage (16.9%). Half of them represent the microblades with a width up to 8 mm maximum, often preserved as fragments. As well as flakes, the majority of blades are non-cortical, but there is also small number of blades with cortex on the lateral, lateral-distal, or distal side. The blades with parallel scars on the dorsal surface, originating from single platform cores, predominate. There is also a small number of blades with opposed scars, obviously struck from double platform cores (a category that was not recorded in the core group). From the morphological point of view, the majority of blades have parallel or irregular lateral edges, rather than convergent or divergent shapes. The cross-sections are mainly trapezoidal or triangular. The blades have straight, convex, or irregular profiles. Nearly half of all blades are incompletely preserved as various fragments, predominantly proximal and proximal-medial parts, followed by medial-distal, distal, and medial parts.

The number of **retouched artifacts** does not surpass 2.5 % of the total assemblage. This category consists of 184 pieces, including geometric and retouched microliths and other retouched tools (Table 4).

Typologically, the most expressive group of retouched artifacts represents the geometric microliths (79 pieces). The most numerous are triangles, namely the elongated forms (33 pieces; Fig. 10: 1–7, 10, 14–16, 26, 38–43; Fig. 11: 1–5, 10–15, 17, 18, 24), rather than short or intermediate forms (18 pieces; Fig. 10: 8–9, 11–13, 17, 19, 23, 34–37; Fig. 11: 6–9). Within the elongated forms, the longer retouched edge is typically concave shaped (Fig. 11: 1–4, 9, 10, 13). Another elongated triangle is atypically retouched along all three edges.

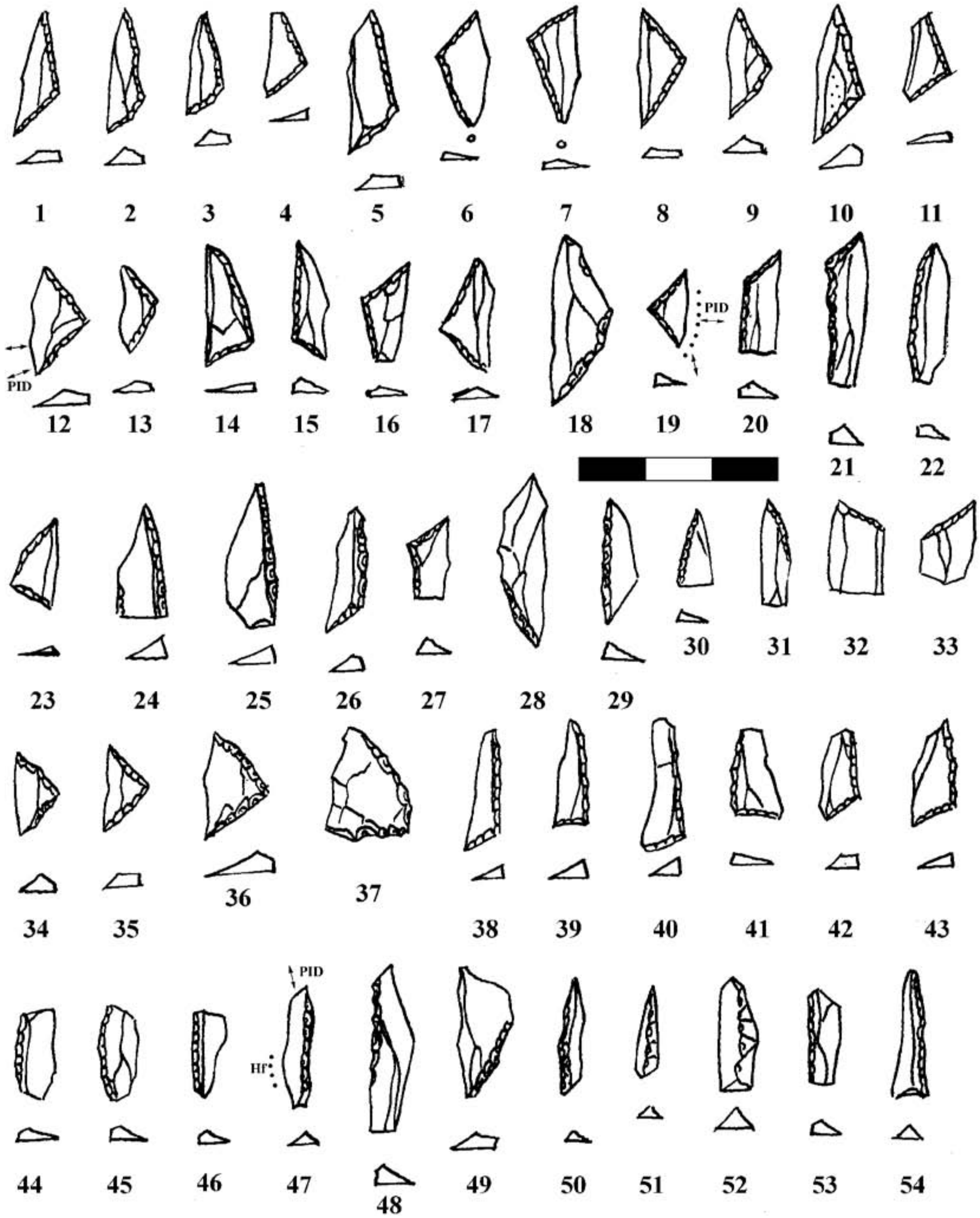

Fig. 10. Okrouhlík: Early Mesolithic artifacts. The dots indicate the location and intensity of the development of the observed traces. The arrows indicate the direction of the tool motion. Worked materials: PID = projectile impact damage; Hf = hafting

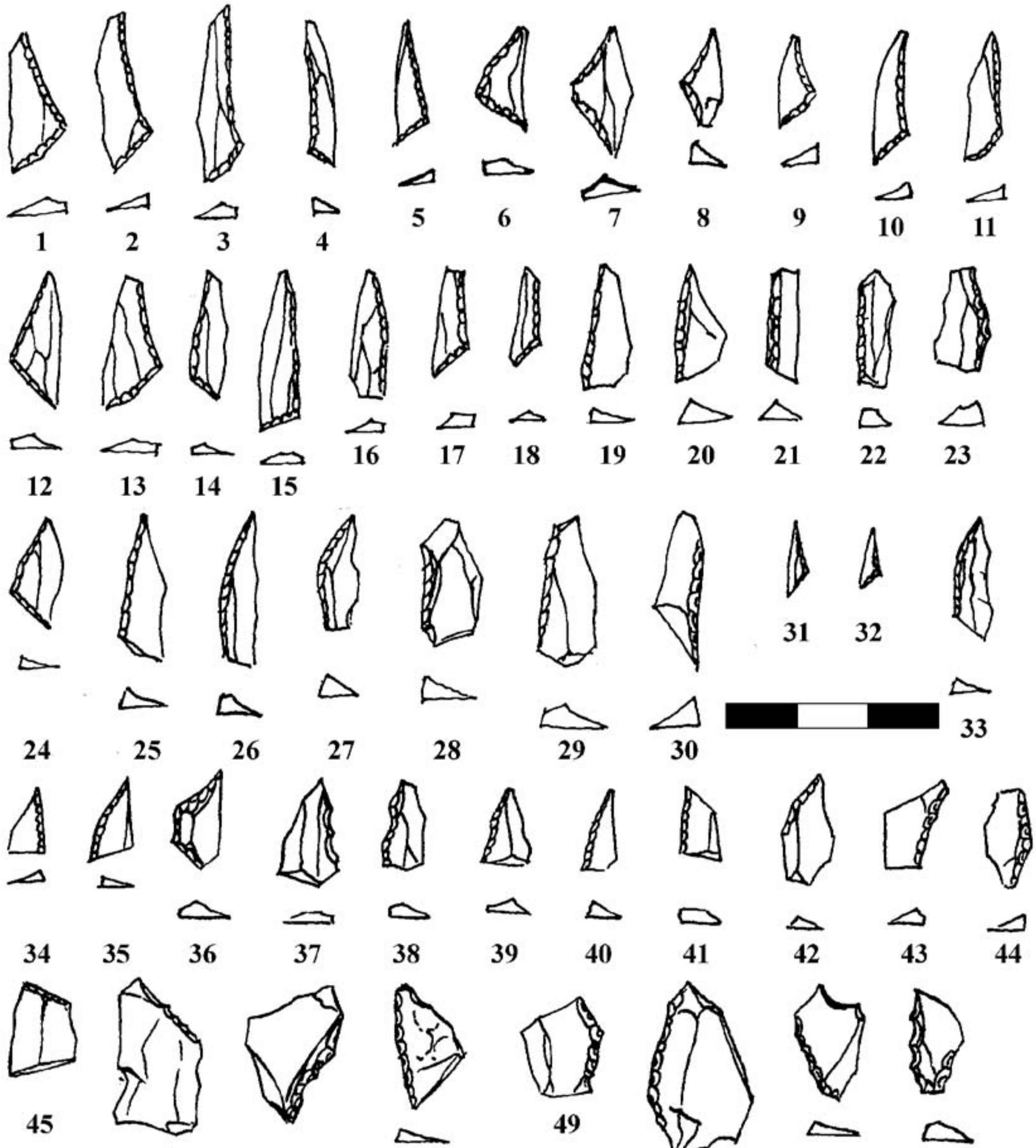

Fig. 11. Okrouhlík. Early Mesolithic artifacts

The second group of geometric microliths includes morphologically various microlithic backed points (27 pieces), made on microblades or microlithic flakes, and often pointed at the end (Fig. 10: 18, 24, 25, 28–31, 49–51, 54; Fig. 11: 16, 19, 20, 25–27, 33–35, 37–40; Fig. 12: 1). In addition, there is one trapeze, atypically continuously retouched along three edges (Fig. 11: 36).

The microlithic backed blades (22 pieces; Fig. 10: 22, 44–47, 53; Fig. 11: 21–23, 28–30, 41, 43, 44; Fig. 12: 12–14, 23) are frequently preserved as fragments. Some microliths show trans-

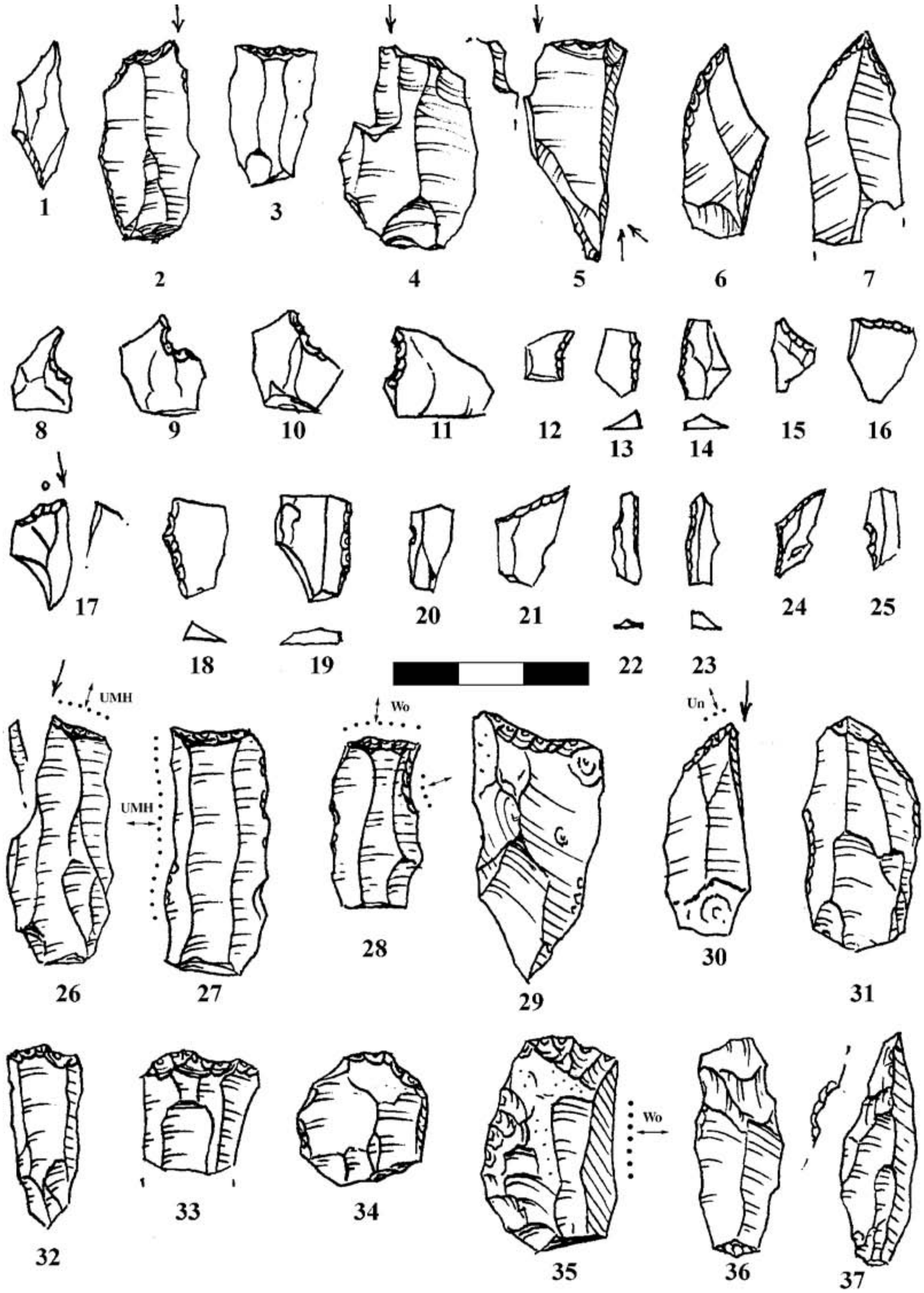

Fig. 12. Okrouhlík. Early Mesolithic artifacts. The dots indicate the location and intensity of the development of the observed traces. The arrows indicate the direction of the tool motion. Worked materials: UMH = undefined medium hard material, Wo = wood, Un = unspecified

versal truncations (six pieces; Fig. 10: 32–33; Fig. 11: 42; Fig. 12: 16), which also appear on certain backed pieces (four pieces; Fig. 10: 20–21, 27; Fig. 12: 24), and on one partially retouched microlith fragment.

Two microburins are, in fact, microblade fragments with a transverse burin blow made on a notch. They represent waste products of the microblades originating from preparation of the geometric microliths. Microburins are very rare in the Mesolithic assemblages in Northern Bohemia. Similar specimens are known from the nearby rockshelter, Arba (two pieces), and one piece was found in the redeposited sediments of the rockshelter, Švedův převis.

The assemblage includes six burins, predominantly made on truncations (five pieces; Fig. 12: 2, 4, 17, 26, 30), or, in one case, as a combination of a truncation with an angle dihedral burin (Fig. 12: 5).

Only four pieces of endscrapers have been recorded. There are two pieces made on blades (Fig. 12: 32–33), one thumbnail piece on a small flake (Fig. 12: 34), and one piece on a larger and rough flake (Fig. 12: 35). The heads are formed by steep retouch of various, straight to convex shapes.

The variously retouched blades number 25 pieces. The retouches are mostly unilateral (18 pieces; Fig. 11: 47–52; Fig. 12: 31) or form a straight, oblique or concave truncation (seven pieces; Fig. 11: 45, 46; Fig. 12: 3, 21, 27–29).

Among the notched pieces, the microlithic forms, made on various small fragments or bladelets, slightly predominate (six pieces; Fig. 12: 8–11, 25) over notches made on blades (three pieces; Fig. 12: 37) or on larger flakes (three pieces). The notch was usually situated in the terminal part of the artifact.

The remaining tool types are two points (Fig. 12: 6, 7), one with an atypically bow-shaped backed edge, a sidescraper made on a rough flake, and a flake fragment pointed by denticulate retouch. The inventory is completed by a burin spall and various blades, flakes and fragments partially retouched, both from the dorsal or ventral face.

In summary, the raw material is characterized by the dominance of local or para-local flints. Technological analysis of the lithic industry has shown a complete chain of core reduction performed at the site. Cores were intensively utilized, as visible from the minimal proportion of initial cores and a relatively high proportion of exhausted residual pieces. The dominant blank types used for retouching were the blades and bladelets, especially their medial parts, while the proximal parts were left unretouched. The high proportion of chips, small flakes, and flake fragments supports the idea of intensive reduction, transformation and tool rejuvenation. Among the retouched tools, the most expressive group are the geometric microliths, especially the elongated triangles, and the microlithic backed points.

Microwear analysis

A sample of 127 artifacts from the 2001 excavation, trench I, was selected for micro-wear analysis, mostly retouched pieces. Potential results of the microwear analysis of this collection were limited by two factors: 1) the artifacts were deposited in loamy-sandy soil; 2) most of the artifacts were microlithic in size (less than 2 cm) and were primarily discovered by sieving the sediment. The implication of these two factors is that weakly developed use-wear traces could have been destroyed or removed by slight abrasion of the tool's surface. In addition, postdepositional modifications such as abrasion polish streaks and scarring were present more often on these implements than on the surface of well preserved tools. Another difficulty discovered during the analysis was the high percentage of burned pieces in the sample of retouched pieces (28% – 36 pieces). Nevertheless, the burned pieces that were in relatively good condition were examined using low power magnification.

Despite these difficulties, evidence of the tools' usage was found on 20 pieces (16%), and specifically show that the worked materials included: one hide (Fig. 13), three pieces of wood, five pieces of undefined medium hard material, and five pieces of uncertain material; in addition, six pieces demonstrate impact traces. With the exception of one tool, the use-wear traces were only lightly developed, therefore it is assumed that the implements were used for short-term activities. This may also be due to the special usage and working efficiency of the microlithic industry, where replacing the microlithic elements would probably be easier than resharpening the larger

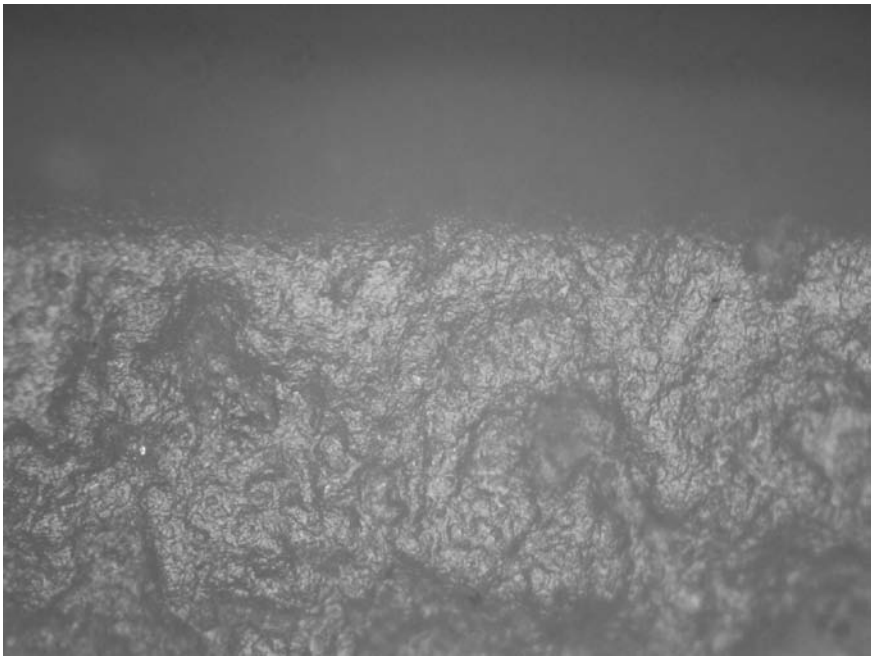

Fig. 13. Okrouhlík, use-wear polish: Hide scraping, mag. 200 ×

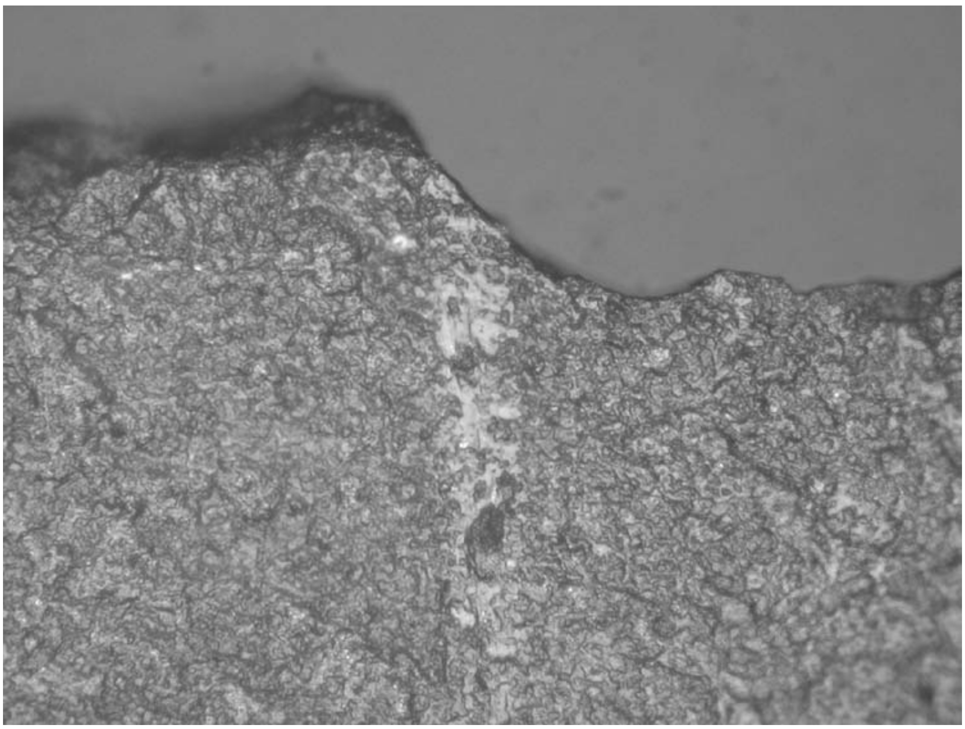

Fig. 14. Okrouhlík, polish streak: Projectile impact traces, mag. 200 ×

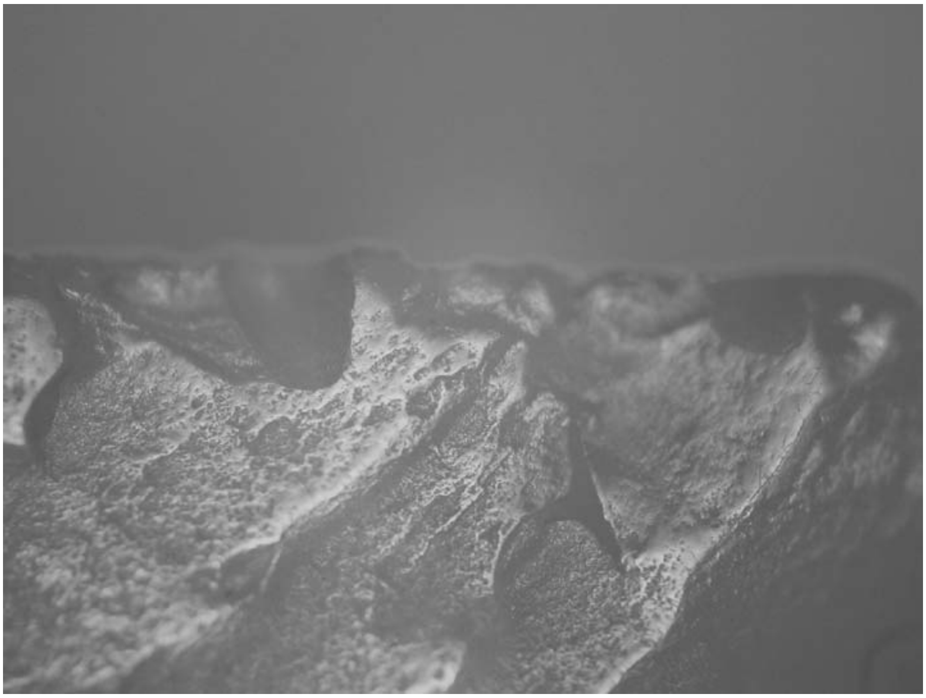

Fig. 15. Okrouhlík, use-wear polish: Wood shaving, mag. 100x

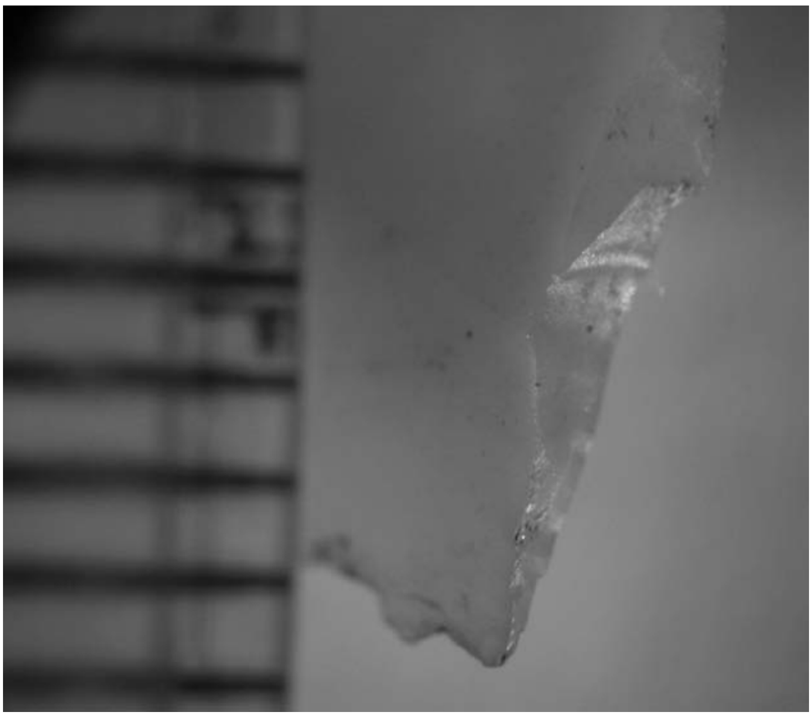

Fig. 16. Okrouhlík: Detail of an impact on one of the extremities of a trapezoid projectile

pieces. The transversal motion was found to be the dominant direction of working activities. Transversal motion made up 40%, dynamic activities 30%, longitudinal/diagonal motion 20%, and undetermined motion 10%. Interestingly, all the wood-working traces represent transversal motions: wood planning, shaving or whittling.

Traces interpreted as the result of damage caused by projectile impact were observed on six tools and comprise a significant group of recorded activities (30%). Microwear traces consisted of streaks of polish (Fig. 14) and hinge/step terminated scars on the points of the projectiles. The macro-traces of the impact damage will be discussed later. In support of the evidence of archery, well developed traces of wood shaving were preserved on one tool (Fig. 15).The polish on this tool was about 1 cm wide and could correspond to the estimated width of an arrow shaft.

Considering the fact that Okrouhlík was not an open-air settlement and it was limited by the rock wall, the composition of the worked materials corresponds with use-wear results from other Mesolithic sites. It can be assumed that the traces originating from working meat/hide or soft vegetables might have been unrecognized due to the light abrasion of the sandy soil matrix. The quantity of traces originating from wood working shows a significant difference from the Upper Paleolithic settlements yet analyzed in the Czech Republic and reflect the changes that occurred in both the environment and the style of living of the Mesolithic society.

Projectile damage analysis of the microlithic assemblage

The microliths from Okrouhlík were further examined for the identification of fractures diagnostic of projectile impact. The analysis was performed at the macro-level and without the aid of magnification (Fisher *et al*., 1984). Step terminating bending fractures were found on six microliths, whereas the spin-off fracture type was identified only in a single case.

The microliths bearing diagnostic macro-fractures represent a variety of types. In three cases these are backed and truncated pieces. One of them has a spin-off fracture on its ventral surface. In two other cases, projectile damage appears as step terminating bending fractures that removed part of the retouch on the truncation in one case, and from the backing on the other. This type of fracture also occurred on a broken backed bladelet with abrupt bilateral retouch. One case of a step terminating bending fracture on the sharp lateral edge was recognized on a broken backed microlith, on its dorsal surface. Triangles, the most prominent type of microlith at the site, have one representative bearing a step terminating bending fracture, which removed part of the retouch on the short edge of the triangle, on the truncation. The single trapeze found at the Okrouhlík site is also outstanding with regard to its projectile fractures. On both truncations step terminating bending fractures, directed from the long sharp, unmodified edge were identified (Fig. 16). The fractures removed part of the retouch on the truncations. This kind of damage is diagnostic for the use of the microlith as a transversal arrowhead. Finally, a step fracture was identified on a broken unretouched bladelet.

Based on these observations, a variety of microlith types were used as projectile implements, mostly as piercing projectile arrowheads. Backed implements could have been used as lateral components of the projectiles. The diagnostic projectile fracture found on the triangle suggests a use as a piercing arrowhead. Triangles could have also been attached as lateral barbs of projectiles. Experiments have shown that the majority of barbs remain undamaged (Crombe *et al*., 2001). Such a use can explain the fact that only one triangle bears the projectile damage.

THE DOLSKÝ MLÝN (GRUNDMÜHLE) ROCKSHELTER

(cadastre Vysoká Lípa, distr. Děčín)

This rockshelter is more than 20 m long and maximally 3 m wide (Fig. 17). It is located at the foot of southwestern wall of the Kamenice canyon, on the shore of the river. The sedimentary fill is thick, as a result of sand accumulation from the side fissure leading to the canyon. Trench dimensions: A: 3 × 2 m; depth: 2.6 m; B: 2.5 × 2 m; depth: 3.2 m.

Stratigraphy (Trench B; Fig. 18)

1. forest humous soil, with thin ashy, clayish

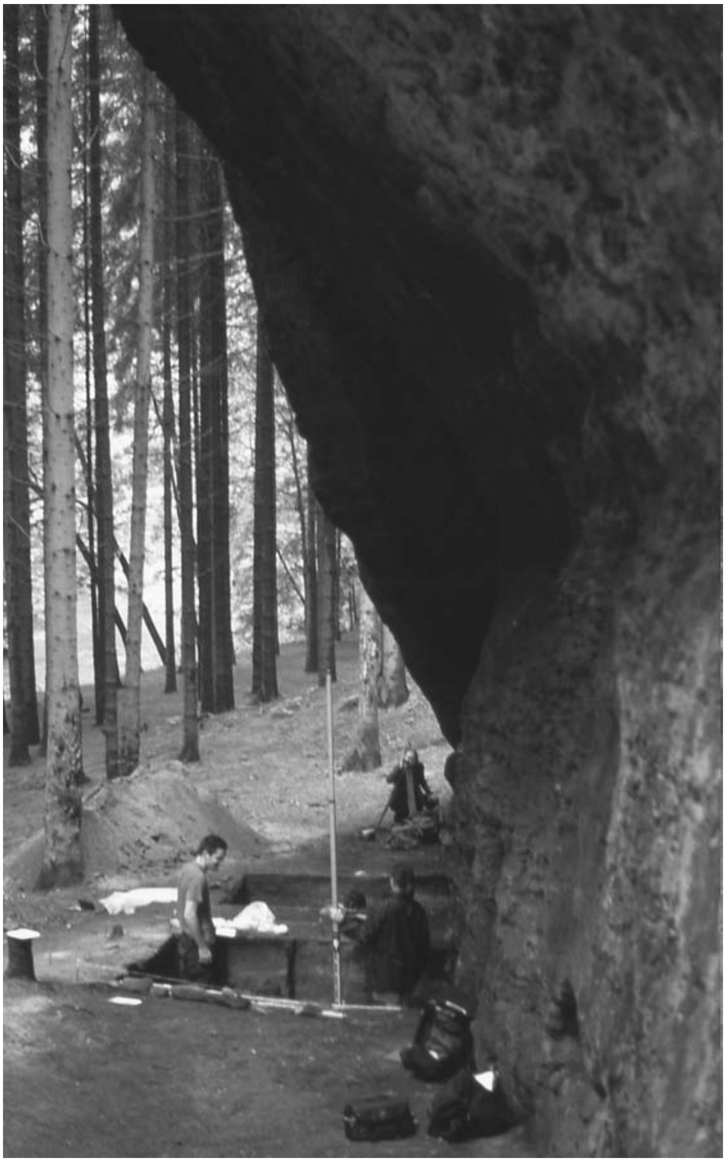

Fig. 17. Dolský Mlýn: View of the site during excavation

and sandy bands (1a)
2. grayish sandy horizon ("podzol")
3. yellow to ochreous, coarse-grained sand
4. brown, sandy-clayish deposit
5. gray, sandy deposit, with horizons of charcoal
6. brown, sandy-clayish deposit with irregular margins (bioturbation); layers 4 to 6 are penetrated by a bow-shaped iron deposit
7. isolated deposits of charcoal and red-burnt sand (fireplaces)
8. yellow to white, coarse-grained sand, with irony bands
9. dark brown, sandy-clayish deposit
10. black, clayish filling of hearths
11. white to cream-white sand
12. gray sand, at places brownish to black, with charcoal; a hearth is located at the base

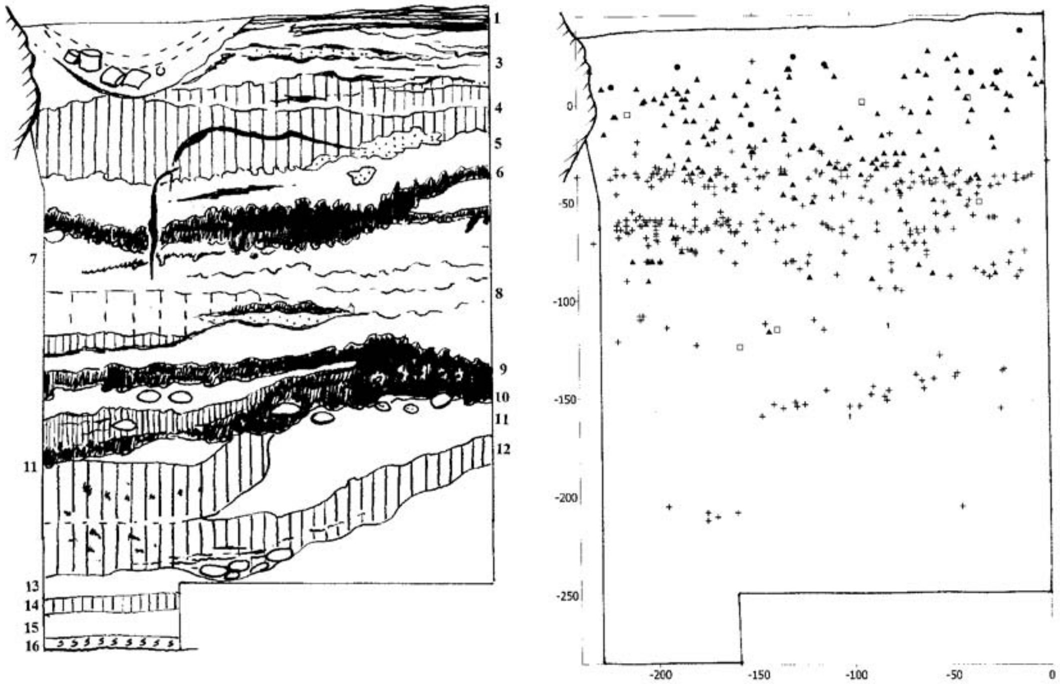

Fig. 18. Dolský Mlýn, stratigraphy of trench B, SE transversal section: left – the section (description of layers 1–16 in text); right – vertical distribution of artifacts

13. white to yellow sand
14. gray sand, with burnt bone fragments
15. white to yellow sand
16. yellow, patchy, and compact clay deposit, overlying the sandstone bedrock; individual pieces of charcoal

In sum, the stratigraphy begins with finely bedded sandy and charcoal layers (0.4 m), with subrecent pottery, disturbed by recent and subrecent pits from the surface. Following was a complex of 1.2–1.4 m thick sandy layers, interstratified by *humus* darker organic layers, and hearths. This complex included prehistoric pottery and lithic industry. Results of a geochemical analysis of one of the subrecent clayish microlayers in the upper part of the sequence, conducted by J. Havel, reveals a higher percentage of calcium and phosphorus, and suggests a possible organic nature of the sediment (domestic animals?). Even if this observation clearly corresponds to activities of the mill house during the past few centuries, this type of organic sedimentation, widely recorded from the Near Eastern or Central Asian caves, was not previously recorded at Czech sites.

The base was formed by 1–1.4 m of sandy deposits with darker inter-bedded layers, with Mesolithic artifacts. A sequence of ^{14}C dates were obtained from charcoal layers and hearths in the depth intervals of 20–35 cm, with the results of 6720 ± 120 BP, 7020 ± 50 BP, 7770 ± 70 BP, and 6910 ± 60 BP (the last reading is from the deepest context is probably contaminated). Since the Mesolithic industries of Dolský Mlýn are characterized predominantly by the microlithic trapezes, the ^{14}C dates correspond well to this cultural context.

Planigraphy and features (Fig. 19)

In trench B, 210 cm below surface, there was a massive hearth composed of a huge accumulation of basalt pebbles, of the same type as at Okrouhlík, dated to 7020 ± 50 BP. Thick pebble overlayer formed a coverage of three circular, pan-shaped depressions. Another, less complex hearth, composed of basalt pebbles, burnt sand and charcoal was found below, in the total depth of 240 cm, and a date of 7770 ± 70 BP. Associ-

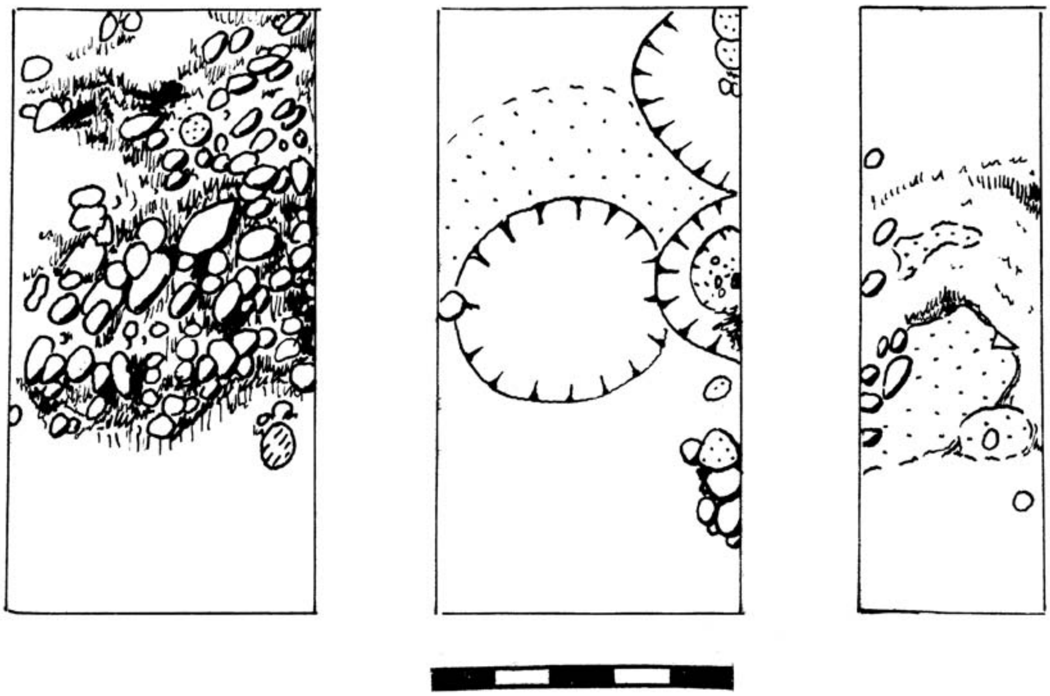

Fig. 19. Dolský Mlýn, trench B, planigraphy in three Mesolithic layers with hearths and pits: Left – layer 10, coverage of a hearth composed of basalt pebbles; center – base of layer 10, complex of pits with ashy filling, after removal of the pebble coverage; right – layer 12, part of another hearth, with individual basalt pebbles

ated was charcoal, *Corylus avellana* nutshells, and a rich faunal evidence.

Archaeobotany

The majority of charcoal originates from the later prehistoric layers: pine (*Pinus* sp.) and hazel (*Corylus avelana*); oak (*Quercus* sp.); ash (*Fraxinus* sp.); lime (*Tilia* sp.); and maple (*Acer* sp.). The Mesolithic charcoal sample is smaller. It lacks maple and ash, but includes elm. Hazel is also represented by the carbonized shell fragments.

The later prehistoric layers also include single seeds of *Malva pusilla* and *Chenopodium album*, while the subrecent layers included carbonized grain of rye (*Secale cereale*) and seed of brome grass (*Bromus* sp.). In addition, high numbers of undeterminable sclerocia of fungi and soil micromycets were recovered in flot fractions of the soil samples (Opravil, 2003).

Malacology

Fragments of land snails indicate a predominantly decidous forest, which was more favorable for snails compared to present vegetation at the site. Chronostratigraphically the species characterize a later stage of the Holocene, later than the period Boreal, and corresponding to the Holocene climatical optimum.

Worth mentioning are the frequent fragments of shells of large *Unionidae*, most probably from the Kamenice river, and collected for food (Ložek, 2003).

Archaeozoology

The archaeozoological evidence contrasts with that at the neighboring site, Okrouhlík, by numerous fragments of large bones, but also by a rich component of vertebrate macro- and microfauna (Horáček 2003). Several species of the medium sized mammals (hare, marder, badger, bea-

Table 5
Dolský Mlýn. Representation of the basic granulometric components in the analyzed samples

Layer	Gravel fraction (%)	Sand fraction (%)	Dusty-clayish fraction (%)
1	6.2	89.1	14.7
2	4.6	91	4.4
3	3.8	91.3	4.9
4	3.3	83.9	12.8
5	4.2	73.2	22.6
6	4.2	56.4	39.4
8	3.7	92.3	4
9	4.6	89.1	6.3
10	2.6	86.6	10.8
11	3.1	90.7	6.2
12	3.8	85	11.2
13	4.1	92.2	3.7
14a	3.3	92.5	4.2
14b	3.4	92.2	4.4
15	3.0	84.6	12.4

Table 6
Dolský Mlýn. Trench A. Finds of malacofauna

Layer	Species
4a	cf. *Fruticicola fruticum*
	Helicigona lapicida
	Cepaea hortensis
4	*Monachoides incarnatus*
6	cf. *Alinda biplicata*
	Fruticicola fruticum
	Helicigona lapicida
	Unionidae
	Clausiliidae
8	*Cochlodina laminata*
	Fruticicola fruticum
	Monachoides incarnatus
	Unionidae
	Helicidae sp. div.
9	*Helicidae/Bradybaenidae*
	Unionidae

ver, fox) and several small sized animals indicate a varied woodland and semicovered habitat (*Sciurus*, *Eptesicus serotinus*, *Barbastella barbastellus*, *Clethrionomys*, *Apodemus*). In addition, fish remains (mostly vertebrae) of several size categories represent a frequent component of this oryctocenosis, with considerable representation of the relatively large individuals (about 30 cm of the estimated body length, layer 9; Tables 5, 6).

Lithic technology and typology

The lithic industry derives from several stratigraphic horizons. Layers 4–8 are post-Mesolithic, while the Mesolithic layers could be separated into two units, the upper (layers 9–10), and lower (layer 12). In addition, there is an assemblage collected from redeposited sediments with an uncertain cultural provenience (Table 3).

Layer 9–10. The upper Mesolithic layer yielded a total of 354 artifacts. The composition of the major technological groups is characterized by the predomination of chips, small flakes, and flake fragments (252 pieces; 71.2 %), followed by blades (63 pieces; 17.8%), flakes (30 pieces; 8.5 %), and retouched artifacts (nine pieces; 2.5 %). Cores were absent.

Retouched artifacts consist of two trapezes (Fig. 20: 1–2), a fragment of a blade with transversal retouched truncation (Fig. 20: 3), two fragments of blades with a steep lateral retouch (Fig. 20: 4), a fragment of partially ventrally retouched blade, a notched piece made on a proximal part of a microlith (Fig. 20: 5), a borer with a missing terminal tail (Fig. 20: 8), and a flake sidescraper.

Layer 12. In the lower Mesolithic horizon a total of 360 lithic artifacts were found. The predominating artifact category is the small flake fragments and chips (264 pieces; 74%), followed by flakes (47 pieces; 13%) and blades (41 pieces; 11%). One flint core with a changed knapping orientation, discarded in its advanced reduction stage, was also found (Fig. 20: 29). The seven retouched artifacts are represented by two trapezes (Fig. 20: 18, 20), one of which was continuously retouched on the three edges, similar to the trapezoidal microlith from Okrouhlík. Two microlithic backed bladelets (Fig. 20: 19, 21), a fragment of bladelet with steep lateral retouch (Fig. 20: 22), a

Table 7

Dolský Mlýn A: Representation of the individual vertebrate taxons (MNI)

Layer	4a	4	4	4-5	5	6
Depth (cm)	40–50	70–80	80–90	90–105	105–110	130
Pisces	1	3	4			
Aves indet.			1			
Aves: Passeriformes			1			
Talpa europaea				1		
Erinaceus sp.						
Eptesicus serotinus				1		
Sciurus vulgaris			1			
Apodemus (Sylvaemus) sp.		2				
Clethrionomys glareolus		1				
Arvicola terrestris				1		1
Lepus europaeus		1			1	
cf. *Cervus elaphus*			1			
Capreolus capreolus		1	1			
Martes martes		1	1	1		
Canis lupus						
Total: individuals	1	9	10	4	1	1
Total: spp.	1	6	8	4	1	1

proximal fragment of a unilaterally retouched blade (Fig. 20: 23), and a small flake partially retouched from the ventral face complete the list (Fig. 20: 31).

Redeposited sediments. The 186 unstratified specimens show similar composition in terms of major technological categories as the stratified pieces. Among the retouched pieces, there are two typical trapezes (Fig. 20: 32–33), a blade fragment with an oblique retouched truncation (Fig. 20: 34), a fragment of unilaterally retouched blade, an endscraper made on the ventral face of a flake fragment, a partially retouched blade, and a small flake fragment.

Projectile damage analysis of the microlithic assemblage

The analysis of diagnostic traces of projectile impact performed on the microlithic assemblage of the site of Dolský Mlýn revealed macro fractures in three cases, all on trapezes with double truncation. Two of them exhibit step terminating bending fractures along one of the truncations (Fig. 21). The fracture is directed from the long sharp edge and removes part of the retouch. In the third case the fracture removed a whole corner leaving a part of the retouched truncation, at the base of the transversal arrowhead. The trapeze bearing more severe projectile damage differs from the other two by the relatively sharp angle between the truncation and the long sharp edge: 45 as opposed to 70–80 in the two cases with minimal damage. In addition, the more heavily damaged trapeze has a slightly concave truncation. It is possible that these specific morphological features caused greater damage as a result of the projectile impact than in the cases of the two trapezes having straight truncations and relatively blunt angles between them and the long cutting edge. In other words, the trapezes with straight truncations and relatively blunt angles between the truncation and sharp working edge are more durable, making them more amenable to their use as transverse arrowheads. This would allow one piece to be used numerous times. The blunt angles and straight truncations are characteristic of the majority of the Dolský Mlýn trapezes. They also have relatively standardized metric characteristics.

Table 8

Dolský Mlýn B: Representation of the individual vertebrate taxons (MNI)

Layer	3	4	4–5	5	6	6	9
Depth (cm)	30–35	55	80	85–90	110	110–120	180–190
Pisces						2	2
Anura, indet.						1	
Ophidia indet.						1	
Aves indet.				1			
Barbastella barbastellus							1
Castor fiber				1			
Apodemus (Sylvaemus) sp.		1			1	1	1
Clethrionomys glareolus					1		
Arvicola terrestris					1		
Lepus europaeus			1		1	1	
Alces alces	1		?				
cf. *Cervus elaphus*						1	
Capreolus capreolus	1						
cf. *Meles meles*						1	
Martes martes	1					1	
Vulpes vulpes					1		
Total: individuals		1	2	2	5	9	4
Total: spp.							

OTHER ROCKSHELTERS

The rockshelter sites surrounding Okrouhlík were investigated by the standard 1 m^2 test trenches. Since all of them provided evidence of Mesolithic occupations, and in two cases in primary position, additional excavations were conducted at Šamanská rokle and Prasečí převis.

Šamanská Rokle (Shaman´s Canyon)

This rockshelter occupies a dominant position in one of the side canyons. Under 110 cm of sediments, with horizons of later prehistoric ceramics and bones at the base, the sandy filling included several Mesolithic horizons, with bone fragments, artifacts, red-burnt sand, and charcoal, spanning from 110 cm to 160 cm. The Mesolithic sequence is composed of yellow sand with brownish, loamy interlayers, and parts of hearths.

Three samples for archeobotanical analysis were taken from various depths (90–100 cm, 110–120 cm, and 150–160cm). They contained charred wood and twigs of pine (*Pinus* sp.), hazel (*Corylus avellana*) and oak (*Quercus* sp.), a few fragments of charred organic matter of unknown origin and uncharred needles of *Picea abies*. Abundant were also sclerocia of *Fungi* and soil *Micromycetes*.

Prasečí Převis (Pig´s Rockshelter)

This rockshelter, located in a relatively high position above the canyon, has two parts, and only one has been tested. Below 60–70 cm with a later prehistoric occupation, there are several levels providing Mesolithic artifacts and bones, in the yellow, brown-spotted sand, and brownish, loamy horizon with charcoal (70–110 cm). A microlithic triangle from the middle part of the Mesolithic sequence represents the most important tool-type.

Ferdinandova Soutěska (Ferdinand´s Canyon)

This rockshelter is located at the very foot of the canyon, and it is filled by a large debris cone

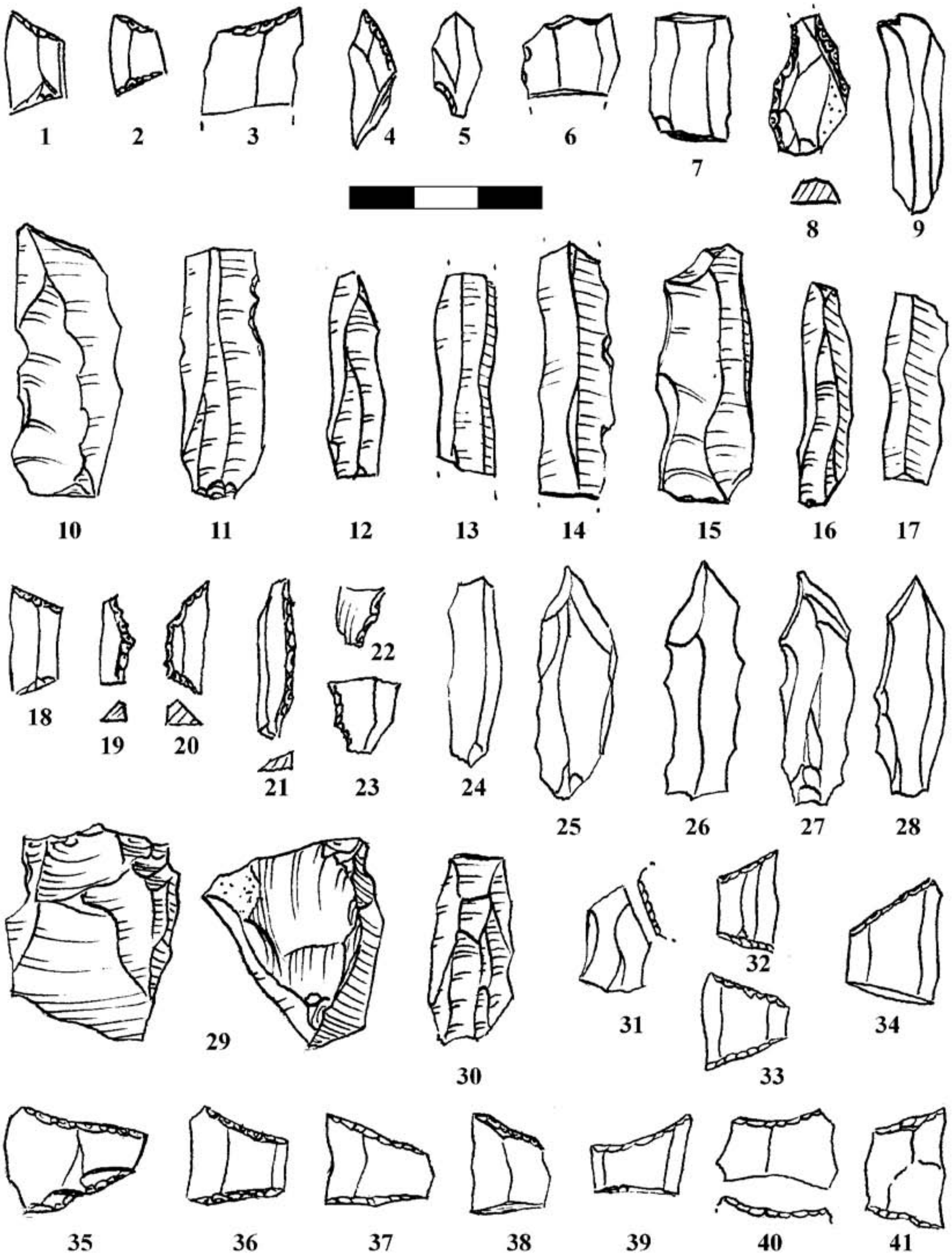

Fig. 20. Dolský Mlýn: Late Mesolithic artifacts

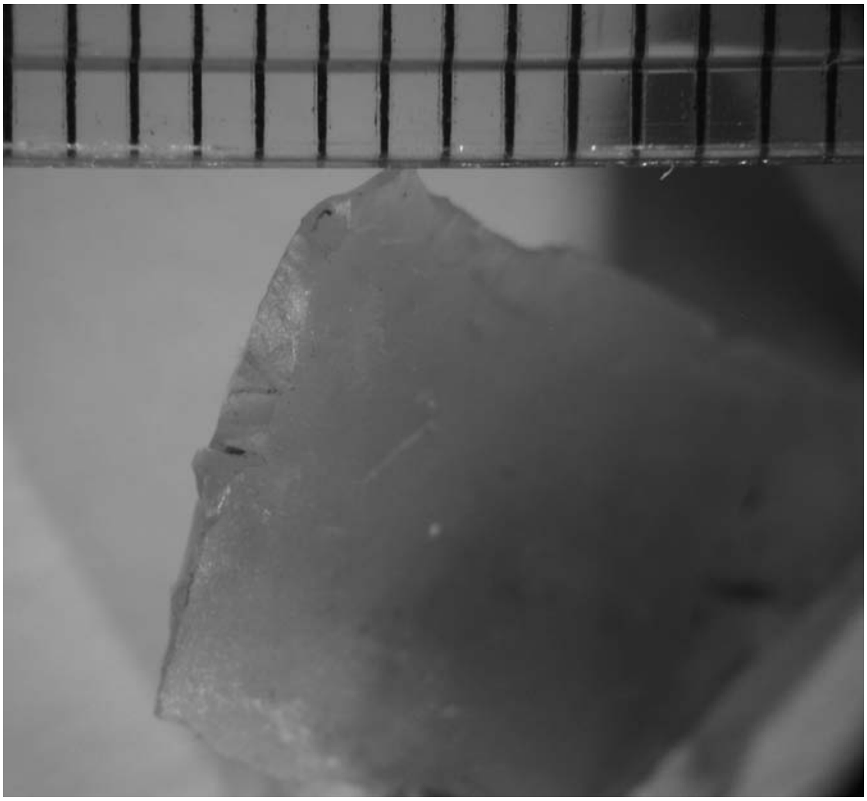

Fig. 21. Dolský Mlýn: Detail of an impact on one of the extremities of a trapezoid projectile

originating from the adjacent rock fissure. Therefore, the ceramics, lithic artifacts, and bone fragments, including later prehistoric and Mesolithic components, are redeposited and mixed within several horizons. Interestingly, the lithic industry contains two typical trapezes.

Kostelní rokle (Church Gorge)

Scattered artifacts were recorded in secondary position in front of a damaged rockshelter at the junction of Kostlení gorge with the Kamenice river canyon.

LIVING SURFACES AND HUMAN ACTIVITIES UNDER THE ROCKSHELTERS

A comparative analysis of the individual rockshelters in North Bohemia reveal a certain hierarchy concerning the size and location of the rockshelters, complexity of archaeological features such as hearths and pits, and the quantity and variability of artifacts (Svoboda, ed. 2003). Several rockshelters of North Bohemia provide rich cultural layers, labor-intensive stone-built hearths and other features, and lithic industries showing evidence of use-wear. These sites permit us to analyze the spatial relationship among the presumed man-made structures, such as the pits, hearths, and artifact clusters, and natural features, such as the rock walls and boundaries of the sheltered areas. However, few of these sites were excavated completely and Okrouhlík, due to the shallow position of the cultural layer, is one of these cases.

There are basically two types of hearths. The majority of the rockshelters contained a "normal" hearth, located in the central part of the sheltered area, and used for cooking, heating, lighting, and as a center of social activities. The central location is typical, and so far seems to have been defined by these functions. Sometimes we find se-

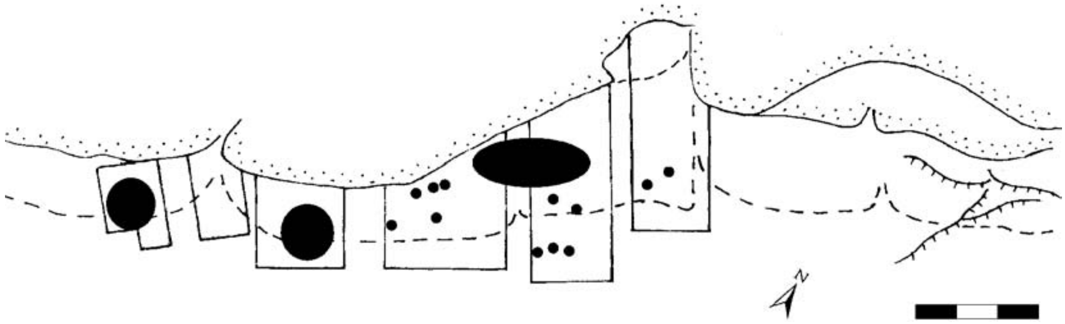

Fig. 22. Schema of spatial organization of a Mesolithic rockshelter (Okrouhlík): Hearths and a system of boiling pits

quences of hearths one above the other, beginning with the Mesolithic at the base and ending with the actual tramping hearths on the top. In several cases, and best documented at Okrouhlík, a system of adjacent kettle-shaped pits were arranged around the central hearths (Fig. 22). A similar pattern is documented, for example, at the Upper Paleolithic sites such as Dolní Věstonice II, (Fig. 23).

The second type of hearth is more elaborate, filled with basalt pebbles from the Kamenice river gravels (both in Okrouhlík and Dolský Mlýn rockshelters), and where these are absent, by blocks of sandstone or ferrous sandstone. If the stones forming the filling were used for heat banking, as we suggest, then the quality of basalt was of course higher than sandstone. In some cases, shallow pan-shaped depressions filled with ash were recovered at the base of the stone block coverage.

We have repeatedly observed that whereas the "normal" hearths, composed predominantly of layers of charcoal and red-burnt sand are located in central parts of the sheltered areas, the more specialized hearths filled with stone blocks tend to be located at the peripheries. A similar pattern of distinction between hearths in the center of a rockshelter and complex "ovens" at the peripheries is ethno-archaeologically documented (Gorecki, 1991).

These relationships are clearly demonstrated in Okrouhlík rockshelter (Fig. 22). The cultural layer is complex and resulted from repeated occupations over several millenia, while the same spatial organization survived through time. The central oval-shaped hearth showing a shallow microstratigraphy of ash and red-burnt sand strips was removed and restored repeatedly, but the ^{14}C date, logically, refers to the last stage of this process. A complex network of kettle-shaped pits was formed around, and on the slope below this hearth. The two ^{14}C dates from the pits reflect a longer time-span compared to the central hearth. Whereas we could hitherto only speculate about the function of these pits on the basis of analogies from other sites and ethnological records, the case documented at Okrouhlík in the summer of 2005, where a group of burnt basalt pebbles was still left by side (Fig. 6), confirms the hypothesis that this was a boiling pit. Spatially, the area of these pits provided the highest artifact densities.

A series of shallow and larger pits were located in the narrow zone between the central hearths and the rock wall. Finally, the two complex hearths, filled with basalt pebbles as heat accumulators, were on the periphery, in an area with a low artifact density.

Dolský Mlýn is the only case in North Bohemia where the large pebble-filled hearth was located in two superposed positions, in the central part of the rockshelter. However, due to the thickness of the overlying layers, this site was only partially excavated and we do not know as yet its spatial organisation.

THE MESOLITHIC/NEOLITHIC RELATIONSHIPS

The sandstone plateaus of North Bohemia, with undeveloped and acid soil coverage, do not

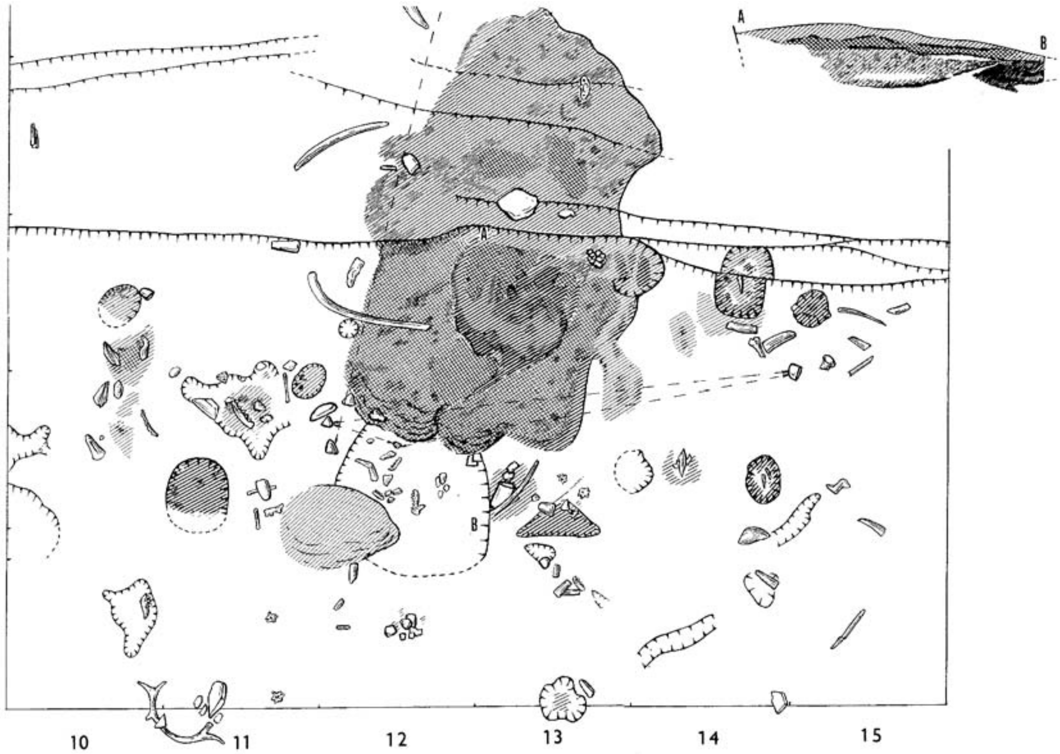

Fig. 23. An example of a similar situation at Dolní Věstonice II–western slope: A central hearth with a semicircle of boiling pits

represent a favorable environment for prehistoric agriculture. However the neighboring regions, the Bohemian Basin in the south and the plains of Saxony in the north, were both intensively occupied by farmers beginning with the Early Neolithic. Therefore, the scenarios of interaction between the last hunter-gatherers and the first farmers are still a matter of discussion. Approaching any interaction between the two different populations entities in archaeology requires a solid chronological framework and geographic dispersal maps as a first step. Traditionally in Czech archaeology, there was a lack of dialogue between specialists of the Mesolithic and Neolithic periods, due in part to different methodology. As a result, the chronological boundary between the two periods may seem more visible than it really was.

The latest uncalibrated dates for the Mesolithic in North Bohemia, usually from sites with the trapezoid microliths (Dolský Mlýn, Bezděz, Pod zubem), lie between 6.5–7 ky BP. In contrast, in Hungary, we have early dates for the Körös culture around 7 ky BP, whereas the earliest dates for the Linear pottery in Moravia (Mohelnice: 6.2–6.4 ky BP) and Bohemia (Bylany: 6–6.3 ky BP, Turnov, Maškovy zahrady) are slightly later.

After calibration, it seems that the first farmers were present in Hungary by 6000 cal BC and in Bohemia and Moravia after 5500 cal BC. Currently, and contrary to the situation further north (Poland and eastern Germany) we have no solid Mesolithic dates later than these, that would suggest an overlap between the two cultured stages.

Under the rockshelters of North Bohemia, we repeatedly find evidence of an occupational hiatus between the Mesolithic and Neolithic; this was most clearly evidenced in the sequence of the Bezděz rockshelter (Svoboda (ed.), 2003). It seems that the rocky parts of North Bohemia remained almost uninhabited during the Linear Pottery period, and witnesses a continuous reoccupation later, during the Stroked Pottery period. The earliest Neolithic occupation is well represented by the site of Turnov–Maškovy zahrady in the Jizera river valley, at the southeastern neigborhood of the sandstone plateux of Northern Bohemia. To the east, in the mountainous granite contact zone, large Neolithic quarrying areas for amphibolic hornfels were active since 5000 cal BC, thus documenting task-specific human penetration into an agriculturally unattractive area at that time (Prostředník *et al*., 2005).

In general, this spatio/temporal socio-economic structure suggests a gradual influx of farming populations from the southeast to the northwest, with new technologies causing, in certain regions, the apparent extinction of the original foragers. This model, however, does not mean that the local population had no impact on future developments, be it in sense of genetics, technology, or behavior, and that archaeologists should not search for evidence of such contact in their record, as was the case in the more northern parts of Europe.

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