

Kolíbky, a Magdalenian Site in the Moravian Karst

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1. Introduction

Paleolithic research in Moravia was initiated in caves of the Moravian Karst more than 125 years ago. In the period between 1867 and 1918, 11 out of 18 sites excavated in Moravia were caves of the Moravian Karst. Between 1918 and 1945, 12 sites were excavated, but only 4 of them were caves in this area, including the systematic excavations of Pekárna Cave. Between 1945 and 1989, the number of excavated sites increased to 41, 19 of which were caves of the Moravian Karst¹.

Thus cave studies were carried out side by side with excavations at open-air loess sites, but evidence from the space-limited cave sediments was exhausted earlier. Cave sites played an important role during the formation and establishment of the stratigraphic and developmental schemes of the Moravian Paleolithic², but today, with new methods of study available, we mostly find ourselves in empty cavities or on redeposited sediments.

The early researchers recognized that the caves in Moravia were mainly settled during two periods: the Cave-bear Period and the Reindeer Period³, the first of which could be compared to Le Moustier and the second to La Madeleine⁴; an important hiatus separated the two (the Mammoth Period – Gravettian).

Further problems concerned the finer periodization of the Magdalenian. The stratigraphy of Pekárna Cave was not used for this purpose, because K. Absolon and R. Czižek noted no basic difference between the two layers (g, h) attributed by them to the Magdalenian⁵. Later attempts at periodization were based on the concept of a gradual disappearance of glacial fauna⁶, or on the sedimentological change related to the end of loess deposition⁷. These authors, however, were mostly handicapped by the quality of the material from earlier excavations.

Between 1961 and 1976, K. Valoch organised the last systematic excavation in Kůlna Cave⁸. Afterwards it seemed that the Paleolithic evidence from the Karst was exhausted.

Between 1981 and 1987, a survey throughout the territory of the Karst was undertaken, aimed at reconsidering the situation in caves already excavated and at revealing data about new caves. Trenches

¹ J. SVOBODA, T. CZUDEK, P. HAVLÍČEK, V. LOŽEK, J. MACOUN, A. PŘICHYSTAL, H. SVOBODOVÁ, E. VLČEK, *Paleolit Moravy a Slezska*. Brno 1994, Tab. 1–3.

² J. WANKEL, První stopy lidské na Moravě. *Čas. Vlast. spolku muzejního Olomouc* 1, 1884, 2–7, 41–49, 89–100, 137–147.– K. J. MAŠKA, *Der diluviale Mensch in Mähren*. Neutitschen 1886.

³ See note 2, J. WANKEL.

⁴ See note 2, K. J. MAŠKA.

⁵ K. ABSOLON, R. CZIŽEK, Palaeolithický výzkum jeskyně Pekárny na Moravě. *Čas. Mor. zem. muzea* 24, 1926, 1–59; 25, 1927, 112–201; 26, 1932, 479–598.

⁶ R. MUSIL, Fauna moravských magdalénských stanic. *Anthropozoikum* 7, 1958, 7–26.

⁷ K. VALOCH, Magdalénien na Moravě. *Anthropos* 12, Brno 1960.

⁸ K. VALOCH et al., Die Erforschung der Kůlna Höhle 1961–1976. *Anthropos* 24, Brno 1988.

were dug in a total of 20 caves, but only 5 of them yielded traces of Paleolithic settlement: Kateřinská Cave⁹, Cave No. 184¹⁰, Barová Cave¹¹, Pekárna Cave¹², and Kolíbky. The importance of this project lies in the new data on chronology and ecology of the Late Glacial rather than in Magdalenian archaeology. The project was conducted by V. Ložek and I. Horáček, paleontologists of the Geological Institute, CSAS, L. Seidl of the Moravian Museum, H. Svobodová, palynologist of the Institute of Systematic and Ecological Biology, CSAS, J. Svoboda, Institute of Archaeology, CSAS, and other specialists. The new data will be evaluated as part of the INQUA project No. 253 – Termination of the Pleistocene.

Kolíbky is the only site that yielded new important archaeological evidence. Its structure was influenced by the nearby sources of local lithic materials and ochre. Furthermore, it opened, for the first time in Moravia, the question of Magdalenian „lamps“.

2. Lithic raw materials in the Moravian Karst

The Moravian Karst is made predominantly of Devonian (partly Early Carboniferous) limestones. The Devonian limestones contain no cherts. Thin beds of black cherts up to 10 cm in thickness can be found in the Lower Carboniferous limestones of the southernmost part of the Moravian Karst near Mokrý. To date, this raw material has not been identified among the Paleolithic artifacts.

During the Mesozoic, the Jurassic sea spread over the Moravian Karst. Today, however, only a small denudation relict of Jurassic sandy limestones is exposed near the village of Olomučany. This outcrop is a very important source of raw material. The Jurassic (Oxfordian) limestones were intensively silicified in places: intercalations of dark-grey to black cherts from layers a few centimeters in thickness. Artefacts made of this chert have been found not only in the vicinity of the geological outcrops themselves, but also at several Upper Paleolithic sites in the Moravian Karst (Barová, Býčí skála and Kůlna Caves). In addition to the prevalent cryptocrystalline and microcrystalline chalcedone, this chert also contains glauconite, very often disintegrated into limonite.

The cherts of the Rudice Formation are the second important source of siliceous raw materials in the Moravian Karst. This formation was created by the intensive tropical weathering of Jurassic chert limestones during the Lower Cretaceous. Nodules and fragments of these cherts resistant to weathering form extensive gravel sheets on the karst plateau near Rudice, Olomučany, Habrůvka and Babice, where they lie nonconformably on the Devonian and Jurassic strata.

K. Absolon described another type of raw material from the central part of the Moravian Karst: the so-called Býčí skála quartzite¹³. A. Přichystal noted that this is not a quartzite but a special chert of the Rudice Formation which, probably, originated as a result of the silicification of sandy limestone or of calcareous sandstone. Gravels of this chert are found on the karst plateau above the Býčí skála Cave as well as in the cave itself¹⁴. The later represent intrusions through some sinkholes.

⁹ J. SVOBODA, L. SEIDL, A. ŠTROF, Výzkum jeskynných výplní v severní části Moravského krasu. Přehled výzkumů 1981 (1983) 9–13.– K. GEISLEROVÁ, L. SEIDL, J. SVOBODA, H. SVOBODOVÁ, Záchraný výzkum před Kateřinskou jeskyní. Reg. sborník okr. Blansko 1986, 64–73.

¹⁰ See note 9, J. SVOBODA et al.

¹¹ L. SEIDL, J. SVOBODA, V. LOŽEK, A. PŘICHYSTAL, H. SVOBODOVÁ, Das Spätglazial in der Barová-Höhle im Mährischen Karst. Arch. Korrespondenzbl. 16, 1986, 393–398.

¹² J. SVOBODA, Neue Erkenntnisse zur Pekárna-Höhle im Mährischen Karst. Arch. Korrespondenzbl. 21, 1991, 39–43.

¹³ K. ABSOLON, Die prähistorische Erforschung der Býčí skála-Höhle in Mähren vergleichend dargestellt. Brno 1945.

¹⁴ See note 1, chapter by A. PŘICHYSTAL, 43.

3. The site

The Magdalenian settlement in Moravia is limited to the karstic areas and their vicinities. Within the Moravian Karst, the location of the sites follows the geographic division into the Southern, Central and Northern parts. Each of these areas has a large central site: Pekárna in the south, Býčí skála in the center and Kůlna in the north, surrounded by clusters of smaller sites.

The site of Kolíbky lies at the eastern margin of the karst, separated from both the Central and Northern groups. Deep below the site, the Jedovnice brook disappears under a high and romantic rock wall (428 m a. s. l.) only to reappear few kilometers further to the SW in the Býčí skála Cave.

The site is formed by a horseshoe-shaped group of limestone rocks, penetrated by numerous fissures and several smaller caves (Figs. 1 and 2). Two of the caves, nos. 1004 and 1006, are located in the southern-facing front wall at an elevation of 461 m a. s. l.

The first scientific explorations of the site were carried out in 1892, 1907, and 1908 by J. Knies. In his unpublished diary we find the following: „Most of the caves and other larger fissures are filled by sediment hitherto not examined. Originally, I intended to remove the filling from the largest cave in front of it, and therefore I first examined the entrance platform, protected by the surrounding abri. Because I subsequently left the area, the original intention was never completed. Nevertheless, I found traces of Paleolithic man at this place and I believe that similar traces will also be found inside the cave, which was very suitable for occupation.“

„The entrance platform is formed by a small gulf in which a trench 4 m long was cut. The upper layer (0,5 m) is formed by dark humous earth with lots of waste from the production of cast-iron underlaid by yellow loess (0,44 m) and by the solid rock. In its middle part the loess was separated by a thin (0,02 m) white deposit. Further from the cave, at a distance of 4 m from the wall, the rock base sunk, while the thickness of loess increased to 0,8 m.“



Fig. 1. Kolíbky. View of south-facing rock wall with entrance of cave 1004 and trench of the 1982 excavations.

„In 1908 I made several trenches in this locus. The upper layer appeared to be disturbed everywhere and I recognized that gravel had been pounded for many years here. In the undisturbed places the layer sequence was as follows: below the surface, 0,5 m of disturbed Alluvial layer, sometimes mixed with loess, underlaid by 1,2 m of almost pure Deluvial loess, with larger blocks and gravel at the base. Traces of Paleolithic settlement were found within the loess, 0,25–0,4 m below its surface (total depth 0,75–0,9 m). They included solitary charcoal pieces and sometimes charcoal accumulations up to 3 cm thick. Around these hearths, located outside the caves but protected by the abri, were found chipped bones, mainly of horse and reindeer, and less frequently of birds (*Passerina nivalis*). At some places we found small bones from the pellets of birds inhabiting the rocks, and very rarely bone objects worked by man. These are 4 pieces of cut reindeer antler, a fragment of an engraved antler point, and a blunt ivory point obliquely cut at the base. Tertiary shell with two sawn perforations and a shell fragment with irregular engravings on the inner face certainly served as decorations.“

„Altogether 20 flint objects were found, but only a few typical shapes; the best ones are a narrow knife of dark flint and a broad knife, pointed by retouching.“

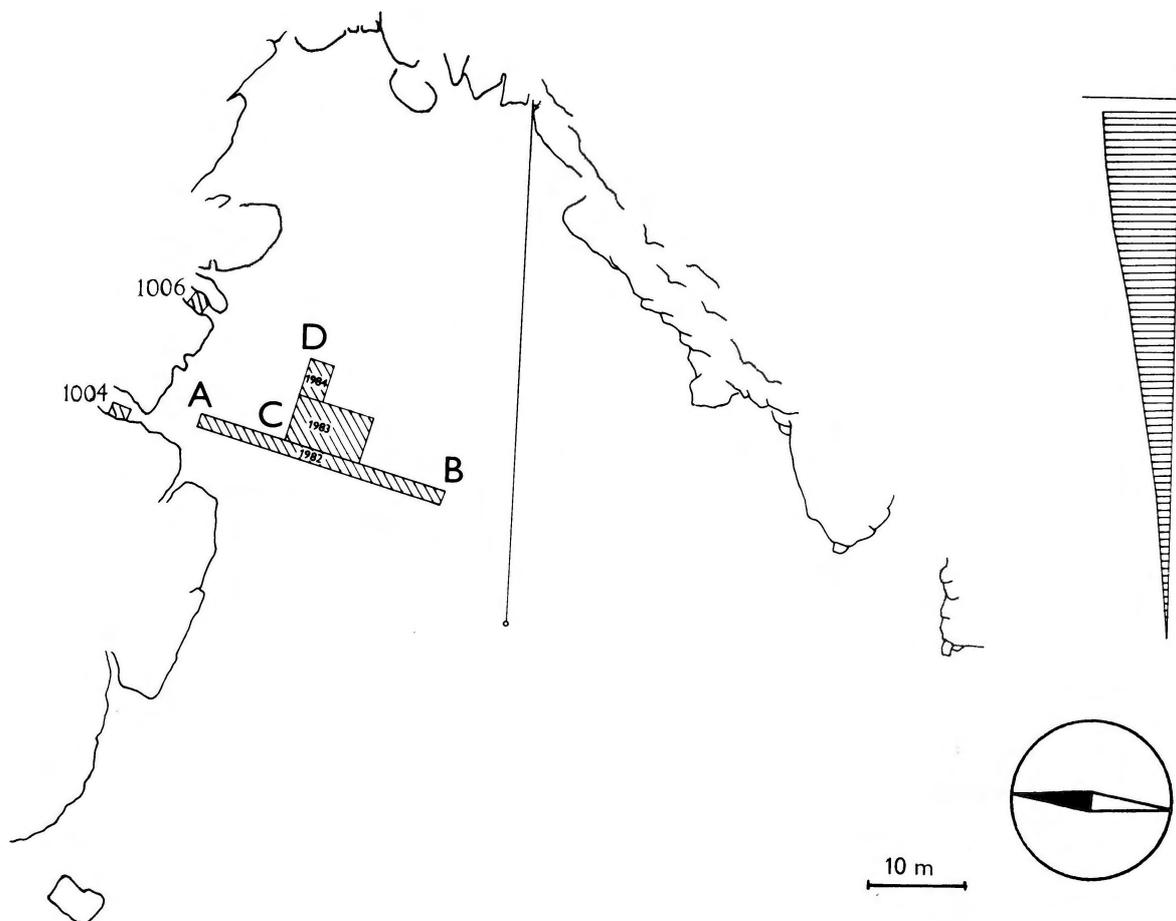


Fig. 2. Kolíbky. Plan of excavated area (survey by M. Bálek).

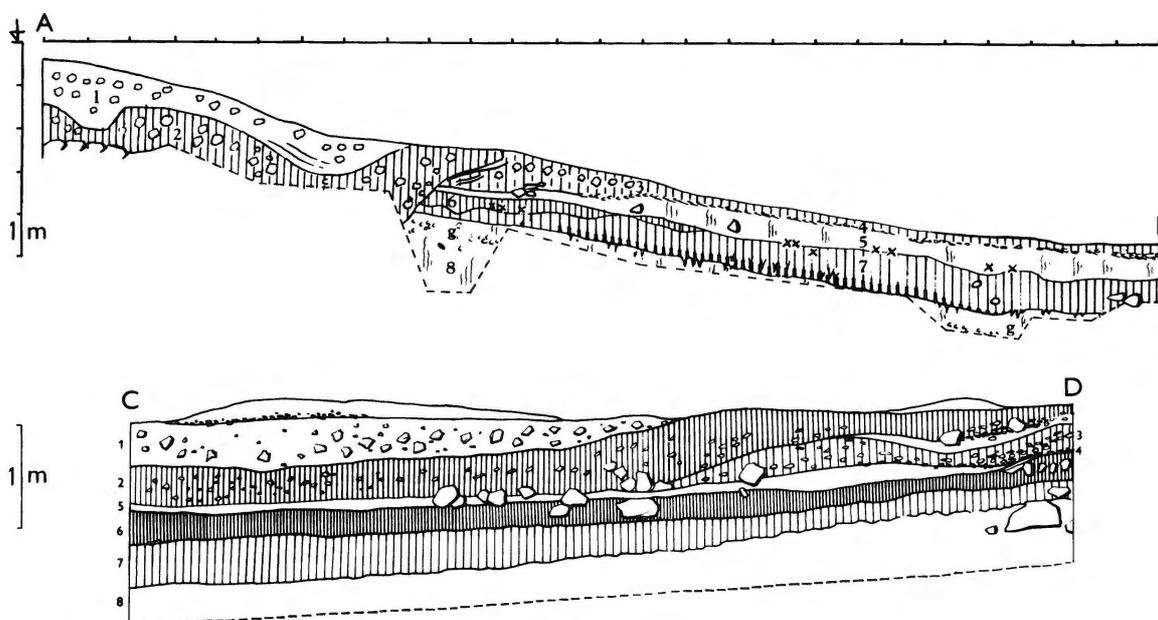


Fig. 3. Kolíbky. Sections AB and CD (description of the layers in text).

„The fauna is represented by the following species: *Myodes torquatus*, *Myodes lemmus*, *Felis catus*, *Arvicola amphibius*, *Cricetus frumentarius*, *Myotis glis*, *Arvicola arvalis*, *Arvicola agrestis*, *Arvicola gregalis*, *Mustela martes*, *Lepus variabilis*, *Meles taxus*, *Canis lagopus*, *Ursus arctos foss.*, *Cervus tarandus*, *Equus caballus foss.*, *Elephas primigenius*.“

Further controlled excavations at Kolíbky were held as late as the summers of 1982, 1983 and 1984. In 1982 we opened a trench 1 m wide and 26,1 m long, cutting the slope before Cave 1004. The edge of the cave entrance platform, where the trench started, is formed by two thick beds of sediments redeposited by earlier excavations (layers 1, 2); the upper one relatively rich in Magdalenian materials. Further from the cave entrance the trench reached intact deposits: the Holocene cover (layers 3, 4), the upper loess with large limestone blocks in its upper part (layer 5), a dark earth lense (6) and a brown soil relic (7) evolved on the basal loess (8). Magdalenian artefacts were found in the upper loess, below the limestone block horizon (5), and, closer to the cave entrance, in the dark sediment (6).

In 1983, the excavation was extended to the area of maximum artefact density, in the 5 x 8,6 m space to the east of the trench (Fig. 2). We followed the spatial distribution of artefacts, sandstone plates and ochre. Overlying deposits with prehistoric and medieval objects were investigated closer to the cave. Simultaneously, we explored the fillings of both caves. Cave 1004, however, was already filled by a thin layer of sediments only, redeposited during earlier excavations. In Cave 1006 we detected sterile reddish clay, covered by recent and subrecent sediments.

In 1984 we opened a smaller area of 4 x 2,5 m adjacent to the east (Fig. 2). The terrain was identical in character to the 1983 area, but Magdalenian objects were scarce.

Samples for palynological and malacozooological analyses were taken from these sections and evaluated by H. Svobodová and V. Ložek. The vertebrate fauna, especially from layer 1, is stored in the Moravian Museum, Brno, and has not yet been analysed.

4. Description of the sections

The stratigraphy of the site is represented by a longitudinal, 26,1 m long section along the slope (AB), and by the transversal section CD (Fig. 3). The stratigraphic sequence is as follows:

1. Redeposited sediments with sharp-edged debris and yellowish-ochreous filling; Magdalenian objects; one of them (Fig. 9,2) has been dated by C¹⁴ (Table 4).
2. Redeposited sediments with sharp-edged debris and darkened filling.
3. Brown earthy deposit with small sharp-edged debris; Aeneolithic and Medieval objects.
4. Brownish-grey humous base of layer 3 with small debris.
5. Upper loess with larger, round-edged limestone blocks (upper horizon) and Magdalenian objects (lower horizon).
6. Dark-brown, earthy, partly calcified layer; Magdalenian objects; this layer disappears in meter 16 of the section AB.
7. Brown-reddish soil relict (B-horizon).
8. Basal loess.

5. The pollen analysis

During the excavation in 1982, three samples were taken for the palynological investigation from layers 7, 5 and 4. The minerogenic sediment was treated by the method of mineral separation¹⁵. The pollen spectra were coloured by fuchsin and observed in 10 slides (20 x 20 mm). The numbers of sporomorphs are indicated in Table 1. The total sum (TS) includes all grains of arboreal (AP) and non-arboreal (NAP) pollen.

In the pollen spectrum of sample No. 1 (layer 7), *Pinus* dominates by 47.5 % of TS. Pollen of *Betula* is represented by 15 % of TS. Non-arboreal taxa include Poaceae, *Artemisia* and *Plantago*.

In sample No. 2 from the Magdalenian layer 5 the arboreal pollen includes *Pinus* (16.3 %), *Betula* (4.3 % TS), *Alnus* (3.4 % TS) and *Salix*. The share of AP is lower compared to sample No. 1 (AP = 27.9 % TS). Among the herbs the pollen of Brassicaceae prevailed (50 % TS).

Sample No. 3 was taken from layer 4. In the arboreal pollen we observed *Pinus* (25.5 % TS) and *Betula* (23.5 % TS), associated with certain pollen of Quercetum mixtum such as *Carpinus*, *Tilia*, *Corylus* and *Juglans*. Among herbs the pollen of Poaceae, Cyperaceae and Asteraceae appeared.

The pollen spectrum of the Magdalenian layer 5 (sample No. 2) documents a heliophilous steppe comparable to the cold oscillation Barová 12 c–d¹⁶, or to Kůlna Cave layer 6¹⁷. The pollen spectrum from the subsoil (sample No. 1) suggests a cold glacial vegetation with an increased number of arboreal pollen.

In sample No. 3 the pollen spectrum contains the pollen of thermophilous deciduous trees. The association of species points to the younger part of the Holocene, probably to the Subatlantic Period.

¹⁵ M. GIRARD, J. RENAULT-MISKOVSKY, Nouvelles techniques de préparation en palynologie appliquées a trois sédiments du Quaternaire final de l'abri Corneille. Bull. AFEQ 4, 1969, 275–284.

¹⁶ H. SVOBODOVÁ, J. SVOBODA, Chronostratigraphie et paléoécologie du Paléolithique supérieur morave d'après les fouilles récentes. In: Cultures et industries paléolithiques en milieu loessique. Amiens 1988, 11–15, Fig. 3, 3.4.11.

¹⁷ See note 8, chapter by H. SVOBODOVÁ, 209–214.

Table 1 Kolibky. List of sporomorphs.

		Samples		
		1	2	3
AP:	<i>Alnus</i>	—	3	1
	<i>Betula</i>	6	4	12
	<i>Carpinus</i>	—	—	1
	<i>Corylus</i>	—	—	1
	<i>Juglans</i>	—	—	1
	<i>Picea</i>	2	2	4
	<i>Pinus</i>	19	14	13
	<i>Salix</i>	—	1	—
	<i>Ulmus</i>	1	—	—
	<i>Tilia</i>	—	—	1
	Total AP		28	24
NAP	<i>Artemisia</i>	3	—	2
	Asteraceae Tubiflorae	1	1	2
	Brassicaceae	1	42	—
	<i>Filipendula</i>	—	—	1
	<i>Galium</i>	—	1	—
	Cyperaceae	—	—	4
	Lamiaceae	—	—	1
	<i>Plantago lanceolata</i>	2	1	—
	Poaceae	3	16	4
	<i>Vaccinium</i>	—	—	1
	Indeterminata	2	2	2
Total NAP		12	62	17
Total AP + NAP		40	86	51
Pteridophyta:	<i>Lycopodium annotinum</i>	—	2	5
	Polypodiaceae	3	14	8
	<i>Pteridium aquilinum</i>	—	—	1
Total		3	16	14
Bryales		18	41	16

6. The molluscs

The site was visited by V. Ložek on 28. May 1983 and samples were taken from the humic Holocene soil with limestone debris (layer 4) and from the underlying yellow-grey loessic loam of Pleistocene age (layer 5).

In the loessic loam were found solitary shell fragments of *Succinea oblonga* DRAP., representing a typical loess fauna; this corresponds well to the character of the sediment.

The contact with the younger Holocene sediments was sharp. Such a sequence is unusual and suggests that the above layers, which are quite thin, were redeposited. Thus only the lower brownish-grey part of the layer 4 directly above the loess was sampled. This sample yielded a relatively rich malacofauna:

Woodland species: *Acanthinula aculeata* (MÜLL.), *Acicula polita* (HTM.), *Aegopinella pura* (ALD.), *Cochlodina laminata* (MTG.), *C. orthostoma* (MENKE), *Macrogastra plicatula* (DRAP.), *Monachoides incarnata* (MÜLL.), *Ruthenica filigrana* (RSSM.), *Vertigo pusilla* MÜLL.

Mostly woodland species: *Alinda biplicata* (MTG.), *Discus rotundatus* (MÜLL.), *Helix pomatia* L., *Vitrea crystallina* (MÜLL.)

Hygrophilous woodland species: *Macrogastra ventricosa* (DRAP.)

Species of open sites: *Truncatellina costulata* (NILSS.), *Tr. cylindrica* (FÉR), *Vallonia costata* (MÜLL.)

Indifferent species: *Cochlicopa lubricella* (PORRO), *Clausilia parvula* FÉR., *Helicigona lapicida* (L.), *Punctum pygmaeum* (DRAP.), *Vitrea contracta* (WEST.), *Carychium tridentatum* (RS.)

Furthermore, there were shells of *Cecilioides acicula* (MÜLL.) and *Pupilla muscorum* (L.), clearly of recent or subrecent age.

By its composition this assemblage corresponds to the younger part of the Holocene, mostly to the period of the so-called woodland optimum. Most of the fauna dates to the time when the surrounding area was covered by relatively moist forest. The increased moisture is indicated especially by *M. ventricosa* (DRAP.) and by a higher proportion of the species *C. tridentatum* (RISSO). The suspicion of secondary admixtures is supported by shells of *Pupilla muscorum* (L.) in a fresh state. *Cecilioides* penetrates actively into the subsoil and this shows that this layer has always been located directly below the surface.

7. Site formation processes

The original position of the Magdalenian has been altered both by human activity in recent times and by natural processes in the past; the latter are still not completely understood¹⁸.

Layers 1 and 2 were clearly removed by excavations. Layer 2, by its position and by the absence of archaeological material, may be the fill of Knies' platform trench. Layer 1, resembling loess in the character of the sediment and containing a Magdalenian inventory, probably represents a redeposited cave filling. It is hardly imaginable that a cave researcher as careful as Knies, who initiated the systematic floating of sediments in excavation, would overlook relatively abundant archaeological and osteological material. Knies mentions that he had no opportunity to excavate inside the caves. It is most probable that this layer is the material from later speleological investigation not under archaeological control, aimed at opening access to the inner parts of Cave No. 1004. According to local informants, work of this kind took place here during the 1950s.

The complex of layers 3 and 4 is, on the basis of palynological and malacozoological evidence, of younger Holocene age. The pottery points to the two extreme data of this period: the Aeneolithic Jevišovice culture (determination by A. Medunová) and the High Middle Ages (determination by R. Procházka)¹⁹. The non homogenous character of the inventory and the sharp boundary at the base caused us to suspect that these sediments did not evolve in situ.

Large limestone debris forming a horizon in the upper part of layer 5 (Fig. 4) suggests that the upper loess has been removed downslope by natural processes. However, it is impossible to judge how far this is true for the lower horizon of this layer and for the dark sediment (layer 6), both with the Magdalenian artefacts. With the younger Holocene sediments (3, 4) above and an undated soil relic (7) below, the stratigraphic position of the Magdalenian layer and of the related sediments is not precisely determinable.

¹⁸ J. SVOBODA, Present state of the Late Upper Paleolithic studies in Moravia. In: Late Glacial in Central Europe. Wrocław 1987, 131–141. – Preliminary interpretation of Kolíbky given here, p. 135, was caused by misunderstanding with numeration of the pollen samples.

¹⁹ Jedovnice-Kolíbky, excavation report. Manuscript, Institute of Archaeology Brno.



Fig. 4. Kolíbky. Excavation in layer 5: the horizon of the limestone debris is visible in the upper part of the layer; the Magdalenian horizon is at the base of the excavation.

The combined evidence of palynology, malacozoology and archaeology, and the character of the sediment, points to the last period of loess formation, represented at Barová, layer 11, and Kůlna, layer 6²⁰.

The underlying soil relic (layer 7), by its position below a thin loess cover, has no stratigraphic analogy in South Moravia, except, perhaps, in the new excavation by P. Škrdla at Mokrá. The palynology suggests a glacial period with a relatively high number of arboreal pollen, but his spectrum may belong to the period of sedimentation of the substrat.

The basal loess (8) is deposited *in situ* and shows no evidence of disturbance.

8. Horizontal distribution of objects

Knies mentioned charcoal accumulations and objects dispersed in the loess directly before the cave. In layer 6 of our excavation, the stone industry and plates were widely dispersed, with increasing density towards the cave entrance. Two shallow depressions, with dimensions of 120 x 70 cm and 60 x 30 cm, 30 and 25 cm deep, occur at the base of this layer. The distribution of objects in layer 5, downslope from the cave, is even more scarce²¹.

9. The raw materials used

We examined 104 flaked artefacts, 36 pieces of lithic blocks and plates or their fragments, and a few lumps of ochre. Flaked artefacts were found in the 6th, 5th and 1st layers, blocks and plates in the 6th and 1st layers. Table 2 shows the raw material distribution of the flaked artefacts per layer.

²⁰ See note 12, Tab. 1.

²¹ Jedovnice-Kolíbky, excavation report and plans. Manuscript, Institute of Archaeology Brno.

Table 2 Kolíbky. Lithic raw materials.

	SGS	ND	OICH	CHRF	CHRF?	BSCH	CCH	DQT	Total
Layer 6	18	4	3	7	1	—	4	—	37
Layer 5	4	3	—	3	—	—	—	—	10
Layer 1	1	11	16	17	5	4	—	3	57
Total	23	18	19	27	6	4	4	3	104

SGS siliceous rocks from glaciated sediments

ND non determined siliceous rocks

OICH Olomučany type chert

CHRF cherts of Rudice Formation

BSCH Býčí Skála type chert

CCH Cretaceous honey-brown chert, rich in sponge spicules

DQT Drahany quartzite

Siliceous rocks from glaciated sediments (SGS) represent the prevalent imported material. The nearest occurrences of glacial sediments are found in the area of the Moravian Gate, about 90 km northeast of the Moravian Karst. These sediments contain various types of siliceous rocks with chert of Danian limestones and flint of Senonian chalk prevailing. Among the artefacts examined we were able to identify cherts of Danian limestones with many relics of Bryozoa. It should be noted that because of almost complete patination, the prevailing part of non determined siliceous rocks (ND) should, most probably, be classified in the SGS group.

The second group is represented by local siliceous raw materials, especially by the cherts of Rudice Formation (CHRF, CHRF?), that are found about 1 km to the west. Outcrops of Jurassic sandy limestone with the Olomučany type chert are located 4–5 km west of Kolíbky. The Býčí skála type chert originated near the Býčí skála Cave (4–5 km to the south-west). The source of the Cretaceous honey-brown chert rich in sponge spicules (CCH) lies outside the Moravian Karst area: the nearest denudation relics of Cretaceous sandstones containing bedded cherts are in the vicinity of Bořitov (15 km northwest of Kolíbky). The origin of the so called Drahany quartzite (DQT) can be found in the Lower Carboniferous sediments that outcrop slightly to the east of Kolíbky.

Data in the table indicate an interesting phenomenon – the predominance of imported SGS raw materials in layer 6 and the prevalence of local raw materials in layer 1.

Stone slabs as well as their segments are made of slightly weathered Lower Carboniferous greywackes and sandstones or arkoses of Lower Devonian age. Both raw materials could have been obtained from an area with a diameter of 5–10 km around Kolíbky. Finally, there are pieces of Carboniferous shales, rounded by water transport.

Lumps of ochre undoubtedly come from the Rudice Formations itself.

10. The Upper Paleolithic inventory

Layer 6. This industry includes a single scraper-like pre-core (length = 9,1 cm) of local chert (Fig. 5).

Typologically, there is a micro-end-scraper on a concave truncation (Fig. 8,4), a dihedral burin (Fig. 8,6), two combined burins (Fig. 8,2.8), a borer on a truncation (Fig. 8,3), a splintered piece (Fig. 8,7) and a fragment of a backed microblade (Fig. 8,5). The assemblage is completed by a partially retouched blade (Fig. 8,7), 6 blades and blade segments (Fig. 10,1, Fig. 10,3–4), a microblade

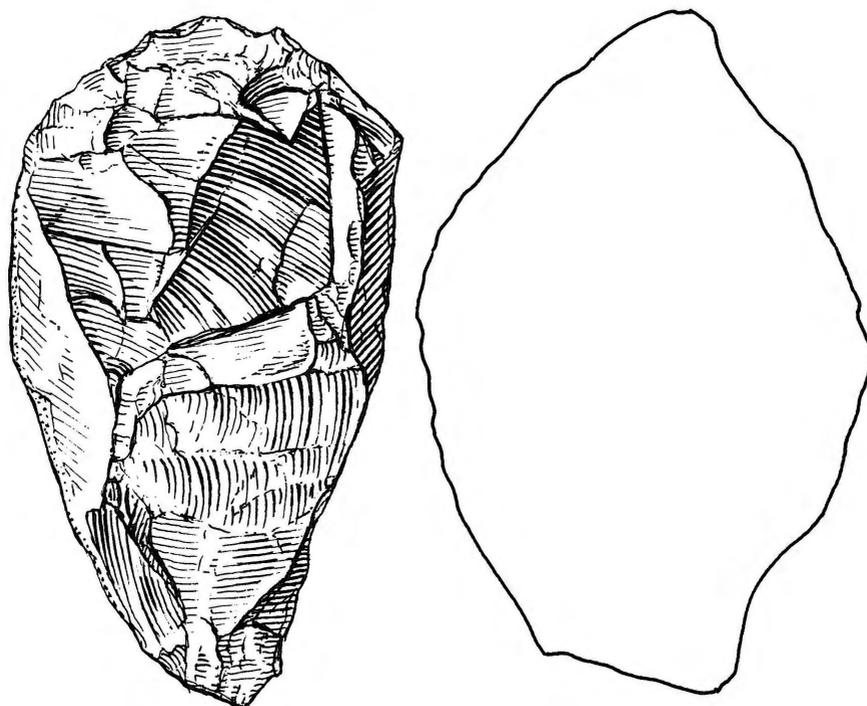


Fig. 5. Kolíbky. Pre-core, layer 6. – 1:1.

(Fig. 10,1), 6 flakes and 15 fragments and chips of siliceous rocks. Four fragments refit into a flint nodule; they were found dispersed over a small area of about 1 m².

Another group of finds is represented by flat pebbles and slabs of Carboniferous shales. There are 2 long and narrow blades, both fragmented (total length of 17,2 cm – Fig. 11,1 and 15,8 cm – Fig. 11,3), and 5 fragments of other shale plates (Fig. 11,2). At some Magdalenian sites of the Karst (Byččí skála and Pekárna) flat pebbles of this kind bear incisions and engravings²².

6 sandstone fragments, found in a smaller area of about 1 m², refit into a larger, 32 cm long plate (Fig. 12,1). There are two other sandstone plates (length = 21,3 cm and 21,5 cm), the larger with traces of charcoal, and 6 smaller fragments. A few lumps of red and yellow ochre complete the assemblage.

Layer 5. In layer 5 there are 2 heavy pre-cores of local chert (length = 7,8 cm – Fig. 6,1, and 7,5 cm – Fig. 6,2). The assemblage is composed of two splintered pieces (Fig. 8,9 and 9,5), one blade segment, 2 flakes and 3 fragments of siliceous rocks. Furthermore, this layer yielded an antler tip with traces of biting at the end, about 8 cm long (Fig. 9,1), and two small lumps of ochre.

Layer 1. The industry of layer 1 includes 2 larger pre-cores of local chert (6,5 cm – Fig. 7,3 and 5,5 cm long) and 2 initiated cores of chert (6,4 cm and 5 cm long – Fig. 7,2). There is one prismatic unipolar core (5,5 cm – Fig. 7,1) and a remnant core (3,6 cm – Fig. 7,4). Two pebble hammerstones (4,9 cm and 9 cm) and a heavy chert hammer (12,5 cm) contribute to our knowledge of the technology of flaking or of shaping the blocks and plates.

²² K. VALOCH, Benützte und gravierte Schiefergerölle im Magdalénien Mährens. Časopis Moravského muzea Sc. soc. 46, 1961, 5–18.

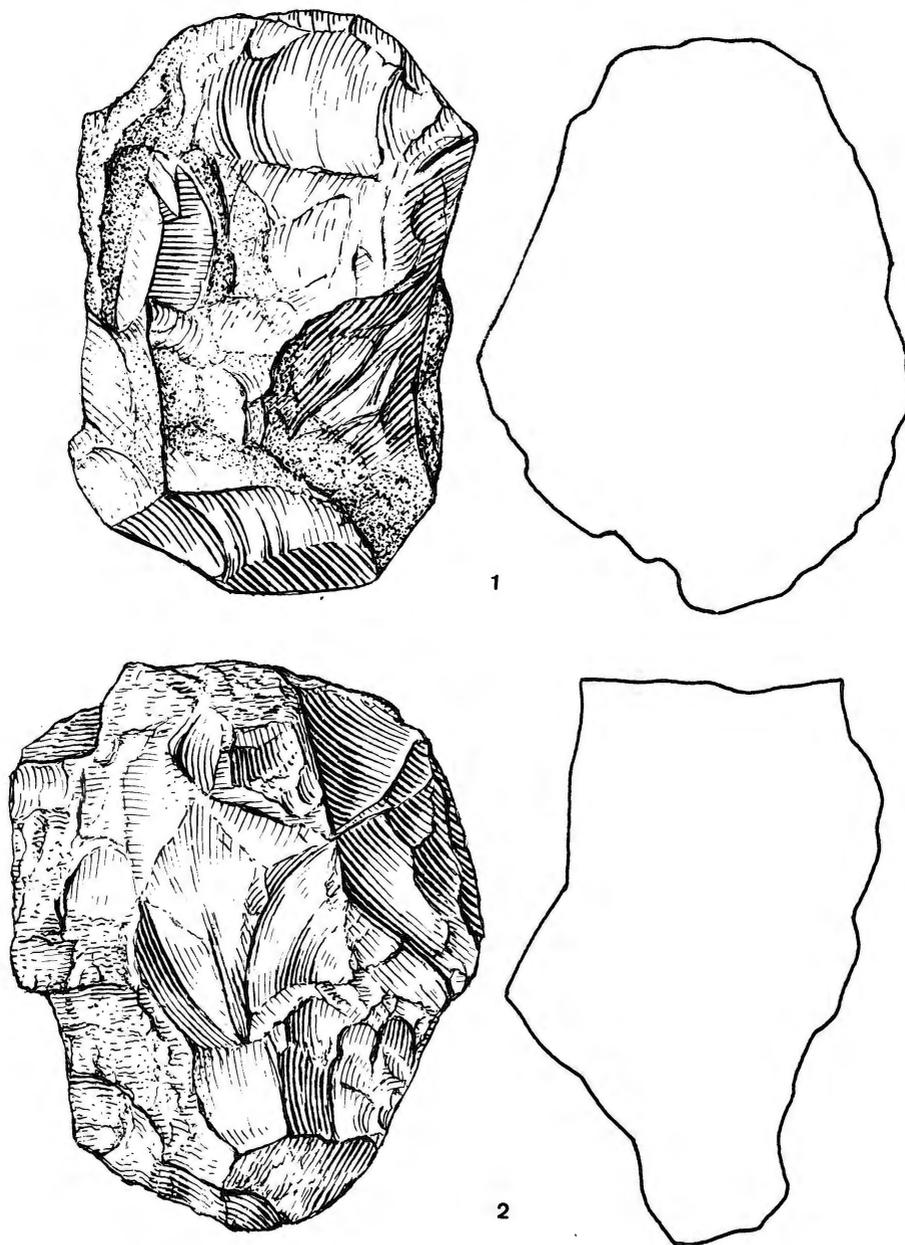


Fig. 6. Kolíbky. Pre-cores, layer 5. – 1:1.

Typologically this assemblage is rather poor. There is a micro-endscraper on a retouched flake (Fig. 9,12), a blade endscraper (Fig. 9,3) a blade with convex truncation and notches (Fig. 9,8) and a microblade with fine ventral retouch (Fig. 9,4). Another blade has notches (Fig. 10,12); 5 blades or blade fragments and one flake are partly retouched (Fig. 9,6,9,15; Fig. 10,5). There are 15 non-retouched blades (Fig. 9,10–11; Fig. 10,2,6,8–11,13–15,19), 2 microblades (Fig. 9,7), 13 flakes (Fig. 9,13–14, Fig. 10,16–17) and 7 fragments and chips of siliceous rocks (Fig. 10,18).

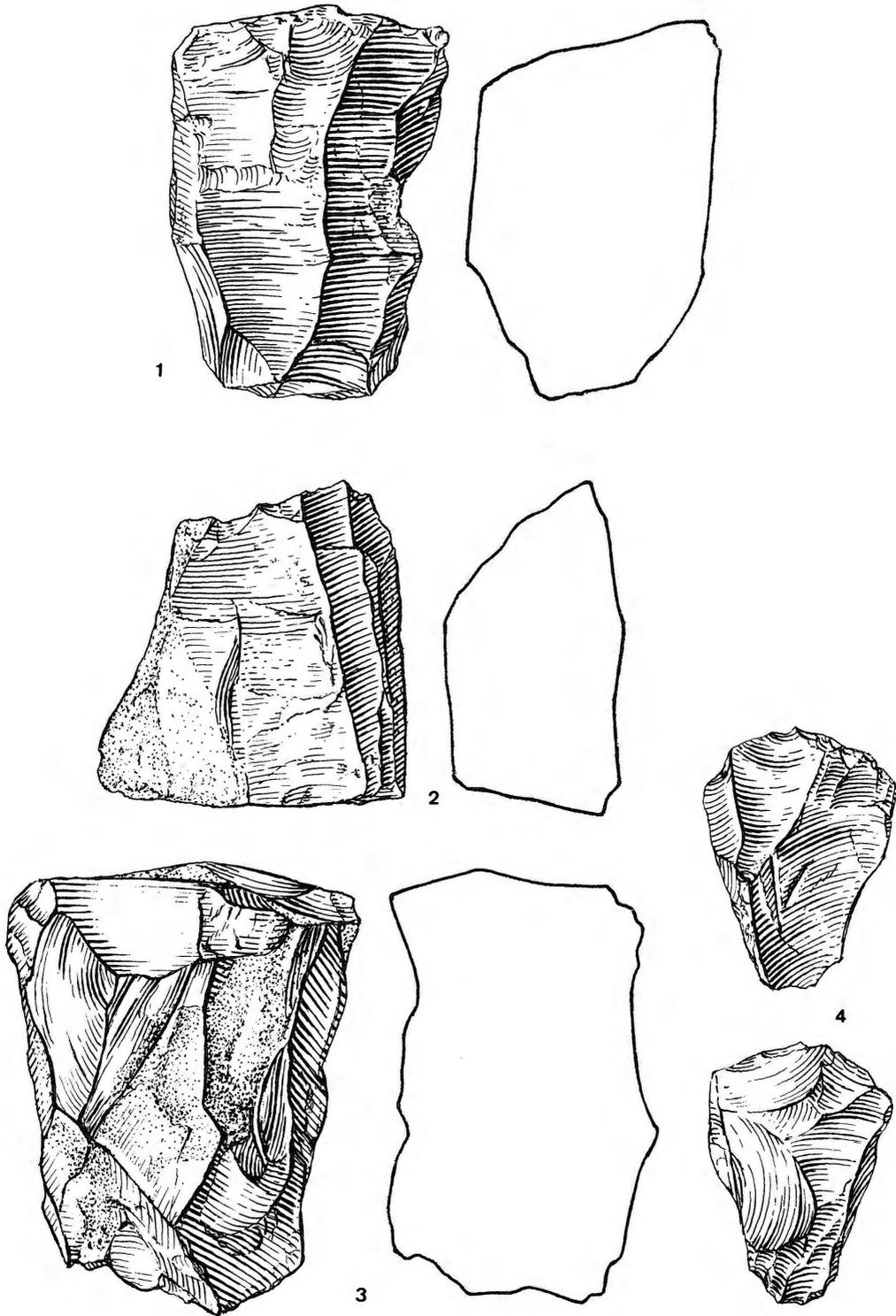


Fig. 7. Kolíbký. Cores, layer 1. – 1:1.

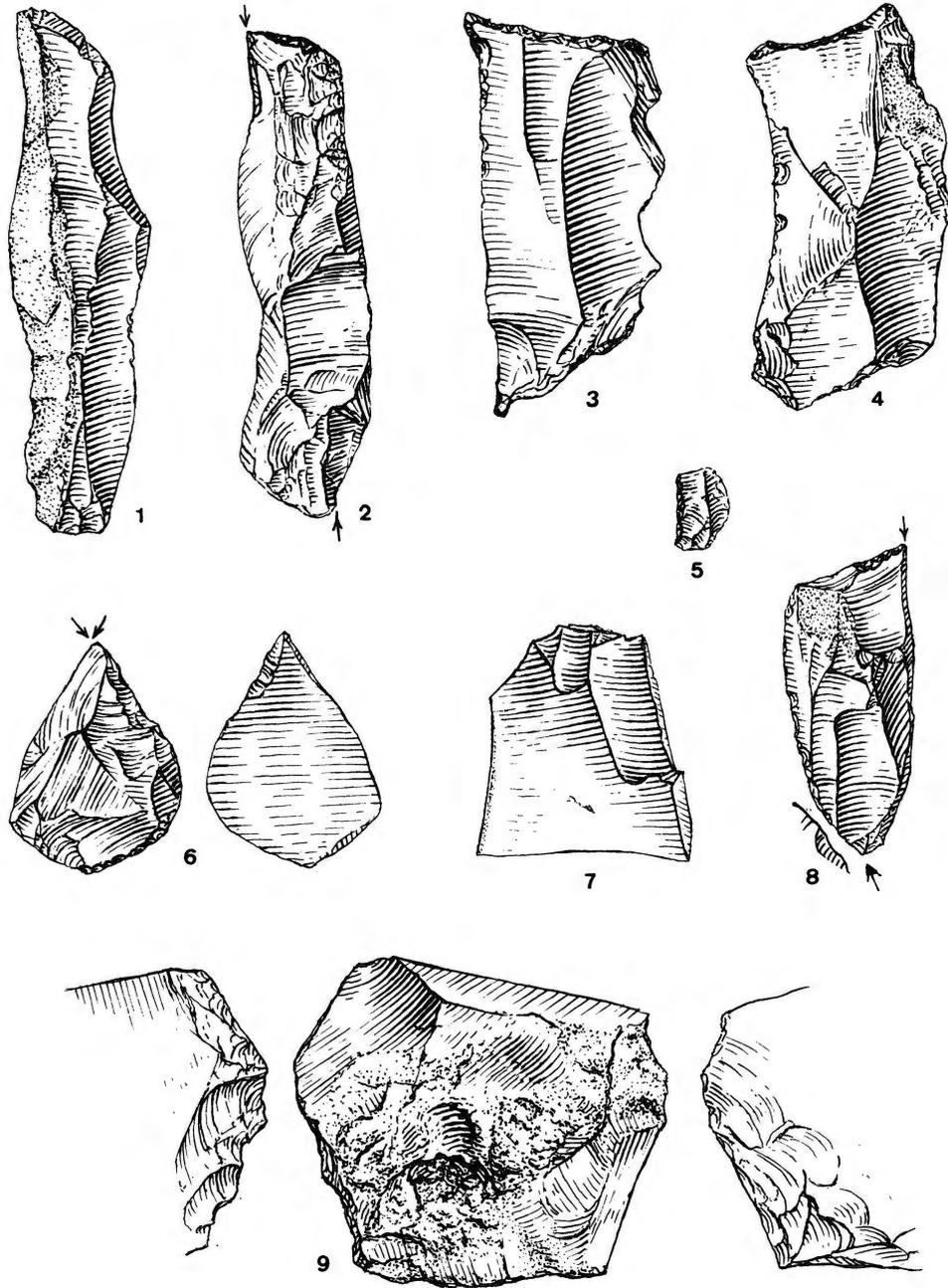


Fig. 8. Kolíbky. Stone tools: 1–8 layer 6; 9 layer 5. – 1:1.

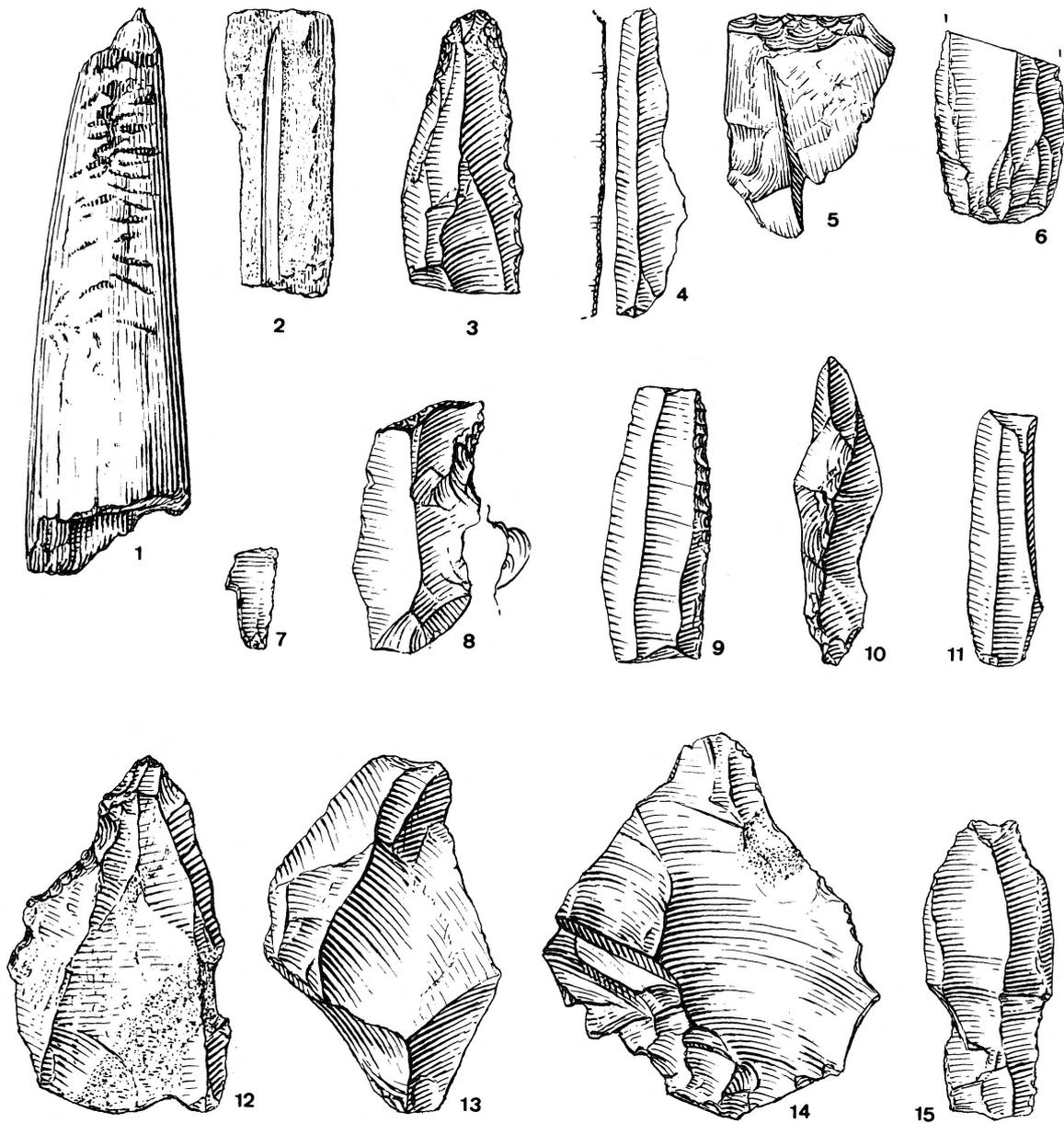


Fig. 9. Kolíbky. Antler and stone artefacts: 1 and 5 layer 5; 2-4 and 6-15 layer 1. - 1:1.

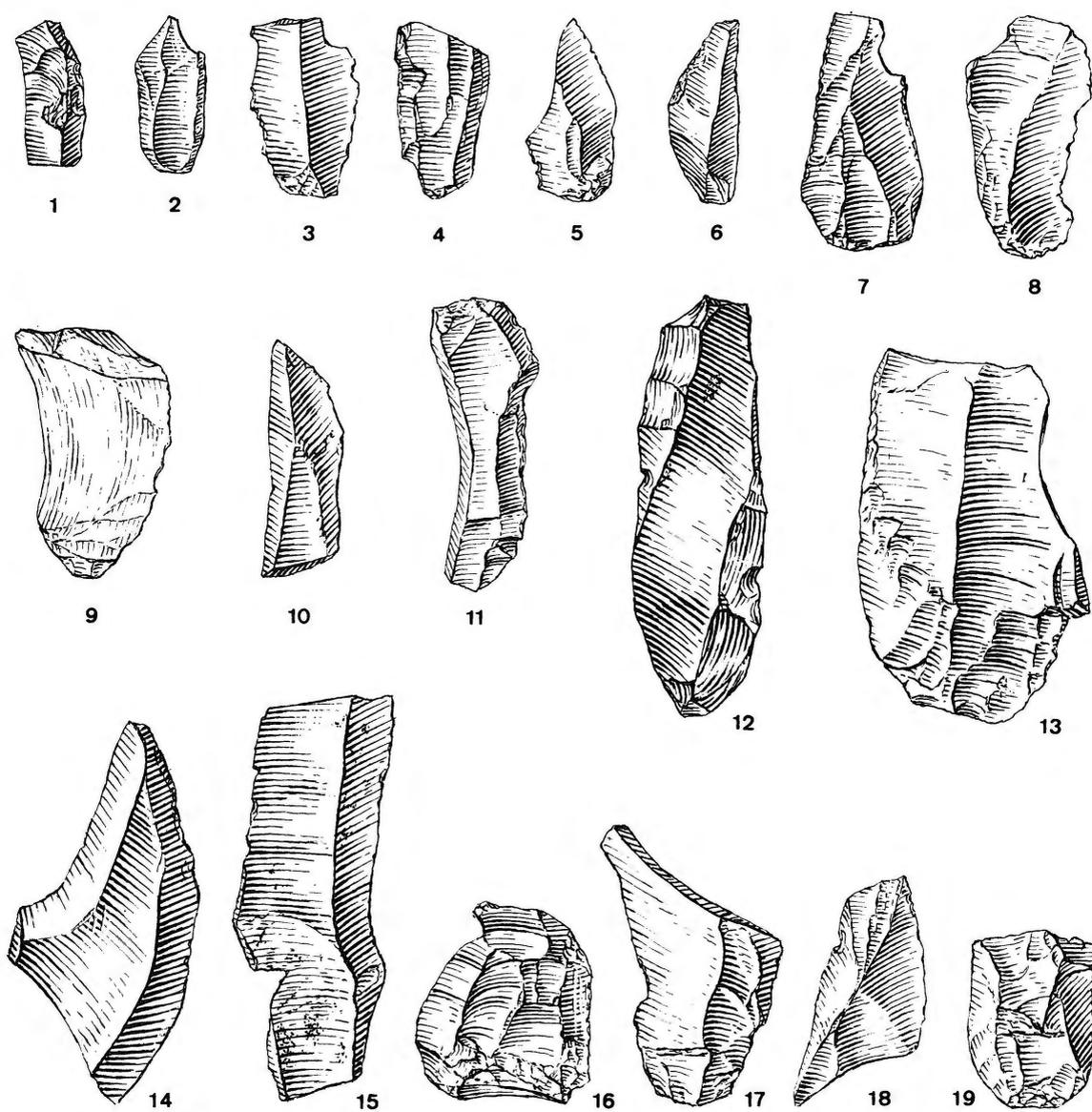


Fig. 10. Kolíbky. Stone blades and flakes: 1, 3-4 and 7 layer 6; 2, 5-6 and 8-19 layer 1. - 1:1.

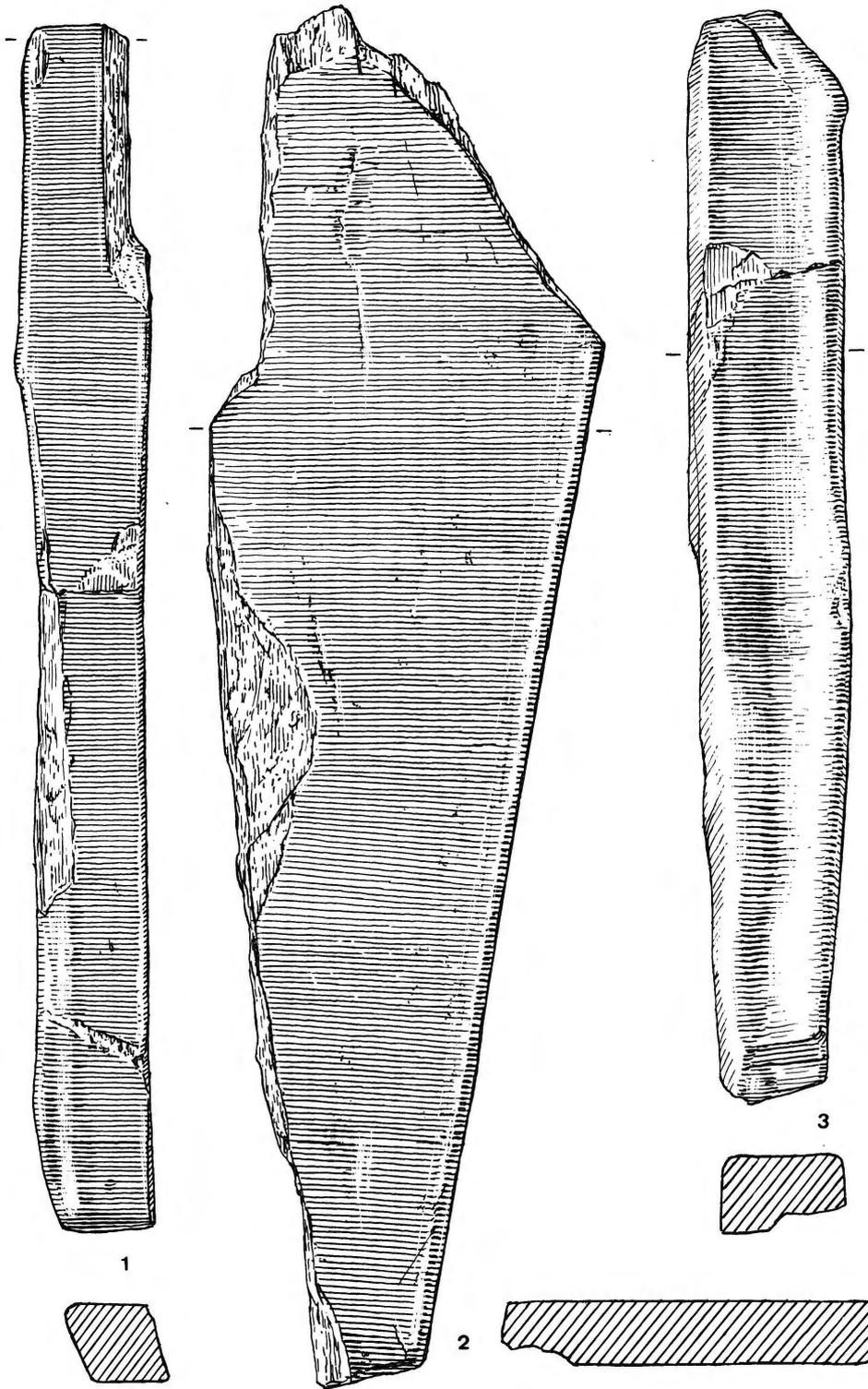


Fig. 11. Kolíbký. Shale blades and plate: layer 6. – 1:1.

The bone industry is represented by a fragment of an antler point with a blood groove (Fig. 9,2). A similar object, probably from the excavations of J. Knies, is to be found in the Moravian Museum collections²³.

There are also four sandstone plates, one of them (Fig. 12,2) flaked along the margin (length = 14,5 cm; 14 cm; 12,5 cm; 11,5 cm), a large lump and a smaller piece of ochre.

Finally, the sediment of layer 1 yielded 16 heavy plates and blocks of greywacke imported from distances of a few kilometers from the site. Six of them show artificial depressions on one face, seven are hollowed bifacially and three are plates or fragments without depressions. The surface of certain burned parts of the blocks is reddened due to the formation of iron-oxides or else it is covered by lime sinter. All depressions are circular, shallow, and somewhat standard in volume. These artefacts and their interpretation call for special attention.

11. List of the greywacke objects

38540. Quadrangular plate with depressions on both sides, red-burned along one edge. Dimensions: 17 x 15 x 8,5 cm; diameter of depression 1: 10,5 cm; depth of depression 1: 1,5 cm; diameter of depression 2: 10,5 cm; depth of depression 2: 2,2 cm. Lime sinter. Fig. 12,3.

38541. Fragment of a quadrangular plate with depressions on both sides, marginally flaked. Dimensions: 19 x 13 x 7 cm; diameter of depression 1: 11 cm; depth of depression 1: 2,3 cm; diameter of depression 2: 11 cm; depth of depression 2: 1,5 cm. Lime sinter. Fig. 12,4.

38542. Fragment of a quadrangular plate with one depression. Dimensions: 19 x 13 x 8 cm; diameter of the depression: 9,5 cm; depth of the depression: 2,5 cm. Fig. 12,5.

38543. Fragment of an oval block with depressions on both sides. Dimensions: 17 x 11 x 8,5 cm. Both depressions incompletely preserved. Fig. 12,6.

38544. Plate with one depression, marginally flaked. Dimensions: 20 x 19 x 7 cm; diameter of the depression: 9 cm; depth of the depression: 1,2 cm. Fig. 12,7.

38545. Fragment of a plate with depressions on both sides. Dimensions: 17 x 10 x 8 cm; diameter of depression 1: 9 cm; depth of depression 1: 0,9 cm; depression 2 incompletely preserved. Lime sinter.

38546. Fragment of a quadrangular plate with one depression, marginally flaked. Dimensions: 26 x 14 x 8 cm. The depression is incompletely preserved. Lime sinter. Fig. 13,1.

38547. Fragment of a plate, burned along one edge and marginally retouched. Dimensions: 14 x 16 x 4 cm.

38548. Fragment of a plate with depressions on both sides and marginally flaked. Dimensions: 18 x 13,5 x 7 cm; diameter of depression 1: 9,5 cm; depth of depression 1: 1 cm; depression 2 is not completely preserved. Fig. 13,2.

38549. Block with one depression. Dimensions: 21 x 18 x 12,5 cm; diameter of the depression: 10,5 cm; depth of the depression: 1,7 cm. Fig. 13,3.

38550. Fragment of a block. Dimensions: 20 x 12,5 x 9 cm.

38551. Fragment of a block with depressions on both sides. Dimensions: 16 x 6,5 x 9,5 cm; both depressions incompletely preserved.

38552. Quadrangular block with one depression, marginally flaked. Dimensions: 20 x 15 x 11 cm; diameter of the depression: 9,5 cm; depth of the depression: 1,4 cm. Lime sinter. Fig. 13,4.

²³ See note 7, Tab. XIV, 3.

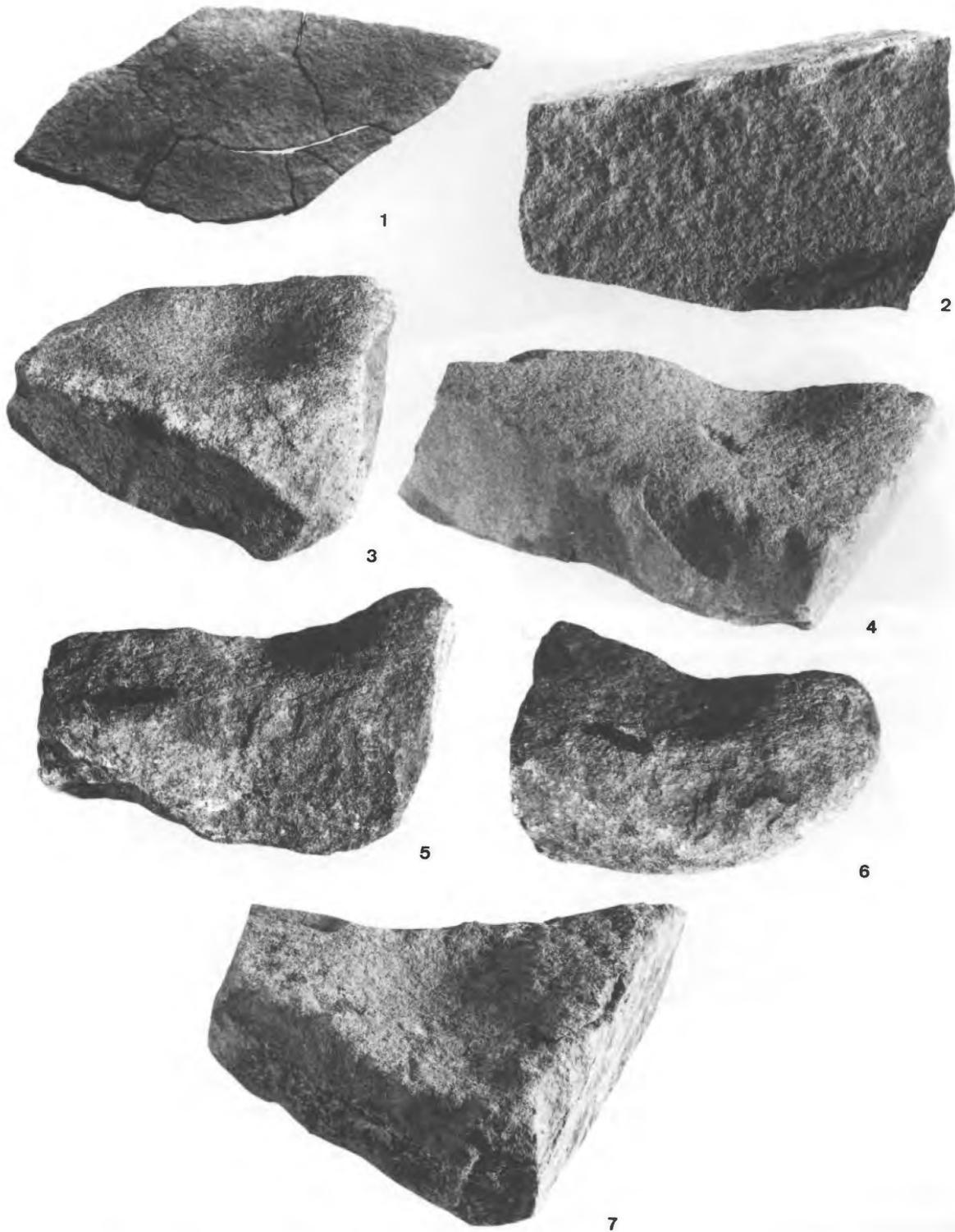


Fig. 12. Kolíbky. 1 sandstone no. 38474, 2 sandstone no. 38559, 3 greywacke no. 38540, 4 greywacke, fragment no. 38541, 5 greywacke, fragment no. 38542, 6 greywacke, fragment no. 38543, 7 greywacke no. 38544; 1 layer 6, 2–7 layer 1.
– Varying scale.

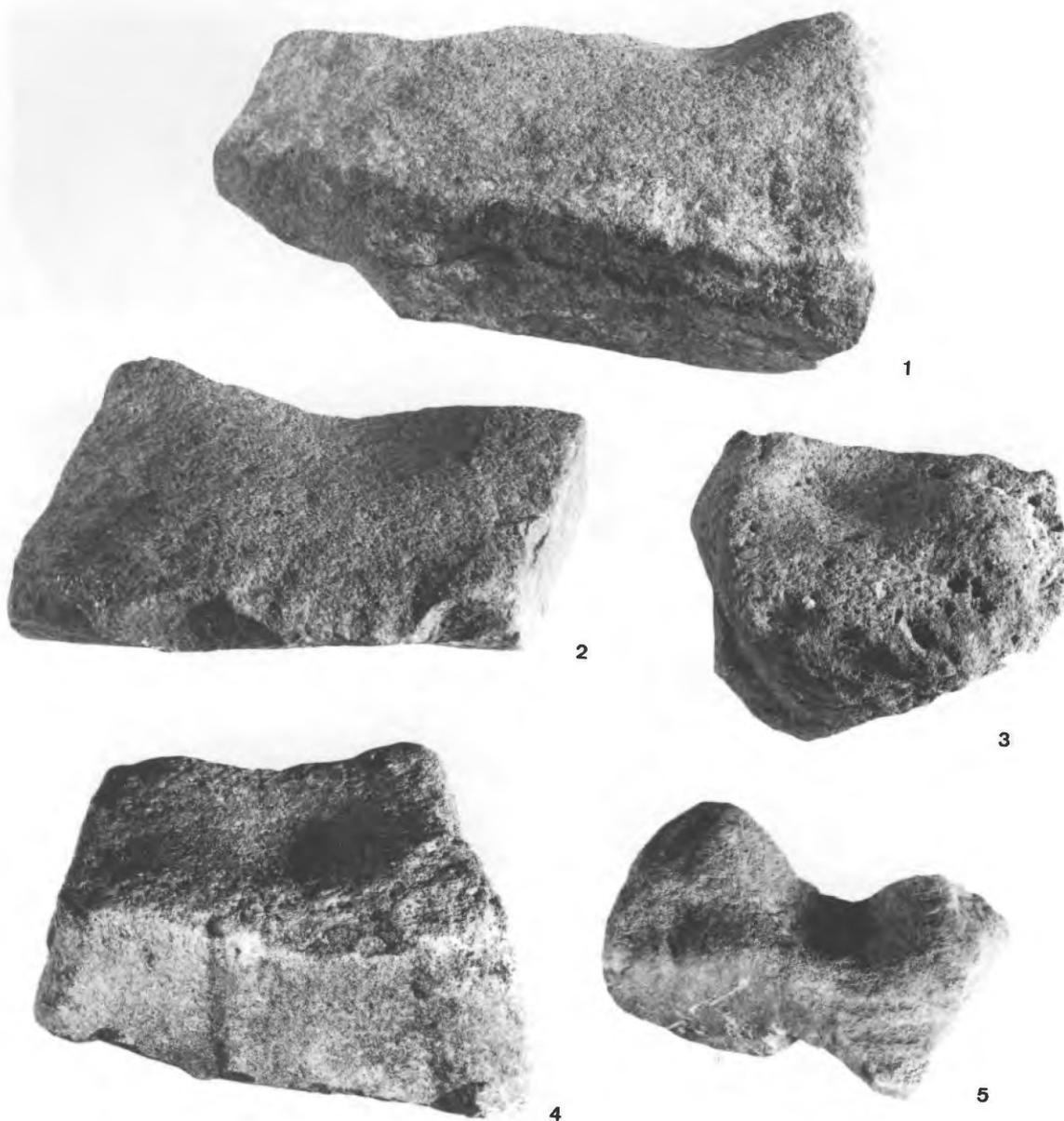


Fig. 13. Kolíbky. 1 greywacke, fragment no. 38546, 2 greywacke, fragment no. 38548, 3 greywacke no. 38549, 4 greywacke no. 38552, 5 greywacke, fragment no. 38553; layer 1. – Varying scale.

38553. Fragment of a quadrangular plate with depressions on both sides. Dimensions: 15 x 12,5 x 7 cm; diameter of depressions 1: 10 cm; depth of depression 1: 2 cm; depression 2 incompletely preserved. Fig. 13,5.

38554. Fragment of a plate with part of a depression. Dimensions: 19 x 16 x 8 cm; Lime sinter.

38555. Fragment of a plate. Dimensions: 12 x 11 x 6 cm.

Table 3 Kolíbky. Elemental and pyrolytic analyses of greywacke objects on organic matter.

Inv. No. Arch. Inst.	Geol. Serv.	Fragment	Elemental analysis		ROCK-EVAL pyrolysis	
			C _{org} (%)	C _{min} (%)	mg C _{org} / g rock S1	S2
38477	6585H	A	0,41	< MD	0,03	< MD
"	"	B	0,13	< MD	0,04	< MD
38540	6586H	A	0,08	< MD	0,03	< MD
"	"	B	0,08	0,11	0,03	< MD
38541	6587H	A	0,10	0,22	0,03	< MD
"	"	B	0,06	< MD	0,04	< MD
38551	6558H	A	0,06	< MD	0,03	< MD
"	"	B	0,07	0,12	0,03	< MD
Limits of detection			0,05	0,05	0,01	0,05

12. The chemical analysis of the greywacke objects

The interpretation of stone containers is derived from use traces on their surfaces, especially in the area of the depressions²⁴. On the surfaces of the objects from Kolíbky, we observed neither traces of ochre nor organic substances. The presence of the latter is important to prove whether a container could have served as a lamp. Therefore, 3 greywacke plates with depressions (layer 1, nos. 38540, 38541 and 38551) and one flat sandstone plate with visible traces of charcoal (layer 6, no. 38477) were analysed chemically by J. Toul.

Two fragments (A, B) of the rock material were separated mechanically from each of the four stone objects. One fragment (A) was taken from the depression where impregnation of the rock with lipid material is more probable (the „active zone“ after S. A. de Beaune). The second (B) was taken as a reference sample from the marginal part of the same object where the lipid impregnation is less probable (the „passive zone“). All samples were crushed and ground in an agate mortar to grain size < 0,20 mm.

Aliquots of the homogenized samples were then analyzed as to the contents of mineral (i. e. carbonate) carbon (C_{min}) and organic carbon (C_{org}). A standard method of geochemical elemental analysis was used, based on the acid decomposition of carbonates (C_{min}) and combustion of the intacted organic matter in oxygen at 1000 °C.

Contents of the volatile and nonvolatile organic matter in the rock samples have been also estimated, using the temperature-programmed ROCK-EVAL pyrolysis. This method determines simultaneously both the content of organic carbon S1, bound in low molecular species of the organic matter (which can vaporize in a helium atmosphere starting at a temperature of ~ 250 °C), and the organic carbon S2, bound in nonvolatile species of organic matter (which split into low molecular fragments at elevated temperatures from 250 to 550 °C during the pyrolysis).

²⁴ S.A. DE BEAUNE, Lampes et godets au paléolithique. Supplément à Gallia préhistoire 33, Paris 1987.

Data on the elemental and pyrolytic analyses are presented in Table 3. For the majority of samples, the values are close to the detection limits of the respective methods. The two selected sampling points (A and B) do not differ significantly from one another on each stone object. Higher amounts of the organic carbon C_{org} were detected in object No. 38474; this may result from an increased sorption of components of the soil organic matter on active surfaces of the hydrated iron oxides that distinctly penetrate both fragments (A, B).

A specific assay commonly used for the chemical evidence of lipid components present in rocks and sediments usually involves solvent extraction (often combined with saponification), preparative fractionation and derivatization, clean-up, concentration and gas chromatographic determination of individual fatty acids (in the form of their methyl esters). In this case, however, considering the extremely low concentrations of total organic matter as well as the ubiquity of traces of lipid constituents in nature, one has to question the reliability of the lipid impregnation proof made by using these complicated, time-consuming and expensive methods. At such low concentration levels, these analytical procedures cannot distinguish safely enough the residues of a hypothetical lipidic lamp fuel from the current external lipid contamination of the studied objects originating from other natural and artificial sources (soil, water, fingerprints, soaps, detergents etc.).

13. The question of the lamps

In one of his general articles, J. Knies²⁵ mentioned a new site in the Moravian Karst, obviously Kolíbký: „During the summer holidays of this year we recognized a new site of Diluvial man as an important one by the discovery of 13 stone vessels – if we may so call Kulmian plates with very clear artificial depressions.“ A more detailed description was given only in a newspaper article²⁶: „Below, at a depth of 10–25 cm, in pure loess the age of which is determined by reindeer, horse and lemming, we detected a row of stones – Kulmian greywackes – laying next to each other, each of them with a shallow depression. Some of the stones, especially the ones reaching deeper into the earth, were covered by a charcoal layer, and the clay has been burned red elsewhere.“

„13 pieces were found altogether, the largest of them measuring 35 cm (length), 20 cm (breadth) and 15 cm (thickness). Some stones have one depression only; the largest is circular and 25 cm in diameter; others are ellipsoid in shape, and in one case there are two depressions next to each other. Another stone has such depressions on opposite sides.“

Knies mentioned that the stones were transported from the site and should have been placed in his Museum of the Moravian Karst at Sloup. Once considered as the most important finds, these objects are not mentioned further in Knies' unpublished diary. In 1929, J. Skutil²⁷, basing himself of Knies' reports, further discussed these objects, which, however, were lost in his day. Skutil compared these pieces with the „pierres à cupules“ from France, interpreted, in his day, as a sort of prehistoric game. Finally, however, he agreed with the original view of Knies that their purpose was in fact practical.

One of the questions arising from these records is whether our collection is the same as the one described by Knies and Skutil. This would mean that Knies, for some reason, lost his interest in these heavy and unusual artefacts and left them at the site to be rediscovered later in redeposited sediments.

²⁵ J. KNIES, Drobné geologické zprávy z území Moravského Krasu. Věstník Klubu přírodovědeckého v Prostějově 10, 1907, 69–75.

²⁶ J. KNIES, Nové sídliště diluviálního člověka u Jedovnice na Moravě. Lidové noviny 15, 344, 13.12.1907.

²⁷ J. SKUTIL, Paleolitická stanice „V Kolíbkách“ u Jedovnic. Časopis Vlast. spolku muzejního Olomouc 41/42, 1929, 105–108.

The total of 13 pieces with visible depressions corresponds perfectly, but not so their description. We never found as large a piece as Knies mentions, or the piece with two depressions on the same face. Finally, it should be taken into account that Knies transported the pieces away. Thus we incline to the version that the original number was not 13, but 26 or more. Knies found his artefacts in front of the cave, while ours probably originate from the cave entrance.

J. Knies was not the first to deal with the problem of stone containers in Moravia. In 1884, J. Wankel mentions concave concretions from Býčí skála, one of them with remains of ochre, and in 1891, M. Kříž recalls further finds from various caves of the Moravian Karst: „I have been lucky enough to find three fragments of prehistoric stone vessels (of greywackes/sandstone), originating from three pots of various sizes, and one stone lamp (of red sandstone)“²⁸. One of the Kříž finds from Pekárna was entered into the catalogue of European lamps by S. A. de Beaune²⁹.

Later, further finds of stone containers were mentioned by K. Absolon and R. Czižek³⁰ from their own excavations at Pekárna. Similar objects appear in the Hadí Cave directly below Pekárna: two fragments of natural sandy limonitic concretions³¹. Their raw material and shape, however, differ from the relatively standard series from Kolíbky.

Thus the character and quantity of the blocks from Kolíbky seem unique within the Upper Paleolithic record of Central Europe. It should be recalled that in Bohemia (Hostim), Central Germany and Rhineland (Gönnersdorf, Andernach) the stone containers are mostly fragments of natural concretions of ferritic sandstones and only some shale plates show artificially hollowed bowls.

14. Discussion

Kolíbky is an example of a site which, due to both human and natural disturbances and to its specific character, raises more questions than it answers. Its importance lies not so much in stratigraphy and chronology (Table 4) as in the evidence of lithic exploitation and further special activities.

The size of Magdalenian sites in Western Central Europe and their relationship to the complex archaeological evidence has been analysed by G.-C. Weniger³². Because of the number of artefacts, Kolíbky clearly belongs to the group of small sites (Aa). Usually, such sites reflect short-term field camps occupied mainly in spring and summer; the bone and antler tools are rare, habitation structures are not evident, and the presence of fire is often recorded by burned artefacts only. Numerous sites of this kind are recorded from the Moravian Karst, and Barová Cave offers another example, well documented by modern excavations.

Weniger noted that small sites are more varied than the other types and gives several examples of special activities performed at such sites in Germany. Similarly in Moravia, the various activities are more readily recognised at small sites (evidence of primary lithic workshops at large sites like Pekárna and Býčí skála was attributed to an earlier occupation stage³³).

²⁸ J. WANKEL, První stopy lidské na Moravě. Časopis Vlast. spolku muzejního Olomouc 1, 1884, 143.– M. KŘÍŽ, Kůlna a Kostelík, dvě jeskyně útvaru devonského na Moravě. Brno 1891, 35.

²⁹ See note 24.

³⁰ See note 5, 522.

³¹ B. KLÍMA, Archeologický výzkum jeskyně Hadí (Mokrá u Brna). Anthropozoikum 9, 1961, 277–289.

³² G.-C. WENIGER, The Magdalenian in Western Central Europe: Settlement pattern and regionality. Journal of World Prehistory 3, 1989, 323–372.

³³ See note 5, and K. VALOCH, Die Quarzindustrie aus Býčí skála in Mähren. Quartär 17, 1966, 51–89.

Table 4. Magdalenian C¹⁴ datings from the Moravian Karst.

Site	Date B.P.	Lab. No.
Kolíbky	12 680 ± 110	OxA-5973
Nová Drátenická	11 670 ± 150	OxA-1952
Nová Drátenická	13 870 ± 140	OxA-1953
Nová Drátenická	12 900 ± 140	OxA-1954
Pekárna (gh)	12 500 ± 110	OxA-5972
Pekárna (gh)	12 940 ± 250	Ly 2553
Pekárna (gh)	12 670 ± 80	GrN-14828
Kůlna (layer 6)	11 590 ± 80	GrN-5097

K. Sobczyk³⁴ analysed Magdalenian sites of Central Europe from the viewpoint of lithic raw material processing and its dynamics. Special attention has been paid to the percentage of core preforms within the core assemblages, which, logically, reaches maximum values at the primary rock-extraction sites in Poland and Germany (Wolowice – 75 %, Brzoskwinia – 25–30 %, Groitzsch – 43 %). In the Moravian Karst, an area more dependent on imported materials, this percentage is usually low (Pekárna – 4 %) and it reaches a higher value only in the large cave workshop at chert sources in Býčí skála (27 %).

Several patterns observed at Kolíbky should be underlined in this context. The appearance of core preforms (5 pre-cores to 4 exploited cores) and hammerstones show a larger extension of local lithic production than could be deduced from the size of the site. A few lumps of ochre from nearby deposits suggest further exploitation activities. So far, stone plates have also been recorded from larger sites; however, their distribution in layer 6 is too scarce to indicate a pavement; the absence of ochre traces does not allow us to interpret them as ochre grinding plates.

Finally, the occurrence of heavy stones with small depressions is even more striking. Comparable objects are unknown from other Magdalenian sites in the Karst; thus we can hardly argue that Kolíbky would have functioned as a specialized workshop and distribution center, but must rather assume that all the objects found have been used at that place. The remark of Knies that they were possibly arranged in a row may suggest that they formed a structure in front of the cave entrance. The presence of charcoal and burnt loess observed by him in the vicinity suggest a function related to heating.

The evidence of heating, together with the absence of ochre traces, helps us to exclude the possibility of ochre containers, however probable this may be with respect to the nearby ochre outcrops. To serve as containers for liquids, volumes of the depressions are impractically small.

To interpret a container as a lamp, S. A. de Beaune³⁵ strongly requires the appropriate traces of use. With the negative results of chemical analyses, we can base our comparison with the French lamps on the probability derived from Knies' observations and on morphological-metrical characters.

In France, 71.5 % of the lamps come from sites exposed to daylight, such as open-air sites, rockshelters and cave entrances, and only the rest originate from deep cavities. More information about the location of the lamps within a living site is rarely available; in the few cases when the position was recorded, the objects were placed within a dwelling or in an activity zone³⁶. These observations correspond well to the data from Central Europe, namely from Kolíbky.

³⁴ K. SOB CZYK, Modes de débitage dans le magdalénien d'Europe Centrale. *L'Anthropologie* 88, 1984, 309–326.

³⁵ See note 24.

³⁶ See note 24.

15. Conclusions

Kolíbky is a small, probably seasonal Magdalenian site, situated away from the three main settlement clusters of the Moravian Karst and contemporary to the large site of Pekárna (Table 4). Special activities performed at this site are partly determined by the sources of cherts and ochre in the nearby Rudice Formation. Other activities, namely the fabrication and use of a large number of heavy stone containers of small capacity, are little understood. Morphological characteristics and the evidence of heating suggest that they may have served as lamps, but the required traces of use are not detectable.