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THE KŮLNA LEVEL 11: SOME OBSERVATIONS ON THE DEBITAGE RULES AND AIMS. THE ORIGINALITY OF A MIDDLE PALAEOLITHIC MICROLITHIC ASSEMBLAGE (KŮLNA CAVE, CZECH REPUBLIC)

ABSTRACT: The Kůlna level 11 is famous for its microlithic assemblage named Taubachian. This kind of industry also exists in other sites in Central Europe and Germany and the reasons for their presence are still discussed today. This study offers some observations about the technical behaviour of those people. The assemblage analysis tends to prove that the product size was voluntary and not imposed by environmental conditions. Only through the study of both fauna and industry the specific way of life of those people can be explained.

KEY WORDS: Kůlna – Taubachian – Microlithic assemblage – Technology

INTRODUCTION

The Kůlna cave is located in the Czech Republic, in the Moravian Karst. It was excavated by Karel Valoch from the Anthropos Institute of Moravian Museum between 1961 and 1976 (Valoch 1988). Several layers have been observed. In the upper part of the sequence, Magdalenian levels are present. Next we can see four Micoquian levels (6a, 7a, 7b and 7c). Below these levels, the excavations show another Middle Palaeolithic level, number 11, subdivided into sub-layers (11a to 11d). On the lower part of the sediments, some artefacts collected prove that human occupation of the cave is less in evidence than in levels 11 to 6 (levels 9, 13a, 13b and 14).

Level 11 is attributed to the Taubachian. The age can be determined by studying both fauna and stratigraphy. It corresponds, in the state of knowledge, to the second half of the Eem Interglacial. The upper part of level 11 (a and b) and level 10 could be dated to a steppic period belonging to the end of the late Interglacial. The Micoquian layers could belong to the beginning of the last cold period (50 to 69 ka), according to ESR dating (Rink *et al.* 1996).

The Taubachian industry is characterized, according to K. Valoch, by the use of small pebbles from various rocks, contributing to a microlithic assemblage. The technology is "non-Levallois". Side-scrapers (numerous in the Kůlna level 11), denticulates and notches are prevalent, associated with micro-choppers. Bones show numerous retouches of compressors (Valoch 1984, 1988, 1995).

The Taubachian industry also exists in other sites in Central Europe and Germany, often in travertine locations (warm water springs). These locations are associated with an abundant vegetation, above all during a forest period like the Eemian s.s. (Gánovce, Bojnice III, Ondrej-Skalka, Taubach, Weimar, Tata). But the upper parts of the Kůlna level 11 and perhaps the Tata patterns show that this microlithic industry is not always linked to a temperate and wide forest environment.

TABLE 1. The number of pebble tools and entire pebbles examined in the Kûlna level 11.

	Silicites	Quartz	Orthoquartzite
Pebble tools	2	19	14
Entire pebbles	–	3	5
Total: 35 pebble tools, 8 entire pebbles			

TABLE 2. Elements of pebble tools.

Shaping			
unifacial:	16	bifacial:	15
small; removals at the end of the pebble:	9	several axes:	6
invasive; removals:	7	short removals:	5
		invasive removals:	4

Sharp angle of the tool	Shape of pebble section		Location of the removals	
30°: 5	quadrangular:	17	the largest edge:	19
45°: 5	oval:	5	the narrowest edge:	2
60°: 1	long oval or quadrangular:	3	undetermined:	1
60–90°: 3	flat:	3	use of the pebble slice (point):	1
	undetermined:	1		

Microlithic industries exist in ancient times, for example in Bilzingsleben and Vertesszöllös, also located in travertines. The question of an association with a specific location, linked to a specific way of life, requiring a specific technology, is still discussed today. Another question arises regarding the pebbles. Was the collection of these small pebbles voluntary or imposed according to the environmental conditions? Could a forest environment have contributed to small pebbles in the rivers near the site, even though other large pebbles were present in other localities? With the accessibility of moraines to men according to K. Valoch (Valoch 1984), small pebbles would, therefore, be searched for Taubachian. Moreover, a local collection of most of the raw materials chosen for their abilities (some stones, with sometimes one artefact of them, from distant locations, radiolarite, moraine flint, "porcelanite stone", by curiosity or a proof of some precious stones) seems to be the case for the level 11 people, but new studies will provide more informationn (Neruda in press). Otherwise, the raw material choice does not seem to exactly reflect the stone possibilities in the environment. The different kinds of silicites (good quality flint, chert and siliceous rocks, radiolarite) and quartz are the most often used stones (33% for each one), followed by orthoquartzite (15%). However, it is not the same case in the Micoquian levels. Silicites account for 80% of the artefacts (Valoch 1995).

The average size of the flakes in level 11 is 3 cm, while it is more than 4 cm in the Micoquian levels. A lot of flakes are broken. Some of them are laminar (about 4%). The flat retouch is lacking in the Taubachian industry, and there are just six bifacial tools. Surprisingly, two of them are in "porcelanite" stone, making them inappropriate as tools because of their softness.

This study has resulted in the observation of some technical behaviour, a reflection about the human aims and the needs in this microlithic world. Even though the date hypothesis shows a different environment between the settlements within the level 11, the assemblage was studied together.

RESULTS OF THE STUDY OF THE LEVEL 11 ASSEMBLAGE

The assemblage gathers 10,555 artefacts, 98% are less than 1–3 cm long. 25% of the cores have a length inferior to 3 cm. 714 are tools and 295 show used marks. Retouches represent more than 6% of the artefacts. However, the choppers and chopping-tools are less numerous (Valoch 1988, Neruda in press).

The analysis of the artefacts involved classifying the raw materials into three main groups of stones, according to their debitage aptitude: different kinds of silicites (radiolarite, rock crystal, siliceous stones), quartz and other variations of this stone and brown orthoquartzite. We added rare stones like limestones and others, which could have a different reaction to a debitage (Valoch 1986). We know that these divisions have eliminated a large part of information, especially regarding the knowledge of behaviour towards rare stones or specific stones (for example porcelanite stone from a long distance and imported already retouched by flat retouches). But our observation on the whole assemblage seems to show that the specific stones have been treated in the same way as the most numerous raw materials, even if they could have already appeared in flakes.

To note statistical elements, especially for technical analysis, we decided to take a sample at random for the

TABLE 3. The product shapes of the statistical sample.

Shapes	Silicites	Quartz	Orthoquartzite	Others
Round	18–10.6%	–	1–11.2%	–
Square	29–17.1%	6–20%	33–37.1%	2
Oval	31–18.3%	7–23.3%	12–13.5%	–
Rectangular	46–27.2%	7–23.3%	25–28%	2
Triangular	44–26%	3–10%	4–4.5%	–
Irregular	1–0.6%	7–23.3%	14–15.7%	–
Total sample	169	30	89	6

TABLE 4. Removal kinds, backs and cortical remains on debitage products (sample).

Removals	Silicites	Quartz	Orthoquartzite	Others
Centripetal	45–26.6%	7–23.3%	28–31.4%	1
Unipolar	67–39.6%	9–30%	34–38.2%	4
Bipolar	16–9.5%	2–6.6%	8–9%	1
Crossed	34–20.1%	5–16.6%	12–13.5%	–
Undetermined	7–4.1%	7–23.3%	7–7.8%	1
Back	*45–26.6%*	*7–23.3%*	*29–32.5%*	*1*
Cortical remains	*62–36.6%*	*10–33.3%*	*51–57.3%*	*1*

debitage products. On the other hand, all the other artefacts were analysed thoroughly. In addition, cores and pebble tools were studied in detail.

The people's needs: pebble tools, debitage products, retouched cores

People obtained what they needed using different methods: by a shaping system, which however stays on a very small scale, and by a main debitage system, which gives flakes and even cores like blanks. The debitage operational scheme seems to take place on the site (flakes, cores), but it is not entirely sure for the shaping system.

The pebble tools: the shaping system

The shaping system joins together a small number of artefacts (*Table 1*). This activity is secondary, regarding the debitage. The examined entire pebbles and pebble tools are, for the most part, in quartz and orthoquartzite, the most abundant and strongest stones nearby Kûlna. The silicites are reserved for the debitage. The pebble shape, is, above all, quadrangular (*Table 2*). Was there a reason for the dominant presence of this kind of pebbles in the river or was it a human choice? The entire pebbles have the same shape but more often are like a ball than a cube.

The flat parts of the pebbles are useful and, therefore, used like a striking platform for shaping. The largest edge is preferred, explaining why the pebble tools are short. The removals are large or small on the pebbles, regardless of the pebble shape and the shaping kind. Moreover, they are less frequent in most cases. The shaping is, in fact, basic. Unifacial shaping is as common as bifacial shaping. These kinds of shaping do not seem to depend on either the pebble shapes or tool angle. The bifacial shaping is not a secondary shaping to rectify the ridge or to recreate a tool. The removals seem to be really less numerous and actually do not affect the pebble morphology. The shaping seems to be short and quick. Maybe unifacial and bifacial shapes are two possibilities of making tools, according to the pebbles and the needs of the people. The sharp angle of the tool varies from 30° to 90° (*Figures 1* and *2*).

The size study of the pebble tools shows a large range of measurements from 15 mm to 240 mm. The most numerous artefacts are, however, between 15 and 60 mm. It is evident that even though people required various tools from very small (micro-choppers) to large ones, the smallest ones were preferred. An analysis of the microscopic marks would perhaps explain if some of the smallest pebble tools were attached to the end of a wood point or to a wood element, or used simply by hand. The microwear studies provide a lot of information of the wood use during Middle Palaeolithic, therefore, why not in a wide forest context like in Kûlna level 11.

Some entire pebbles examined are, mainly, within the largest artefacts population. Undoubtedly, the possibility of a collection of various pebbles can be deduced, especially when it is necessary, for example for percussion (hammers). It is a fact that the smallest pebbles were the most frequently chosen. But big pebbles could also have been found among pebbled beaches around the cave or nearby.

The debitage products

Through the flake analysis, with flakes which could often be broken and used like that, several facts can be cited to list some debitage aims. People were less demanding, but they searched for some specific kinds of products. This low degree of demand probably depended on the kinds of stones used like orthoquartzite or quartz which easily break themselves, but not always. The silicite flakes are quite similar to those in quartz and orthoquartzite (*Figures 3–7*).

- The products are very small, less than 30 mm, in the majority of the cases, but there are also large flakes up to 80 mm long. The flint flakes seem to be mainly small

TABLE 5. Some statistical elements on the tool sample (65 artefacts).

Tools	Silicites	Quartz, orthoquartzite	Others
Partial (one or several locations)	25–48%	2–18.1%	–
Total (one edge)	25–48%	8–72.7%	2
Flat surface	2–4%	–	–
Marginal	*32–61.5%*	*4–36.4%*	*1*
Invasive	*19–36.5%*	*6–54.5%*	*1*
The longest edge, lateral	36–69.2%	5–45.4%	2
The smallest edge, transversal	10–19.2%	3–27.2%	–
The longest edge, transversal	3–5.7%	3–27.2%	–

(perhaps for the stone quality, for a micro debitage or their needs).

- The flakes seem to be, in general, similar for all the raw material kinds, both short and wide. The shapes are various; even the rectangular and triangular morphologies (parallel edges) are more numerous for flint than for orthoquartzite and quartz. Some laminar flakes are also present, especially in silicite. These geometric shapes are often rectified by retouches, as much on entire flakes as on broken ones (*Table 3*).
- The flakes are often thick, but less thick for flint artefacts. The shape of the upper face of the products is made up of different small steep faces, which are remains of the last removals on the core surface (*Table 4*). The removal organisation on the flake face is, for all kinds of stones, centripetal, crossed or unipolar, showing a debitage in the pebble volume.
- Between 25 and 35% of the flakes have a back (cortical or not), sometimes even two opposite backs. A debitage break could have been perceived like a debitage back (these flakes were retouched like entire flakes). It is possible that the wide and thick platforms could also have been perceived like a back. Backs are numerous but they were not only the lone purpose. Other kinds of products were searched. The flake sections are, however, often quadrangular or triangular with a steeper slope on one of the edges. The needs were, therefore, diversified in spite of an impression of homogeneity of the assemblage.

Retouches have been put on flakes of all size. Triangular flakes or blanks with two convergent edges are used first for making points. The edges are either entirely retouched or partially retouched (*Table 5*). Orthoquartzite flake edges are more often retouched and on a long part of the available sharp side.

The retouches are, in general, opposite to the back, when it exists, to the steepest slope of the flake, or even to the platform. However, a back can be retouched or used, especially when there are two of them.

Bifacial or flat retouches are less numerous. Sometimes, flat retouches are located on the bottom of a point or on the inferior face of the flake, often on silicite artefacts or long distance stones like porcelanite stone (precious stones, curiosity, tool collecting?).

The retouch is simple, in general, invasive on orthoquartzite, but small and steep on silicites. Some silicite tools seem to have been used for a long time. Several series of retouches are indeed visible (due perhaps to a long utilisation linked to the quality of the raw material). The work seems to be tidy on silicites (long use, a special use, resharpening, linked to the kind of stone).

The retouch does not, therefore, really change the flake shape in most of the cases. The sharp angles have a large range of values, regardless of flake size and raw materials. In fact, the flake shape and the longest edge are chosen first.

In spite of the shape variability, which seems to show a less controlled debitage, it is evident that people wanted this diversity and used it. Retouched artefacts make up less than 10% of the assemblage. The flakes could be used rough. The observation of these flakes, therefore, gives a good idea of people's needs. There must have been unknown reasons in their decision for making retouches.

The retouched cores

Except if our observation is inaccurate, people decided to use more silicite cores like tools, than those found in other raw materials. These blanks are not the result of a voluntary shapping activity, to be retouched. They do not seem to be bifacial tools. No retouches are observed on quartz cores, but the marks are not easy to read on this stone. On the other hand, ten silicite cores (about 20% of the studied assemblage) carry, without doubt, retouches at least on one edge. Nine are side-scrapers, of which one is double and another is linked to a point. The last one is a thick "Tayac" point. Two cores are broken, and the retouches seem to have been made after the break. Therefore, the degree of demand was probably low, as we can see in their use for the broken flakes. The retouched core size varies from 30 to 60 mm in lenght, which is among the larger size of the debitage products. The thickness is between 10 to 30 mm, classifying these blanks among the thickest ones. The core shape is oval or rectangular.

Four orthoquartzite cores with several orthogonal faces have percussion marks along some edges. It is hard to know whether these crushings result from a debitage, a retouch or a violent use on large blanks (for a size bigger than 60 mm for these cores) which could be used like pebble tools or hammers. However, two orthoquartzite cores show a side-scraper retouch, similar to the retouch on silicite cores.

The choice of cores like blanks does not depend on the technical system on the debitage surface. Instead, it seems

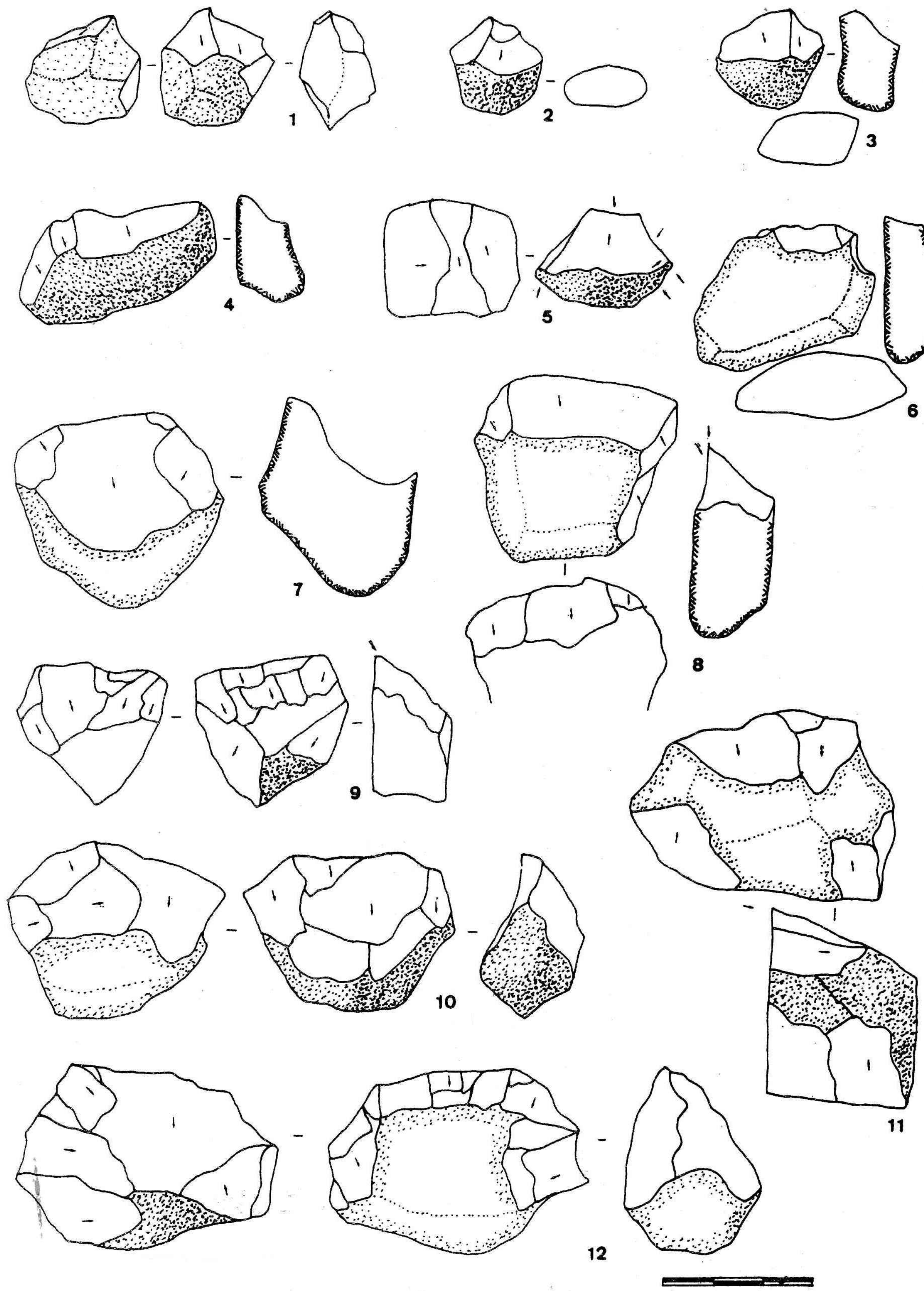

FIGURE 1. Pebble tools from the Kůlna level 11: a basic shaping out on small pebbles: Nos. 1, 4 and 12: orthoquartzite, Nos. 2, 3, 5 to 11: quartz.

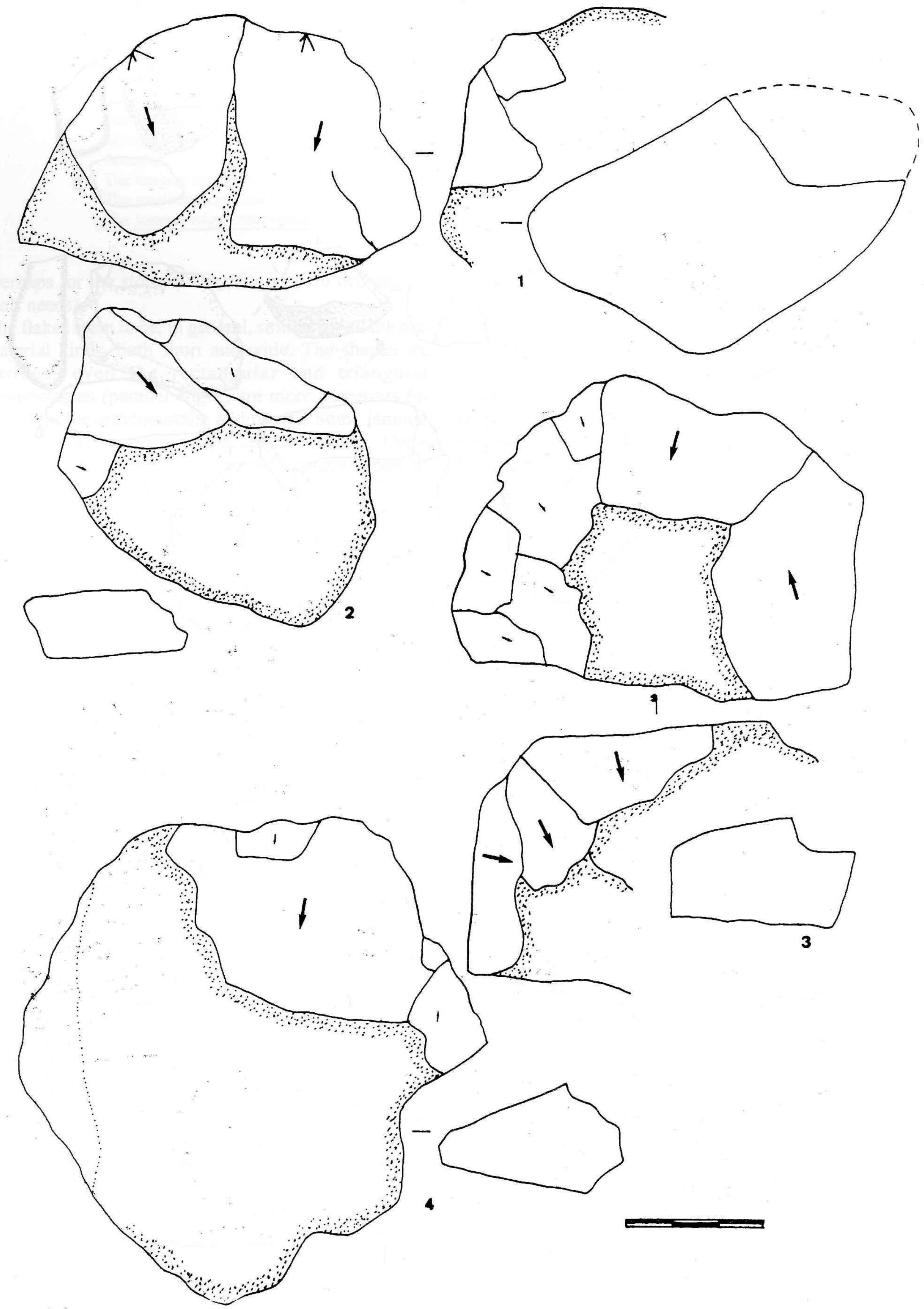

FIGURE 2. Pebble tools from the Kůlna level 11: some larger pebbles for the shaping system: Nos. 1 and 4: orthoquartzite, Nos. 2 and 3: quartz.

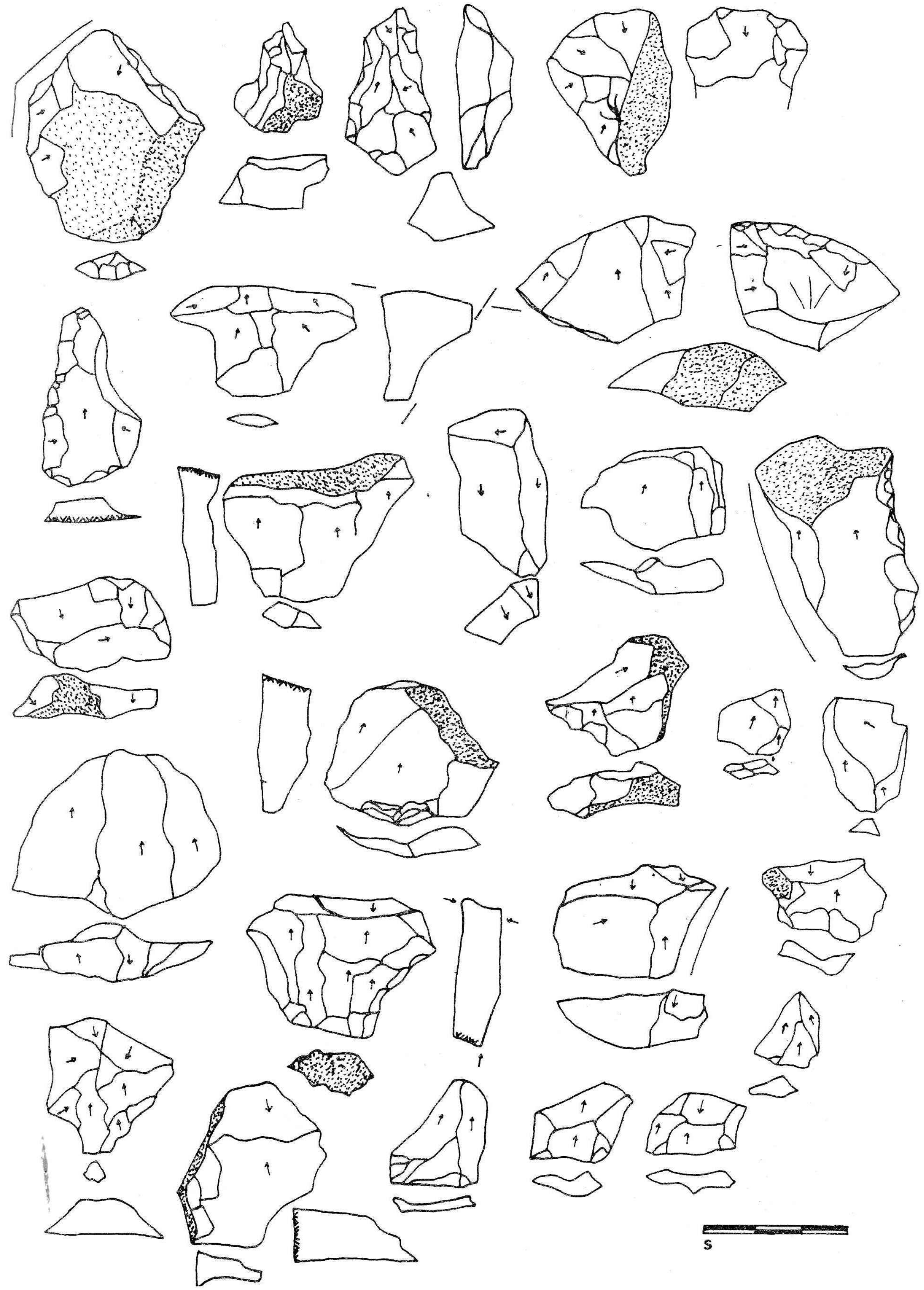

FIGURE 3. Silicites and radiolarite flakes from the Kůlna level 11: Flakes with a back, some cortical remains, wide and thick but also small or elongated.

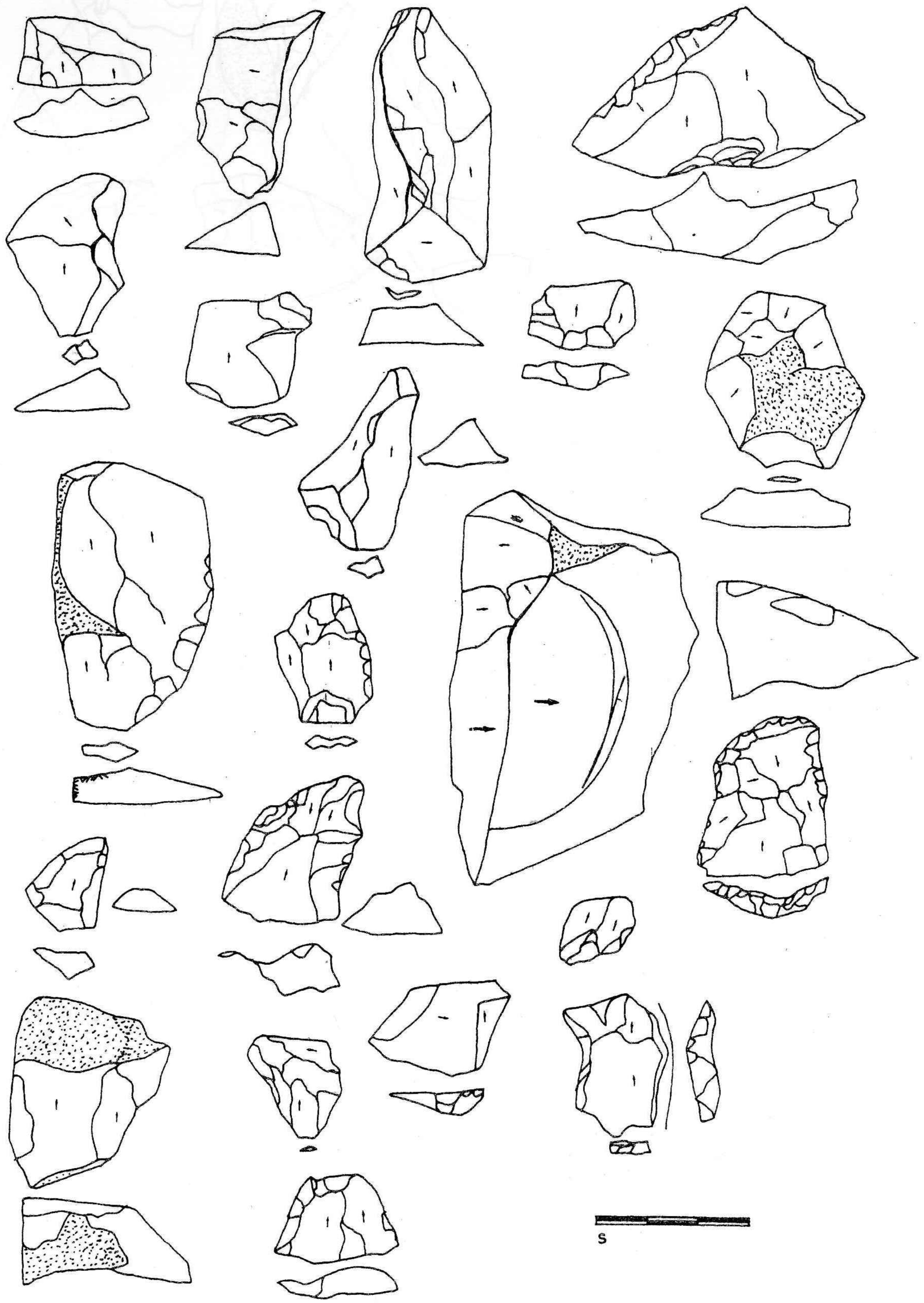

FIGURE 4. Silicite and radiolarite flakes from the Kůlna level 11: Some large flakes showing a centripetal debitage. Flakes with a back, wide and thick or thinner.

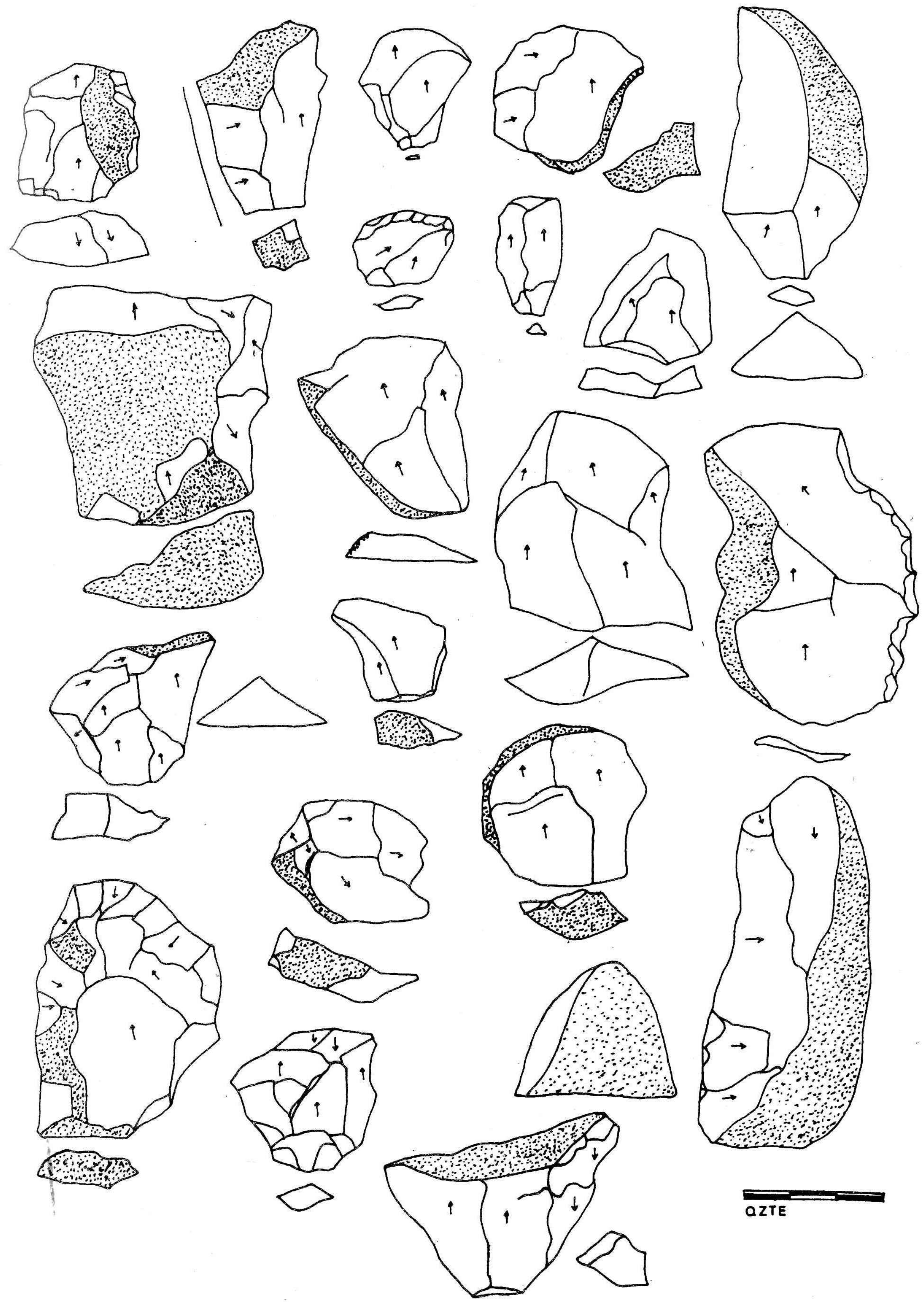

FIGURE 5. Orthoquartzite flakes from the Kůlna level 11: Cortical, wide and thick flakes with a back.

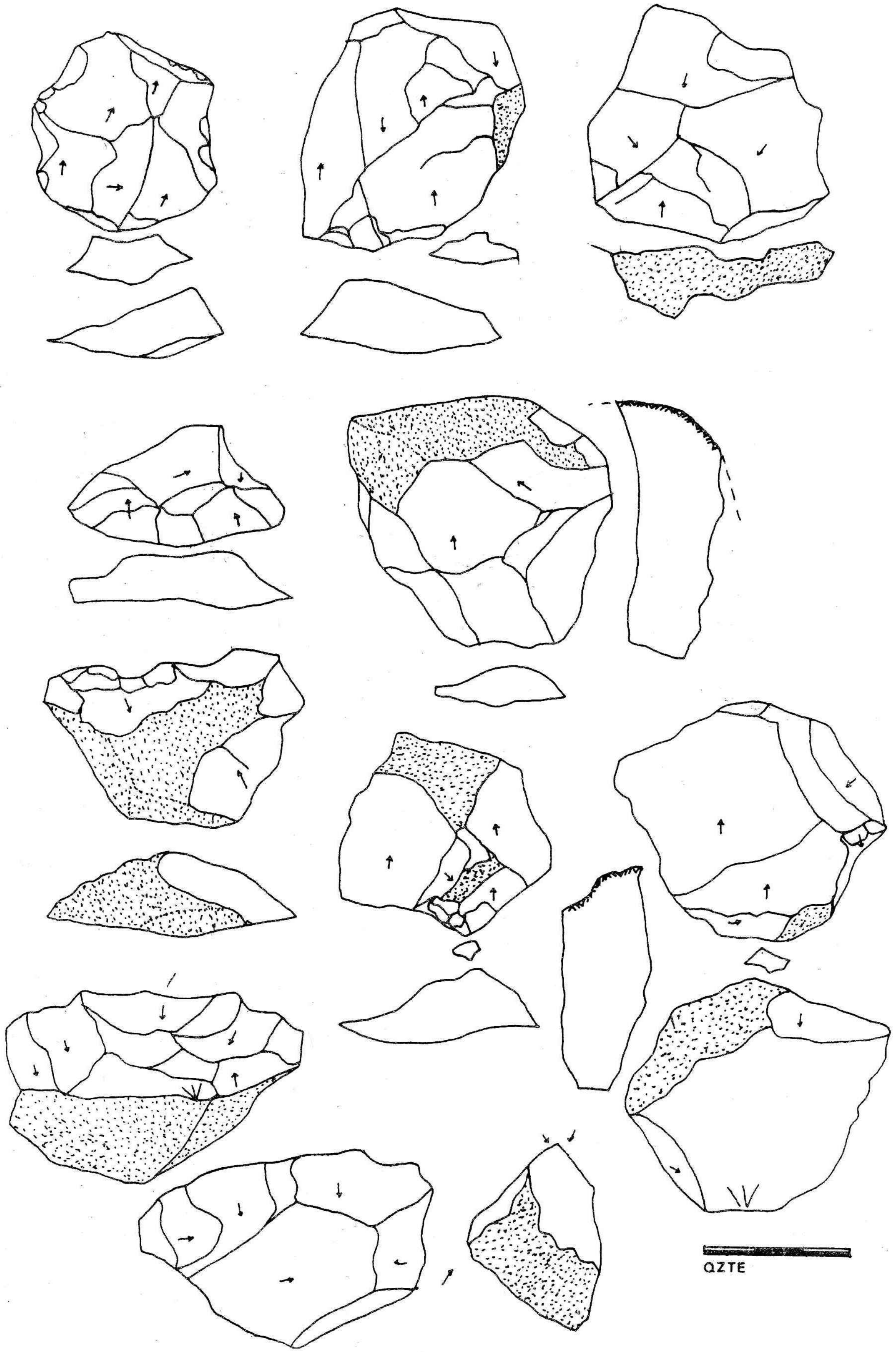

FIGURE 6. Orthoquartzite flakes from the Kůlna level 11.

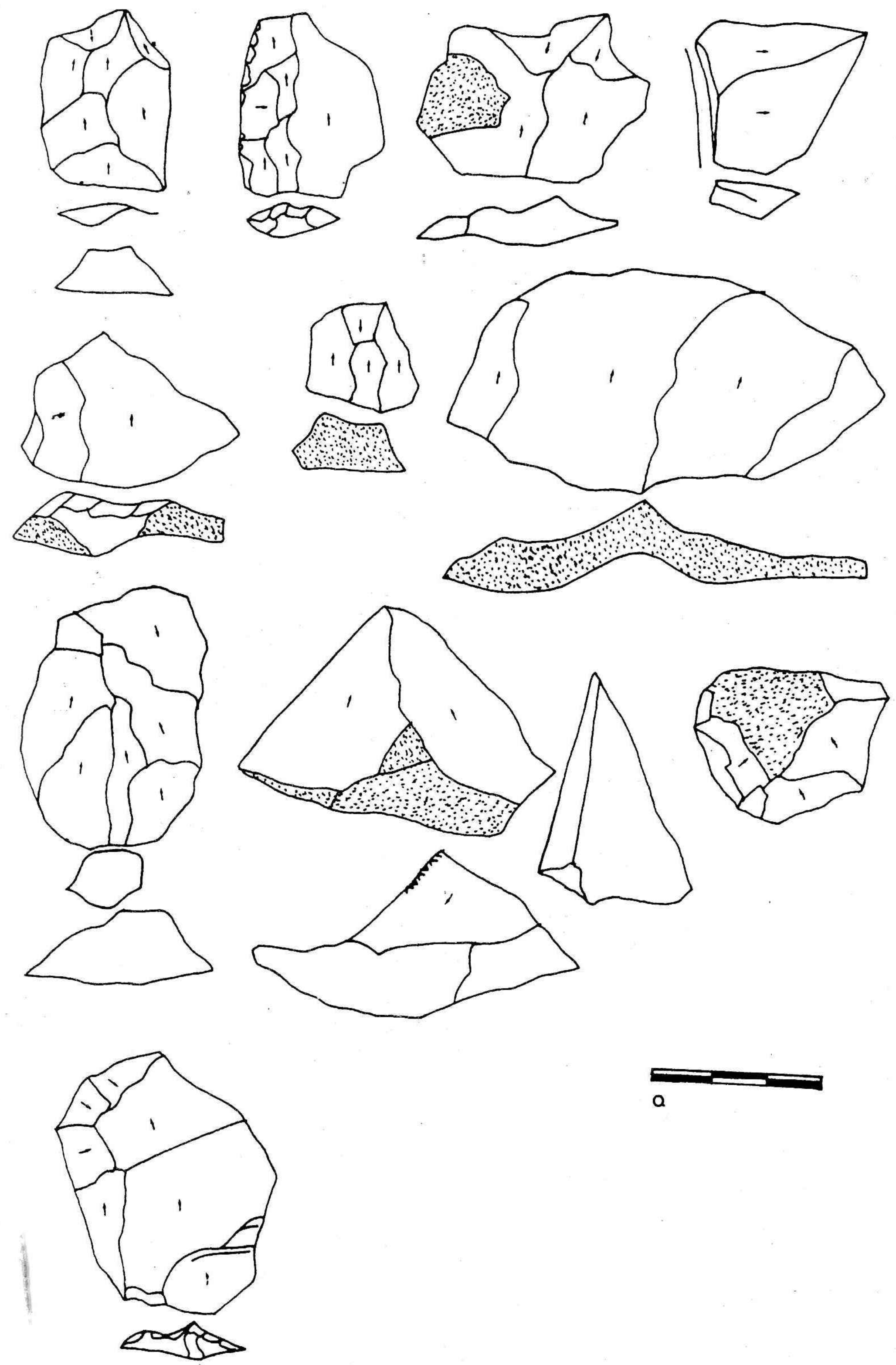

FIGURE 7. Quartz and limestone flakes from the Kůlna level 11.

TABLE 6. The platform kinds of thé debitage product sample.

Platform	Silicites	Quartz	Orthoquartzite	Other
Flat	95–56.2%	12–40%	32–35.9%	2
Dihedral	19–11.2%	1–3.3%	10–11.2%	1
Cortical	14–8.3%	6–20%	34–38.2%	3
Facetted	23–13.6%	1–3.3%	6–6.7%	–
Punctiform	12–7.1%	2–6.6%	1–1.1%	–
Wide and thick	*84–49.7%*	*17–56.6%*	*71–79.7%*	*3*

TABLE 7. The core kinds in the Kůlna level 11.

Core kinds	Silicites	Quartz	Orthoquartzite
2 opposite debitage faces	23–**43.4%**	8–14.5%	9–21.4%
2 opposite faces with a cortical one	8–15.1%	25–**45.4%**	13–**30.9%**
2 opposite faces with several debitage axis	11–20.7%	5–9.1%	6–14.3%
Orthogonal debitage faces	11–20.8%	17–31%	14–**33.4%**
Total	53	55	42

to be linked to the size and perhaps the shape or the thickness of the core. These artefacts could be perceived like necessary complements for domestic needs. The cores could be considered like large blanks and recuperated for a quick shaping out. Some cores can be considered worn, but not all. The retouched cores are not only discarded cores. Consequently, raw materials were not lacking.

The operational scheme for the debitage in a microlithic industry

The debitage rules based on the flakes

The flakes have provided information on the debitage rules, from the beginning to the end of the core history.

- The removals are crossed, centripetal or unipolar. The upper flake surface is made up of steep slope plans. The debitage took place, without doubt, in the pebble volume. The removal organisation shows that several debitage axes were used, and that the core turned in the hands for almost each removal. The width and thickness of the platforms in more than half of the artefacts are essential to an effective core management.
- On some flakes, we can see two backs either on the lateral parts or at the end and the bottom. The cores have to have been small and cut on entire a face. It must have been deliberate (perhaps for people's needs or a new preparation of the core) and these blanks prove a specific kind of debitage. Thick flakes and flakes with a quadrangular section actually belong to the needs and reflect the debitage aims (*Table 6*).
- People used, therefore, the core edges, indicated by the back or the flake sections. The flake section shows that they also used the arris to enable the removals on a pyramidal or trapezoidal surface. The removals do not always go to the centre of the debitage surface and crossed removals are, for this reason, frequent. Although the core edges are used first, the flakes often have a hinged end.
- Cortical locations remain on 35 to more than 50% of the flakes. Orthoquartzite and quartz flakes are more cortical. The cortical removal seems to be slow because there are few entire cortical flakes. The core is not prepared. Both the pebble shape and the natural faces were used. When the cortex remains, it appears on the flake centre, on a back (linked sometimes to the platform: "pebble slices"), on the platform or on the flake end. This aspect of the cortex shows that quadrangular pebble faces with natural striking platforms were used.
- The flat platform is the most frequently found for each stone, but cortical platforms are numerous on quartz and orthoquartzite flakes (natural shape adapted). Thus, the work on the striking platform seems to be more sophisticated for silicites than for the other raw materials (question of stone?). The natural shape of the silicite pebbles is not regular and needs a shaping out of the striking platform. Another proof is the number of facetted platforms, especially for silicites, even if they are not very numerous among all the artefacts (*Table 6*).

The platform angles are less open in the majority of cases. The impact point is, in general, in the centre of the platform, except when there is a back. Then, the impact point is on the core ridge. The location of the impact point depends on the arris chosen.

The location of the impact point explains the platform thickness, and in turn it seems to explain the flake shape and, of course, the thickness flake.

When the platform is large and thick, the flakes are often short and thick. When the platform is small, the flakes are longer and the impact point always uses a main arris.

The dihedral platforms indicate that the orthogonal striking platform sometimes has removals which have another orientation.

Finally, bulbs are not very prominent (soft hammers or kinds of humans' gestures?). However, in Kůlna district, psammite is abundant. This stone is tender and the use of this kind of stone does not carry to a correct determination of the technique.

TABLE 8. Removals on the flaked surfaces of the quartz cores with a cortical face.

Cortex+numerous removals+edges used	2
Invasive cortex+less removals+centripetal	2
Residual lateral cortex+unipolar removals+edges used	3
Some removals+centripetal+edges used	2
Crossed removals+numerous removals+edges used	4
Some bipolar removals	3
Some crossed removals	4
Some centripetal removals	3

TABLE 9. The cortical face shape compared to the flaked surface shape for the quartz cores.

	More flat	More triangular	More trapezoid	More convex	Triangular on the 2 faces
Some centripetal removals	2	3	5	1	6
Some crossed removals	1	1	1	–	1
Some bipolar removals	–	–	2	–	–
Some unipolar removals	–	1	1	–	–
Without removals	–	–	1	–	–

The cores: elements of technical behaviours in a microlithic assemblage

This study involved each stone family. Some differences are visible, but they reflect more details than a real specific technical behaviour. The stone quality is perhaps an explanation for these differences. Men could have adapted their technology according to the different stone qualities. The basic behaviour remained, however, the same (*Figures 8–13*). Human needs are another reason, too. In fact, just the frequencies of the core kinds really differ depending on raw material.

Cores with two opposite faces

Three kinds have been recognized in this group: one flaked surface opposed to a cortical face (striking platform), two opposite flaked surfaces and two opposite flaked surfaces with several debitage plans on each surface (*Table 7*).

Cores with at least one cortical face

This category is frequent among quartz cores, but less among orthoquartzite cores and still less among silicite cores. A high intensity of the debitage regarding the stone quality can be discussed. Other reasons linked to the pebble shape or to the kind of stone can also exist.

The blank seems to be, in almost all cases, a pebble. Some flakes are used sometimes for silicite cores. The cortical face is a part of a quadrangular pebble or a pebble with different flat parts. Pebbles with a convex section are rare. The cortical flat faces are used like a striking platform without cortex removals or with only some very small removals. The cortical face has preserved the pebble section. The few small removals, often not joined and located on a part of an edge, do not really change the pebble shape. There are sometimes several sets, showing tidy work for the striking platform.

The core size is very diversified (25–80 mm for silicites, 35–90 for orthoquartzite and 30–80 for quartz). There are not, therefore, only small pebbles in the raw material collection for debitage. Moreover, cortex remains on the two faces, giving the pebble thickness. It varies from 20 to 60 mm (10 to 30 for silicites). The core thickness varies, on the other hand, from 20 to 50 mm.

The debitage has taken place on the face opposite to the cortical face, except when the cortex still covers a large part of the two surfaces (*Table 8*).

The location and the number of the removals have a great diversity, more or less convergent to the core centre, explaining sometimes the asymmetric section of the debitage surface. The removals are crossed or centripetal, unipolar or bipolar. The debitage uses the arris and the core edges to guide removals which are often deep. Most of the cores do not have, therefore, a general symmetric section. The core face is more pyramidal than the other one (*Table 9*).

In three cases for quartz, the removals on the cortical face were made at the end of the core exploitation. Was this due to the debitage of very small flakes or a core management attempted to prepare again the debitage angles, but without a follow-up?

However, the location of these small removals does not correspond with those of the flaked surface. They are sometimes just a charge of an irregular section of the cortical face, creating asymmetrical edges.

The last removals on the flaked surface use the core edge (flakes with a back). The angle diversity can explain the diversity shape of the different parts of the core, the few hinged removals at the end of the core exploitation (inadequate convexity of the core section) and the reasons for the abandonment of some non exhausted cores.

People did not look for a new shaping out either or on the striking platform. When cortex remains on the two faces, we see that the debitage uses the cortical faces like for the polyedric cores. There is an impression of basic management of the raw materials, but, in fact, people obtained what they wanted: short or large flakes with specific sections, by varying the location of the impact point on the striking platform.

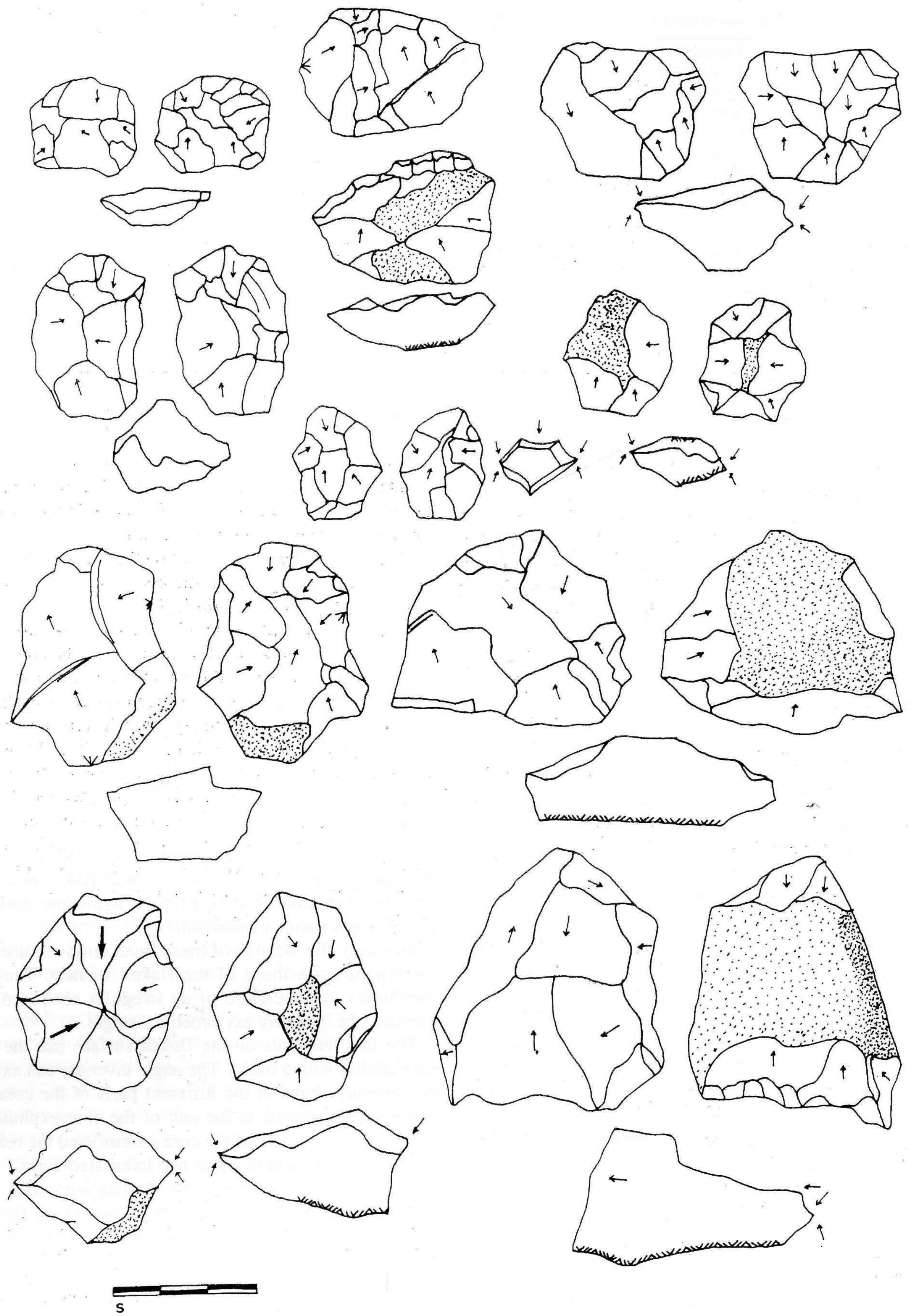

FIGURE 8. Silicite and radiolarite cores from the Kůlna level 11. Cores with two opposite faces with two flaking surfaces or one cortical surface (platform). Use of the shape pebble and the cortical faces.

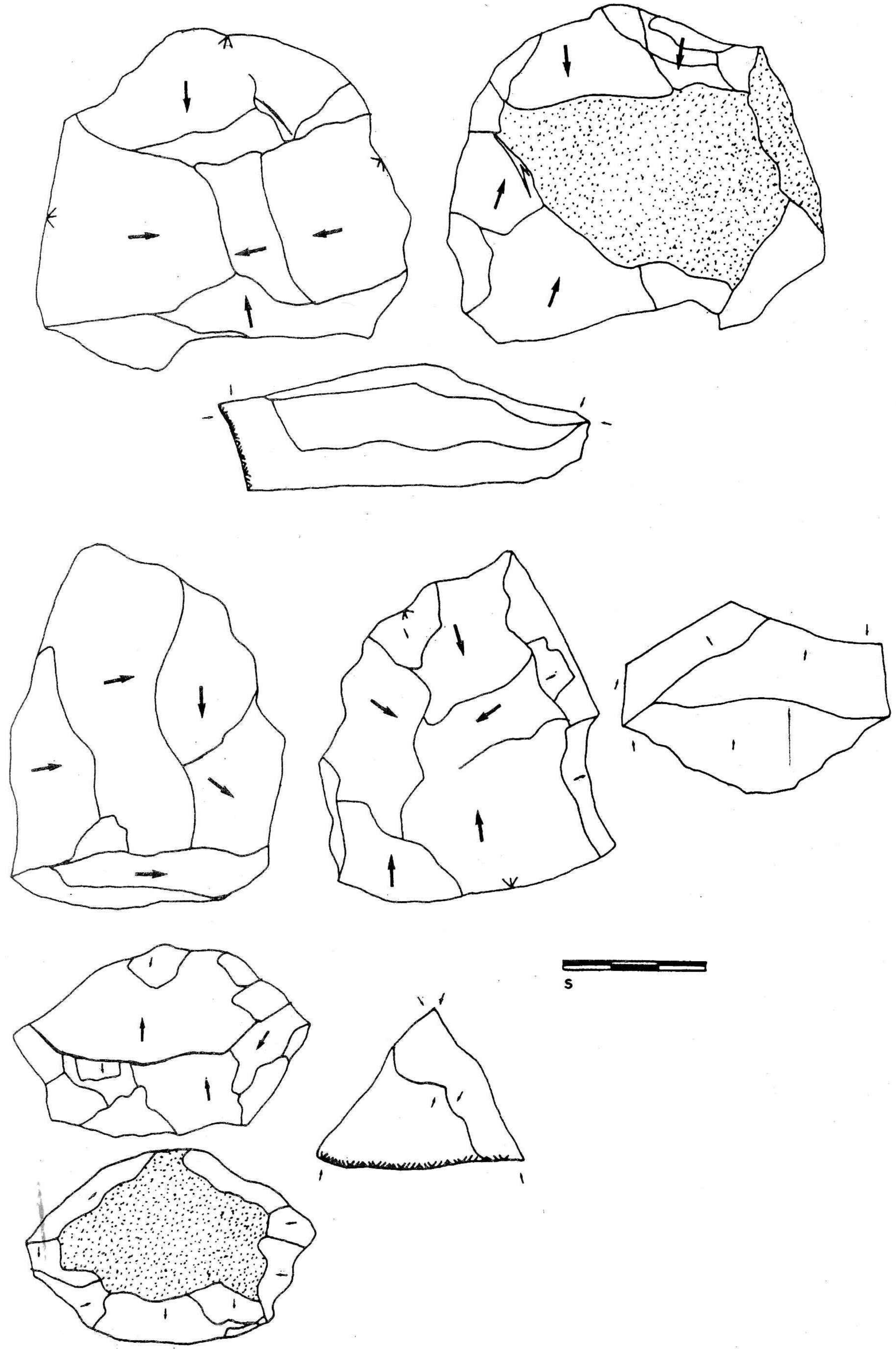

FIGURE 9. Silicite and radiolarite cores from the Kůlna level 11. Several flaking surfaces and debitage axes. Use of the core edges. Debitage in the pebble volume to maintain the good angles.

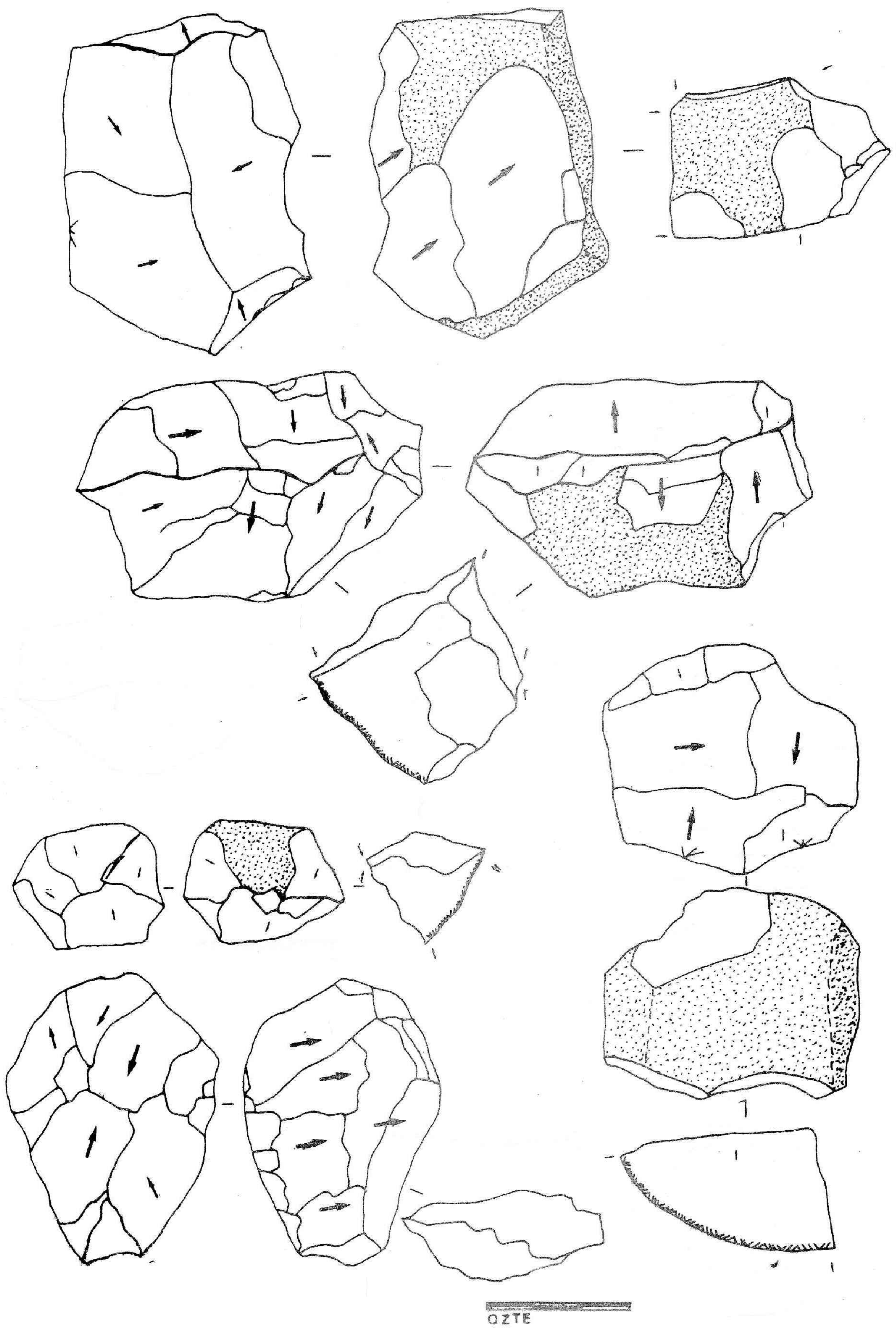

FIGURE 10. Orthoquartzite cores from the Kůlna level 11. Several debitage axes. Debitage in the pebble volume.

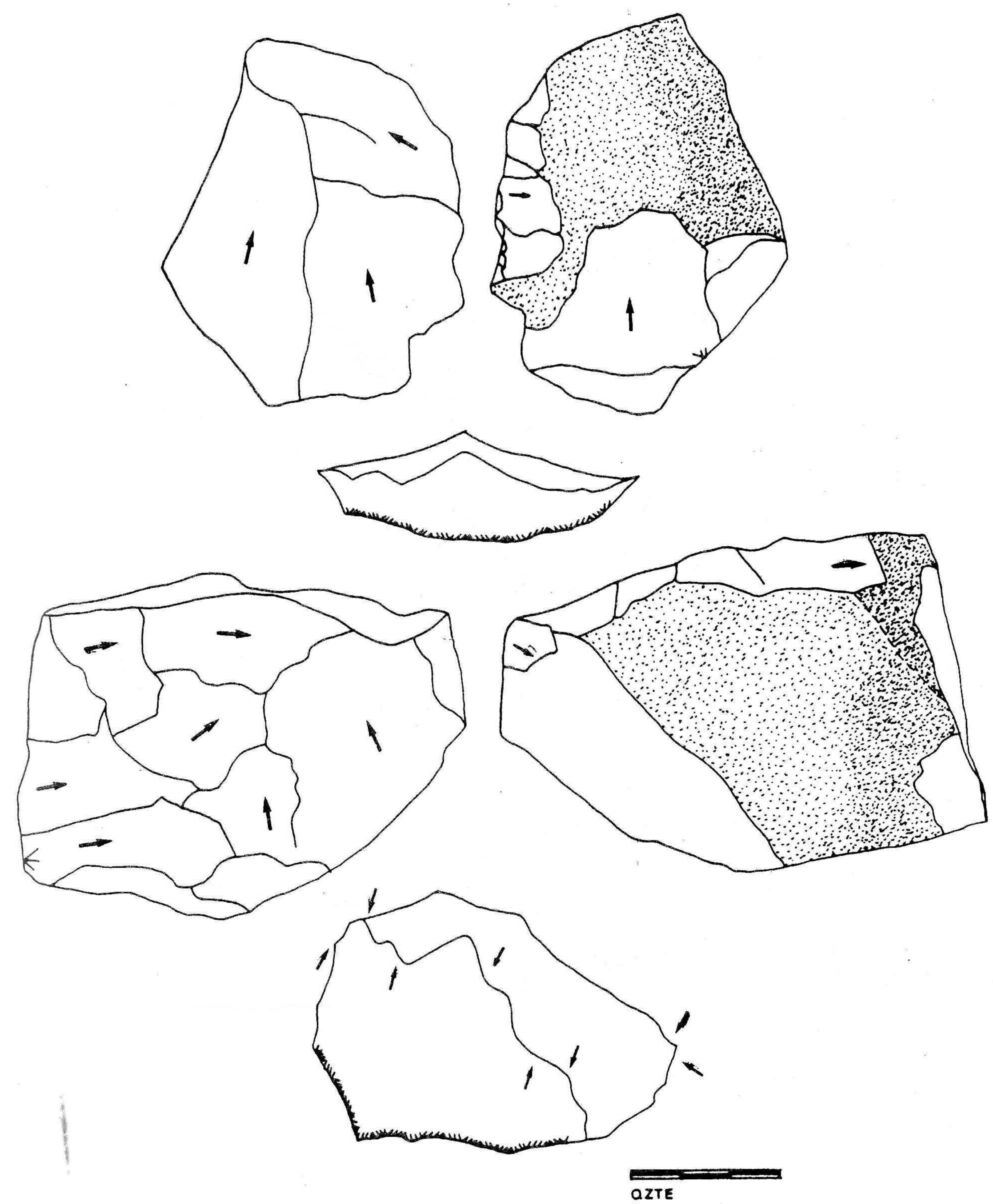

FIGURE 11. Orthoquartzite cores from the Kůlna level 11. Two flaking surfaces. Several debitage axes. An opportunistic debitage.

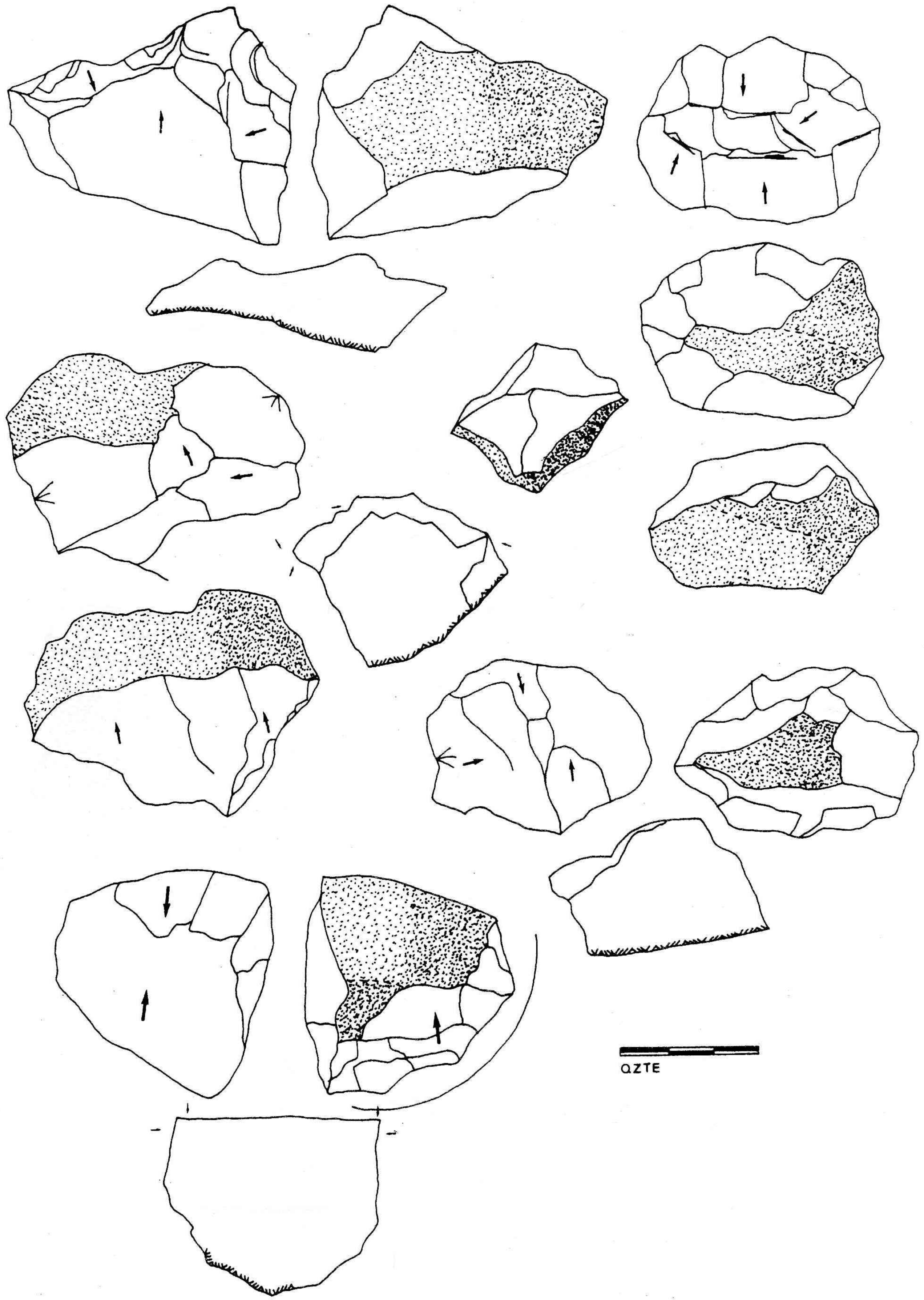

FIGURE 12. Orthoquartzite cores from the Kůlna level 11. Several flaking surfaces or two opposite faces. An opportunistic debitage according to the pebble shape.

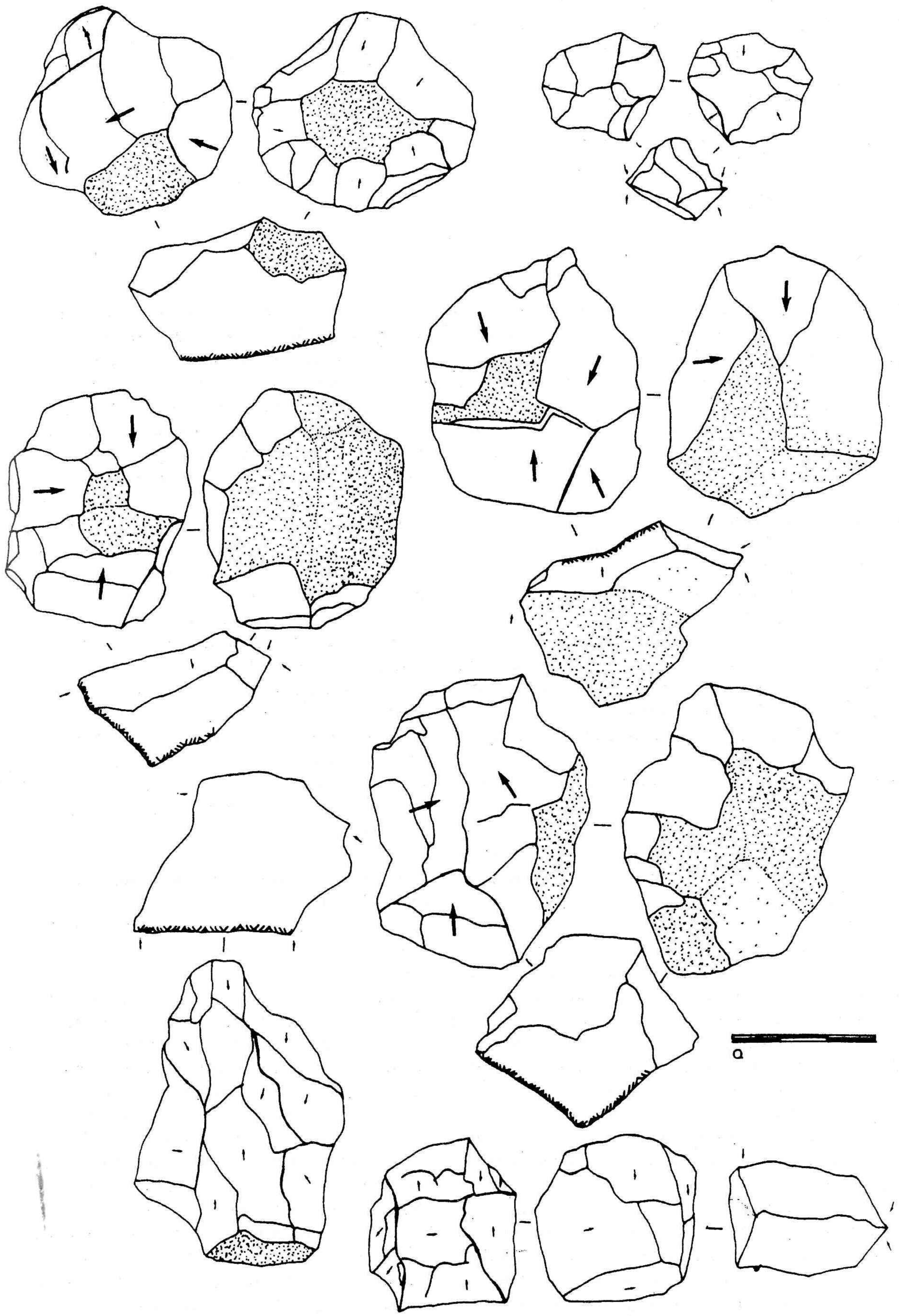

FIGURE 13. Quartz cores from the Kůlna level 11. Several debitage faces. Debitage in the pebble volume. Use of the core edges and the cortical pebble faces.

TABLE 10. Quartz cores: the two flaked surfaces and the removals.

The most pyramidal surface	The less pyramidal surface
Centripetal numerous removals	Centripetal numerous removals
Centripetal numerous removals	Centripetal numerous removals, non convergent
Centripetal numerous removals	Bipolar less numerous removals, edges used
Centripetal numerous removals, convergent	Centripetal less numerous, non convergent
Centripetal numerous removals, edges used	Crossed removals, edges used
Centripetal numerous removals + cortex	Crossed removals + cortex
Crossed numerous removals	Centripetal numerous removals

People could have abandoned the cores in all these kinds of states for size reasons and/or because of the impossibility of producing new specific flakes which were the debitage aims. This can be explained because of the presence of numerous pebbles around the cave. According to the flakes produced, the debitage intensity varies. The different kinds of cores present really reflect people's choices and, of course, their needs.

Cores with two opposite debitage faces

The size varies from 30 to 60 mm for quartz (15 to 35 for the thickness), from 25 to 70 mm for silicites (15 to 30 mm for the thickness) and from 35 to 80 mm for orthoquartzite (20 to 50 for the thickness).

The management of two debitage surfaces does not seem to lead in general to a smaller core size than the preceding ones. Were the blanks of the cortical cores larger before debitage? Was the decision to keep cortex linked to the pebble shape? Moreover, the core characteristics are similar to the cores with a cortical face.

Some residual cortical remains can stay on one or two faces or on a core edge. They are used like a practical striking platform which does not need a shaping out. But, in the majority of cases, these cores are without cortex.

The core sections are not symmetrical. One of the faces is often more pyramidal than the other one. The removals are, therefore, centripetal and do not converge to the core centre. Each section of the face is not symmetrical either. The removal number on each face is various, less numerous on the most flat surface, and especially when the management uses the core edges ("orange slices"). In the latter case, the removals are invasive, explaining the small number of removals on the core surface and the flat shape. When the removals are more centripetal, even not convergent, the flaked surface becomes more and more pyramidal. The removals are often small and deep in this case and, finally, it is difficult to keep the debitage angle adapted (*Table 10*).

The removal size is, therefore, very different (size, shape, section) on each core surface, reflecting, without doubt, the needs and choices in the processing systems, and is not only due to technical constraints. The angles vary all along the core periphery and are more or less open. At the end of the core history, the angles are often equal or superior to 90°. The pursuit of the debitage is, therefore, impossible and stops.

Cores with two surfaces and use of removals like striking platform on each surface

The size range is the same as for the other kinds of cores. This third kind of cores is, moreover, similar to the second one, especially for the first phase of the management. Next, these cores show an original management. The surface of some removals, with a steep slope on the flaked surface, is used as a striking platform. The shape section of the debitage surface is, in this case, strongly pyramidal or trapezoidal. This behaviour seems to indicate the people's choice to require the core exploitation. It is a proof that the debitage was not only conducted, according to two opposite surfaces, but was also opportunistic, according to the core shape and the needs.

A second behaviour is the setting up of a third debitage surface at the end of the core, perpendicular to the two other ones. The peripheric ridge is cut. Sometimes, a second orthogonal debitage face is set on the opposite edge of the core. Was there a last attempt to produce some flakes with specific shapes (thickness, backs, core slices)? However, this behaviour does not just affect exhausted debitage faces and does not always seem to be a last chance to obtain some more blanks.

Cores with several orthogonal debitage faces and polyedric cores

30% of the orthoquartzite and quartz cores show several flaked surfaces, while only 20% silicite cores are in this category.

The location of the different debitage surfaces varies. The angle range, between each face, proves, perhaps, an opportunistic debitage. Each removal is used like a striking platform and, during the exploitation, the core turns in the hands to maintain a good ridge angle. The core size varies from 40 to 60 mm for quartz, 40 to 70 (except one core of 15 mm) for silicites, 35 to 90 mm for orthoquartzite. The thickness is between 15 and 55 mm too. Cortex remains on a majority of them, especially on quartz and quartzite (80%), while cortex only remains on 55% flint cores. Cortex extends at least on one face, showing flat parts of a pebble, kept like a striking platform. Therefore, the cores are like balls and some of them are exhausted. The core section is often cubic or irregular, according to the pebble shape which is used without shaping out. Each flat part of the pebble is, in fact, a flaked surface. The pebbles would

TABLE 11. The size average of the level 11 cores.

Size	Silicites	Quartz	Orthoquartzite
Length average	25–60 mm	30–60 mm	35–90 mm
Length range	25–90 mm	30–100 mm	35–60 mm
Thickness average	10–40 mm	15–35 mm	20–50 mm
Thickness range	10–70 mm	15–55 mm	20–50 mm

have indeed approached a size close to the core size and would have had a quadrangular section. In effect, the removal number is, in general, low.

The number of flaked faces ranges from 2 to more than 5 (3, 4 or 5 flaked faces and more are the most frequent). Some cores show a debitage beginning with two opposite faces, then a third and sometimes even a fourth or a fifth face are created, with a 90° angle in relation to the other ones. The exploitation is alternate or alternating. The removals are centripetal, crossed or uni-bipolar on each face. The edges are frequently used, producing flakes with a back. This kind of removal allows a maintenance of good debitage angles. The removal size varies, with large or small ones on the same flaked surface. The smallest ones are not only resharpening flakes for recreating angles but seem to be voluntary debitage products like the largest ones. They are different from hinged flakes which result from the end of the debitage and are accidental. Their size is, in this case, explained by a bad striking platform angle. Moreover, the removal size, in general, depends on the removal locations on the core and it is possible to believe that it is voluntary (use of an edge or an arris, location of the impact point).

One core is a particular case. It shows a debitage with two opposite faces at first, then a debitage, on a 90° face, covering three-quarters of the core periphery.

"Taubachian" technical behaviours

The pebble selection and the pebble size question: a preference for small pebbles

Evidence of the criteria of pebble collection can be detected in each group of artefacts and give some information on the human choices (*Table 11*).

The first one is, of course, the pebble tools and the entire pebbles. They show a selection of a large number of small pebbles, from 15 to 60 mm long for the most numerous, but also a collection of some larger pebbles (till 80–100 mm). These pebbles were, therefore, more easily available, in the same raw materials than the smallest ones (*Figures 14–16*).

The cortical flakes, especially those with cortical backs, platforms or a cortical steep slope at the end also indicate elements of pebble size. The dimensions change from 40 to 80–90 mm long, with most of them measuring closer to the smaller end. The production is, above all, microlithic but also large flakes were produced which were not accidental but came from big pebbles and cores. These large flakes came, without doubt, from the core debitage and at the beginning of a pebble exploitation.

In spite of the debitage which can greatly reduce the pebble, the cores, especially those with cortical remains on one or two faces, also show a variety of pebbles. While the smaller blanks are the most numerous, big pebbles were accessible too, making it possible for them to be collected, however, where they were.

This microlithic world would really seem to be a voluntary world.

The pebble debitage

The core analysis enables us to see several kinds of management. But in fact, they all belong to the same family, especially the "discoid" family, except for some cores (uni-bipolar method, prismatic and polyedric cores). Most of the cores are left with a flaking surface with centripetal removals. Quadrangular pebbles of various sizes are chosen. A preference goes to the smallest ones (between 30–40 to 60 mm). The pebble shape is used from the start of the exploitation and the first cortical removals are researched. The pebble volume is exploited.

First choice: a part of a pebble is conserved like a striking platform. Second choice: two opposite surfaces produce flakes, according to different striking platforms. Third choice: the pebble edges are the flaked surfaces (small pebbles giving few flakes). The core turns in the hands to maintain angles for as long as possible.

The removal arrangement is similar on each debitage face: crossed, centripetal or uni-bipolar, involving different kinds of flakes (small and flat, thick with a back and laminar flakes). People did not always use core edges to produce flakes but maintained the flaked surface section well. But, otherwise, the arris guides removals on trapezoid surface. The debitage face shape reflects, therefore, a specific story, according to the debitage choice. The face shape becomes various and the core is abandoned exhausted in different states. Flint tends to produce smaller and thinner flakes (good quality of the stone or human needs?).

The size comparison of the cores shows that, regardless of the raw materials, the values are similar. A large group has the smallest dimensions. The polyedric cores are smaller than the other ones. The two opposite debitage cores are also small. The cores with a cortical surface produce, in addition, the few largest ones.

If we compare the core size and the removal size, we can see that people really wanted a lot of small flakes, but also produced few larger ones. The largest cores which are

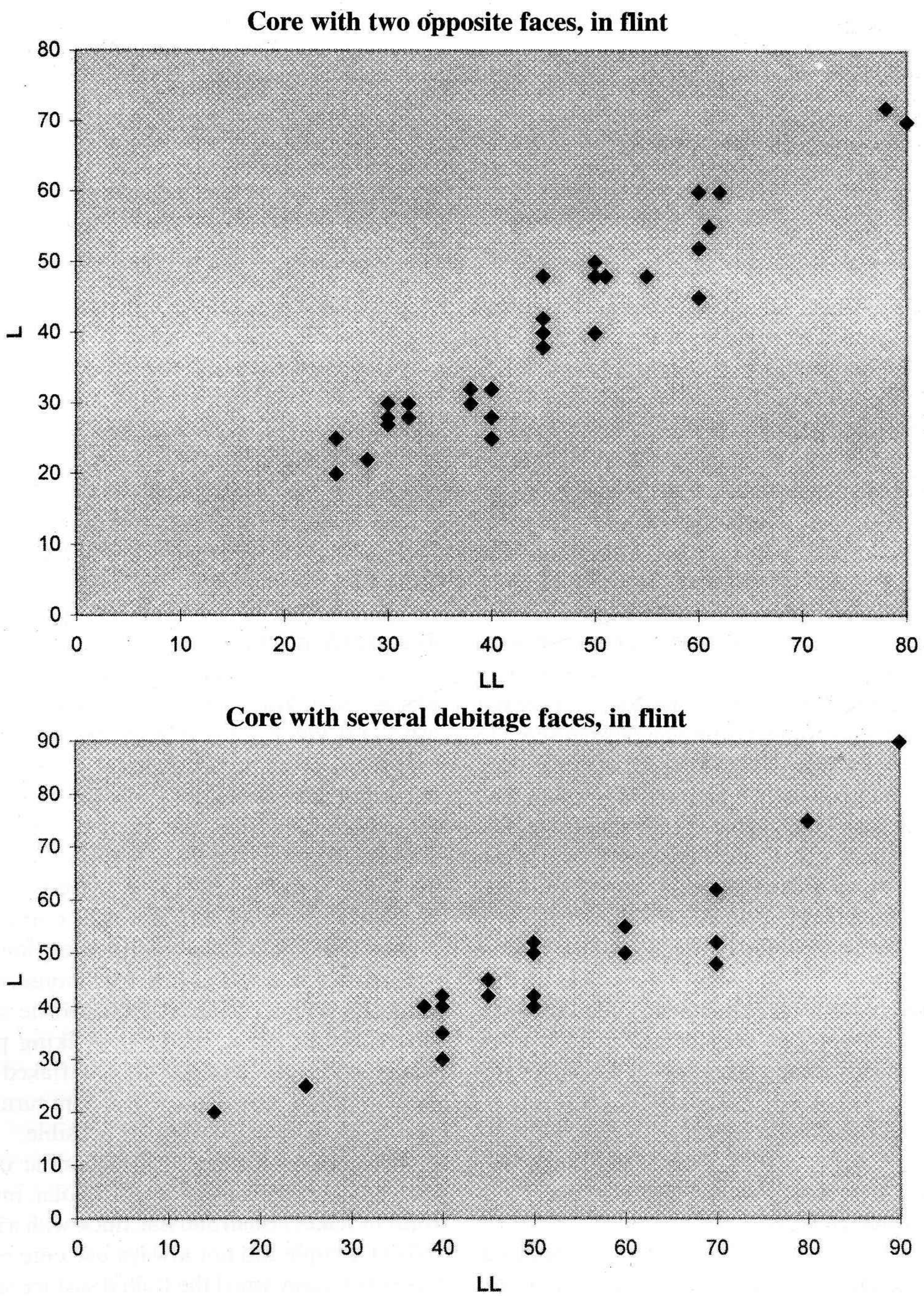

FIGURE 14. Silicite core sizes from the Kůlna level 11. Cores with two opposite faces or several flaking surfaces. A large variability in the sizes. LL – length, L – width.

present result in a lot of small removals. This observation is a proof of a real desire for a small production (*Tables 12–14*).

The microlithic assemblage is, therefore, not only imposed by the small pebble size but also by a definite choice.

The reasons for the existence of cores with a cortical striking platform and cores without cortex and two debitage faces could be explained by the pebble shape. This shape is, in effect, used when adapted, especially in a context of abundant raw materials. There are not any technical differences between the two kinds of cores and the purposes seem to be similar. The flaked surfaces, in the case of cortical cores, are just less often convex than those on cores without cortex. But they both show several surfaces and the shape is trapezoid, triangular or convex. It is, therefore, difficult to say if the flaked surface section offers information on a debitage state or a management choice. It is true that the use of the core edges leads to a flat debitage surface. But pyramidal sections are also associated with crossed removals. A pyramidal section seems to be more quickly exhausted in this kind of debitage (angle equal to or more than 90°). A management of a debitage face opposite to a cortical face seems to be less able to maintain

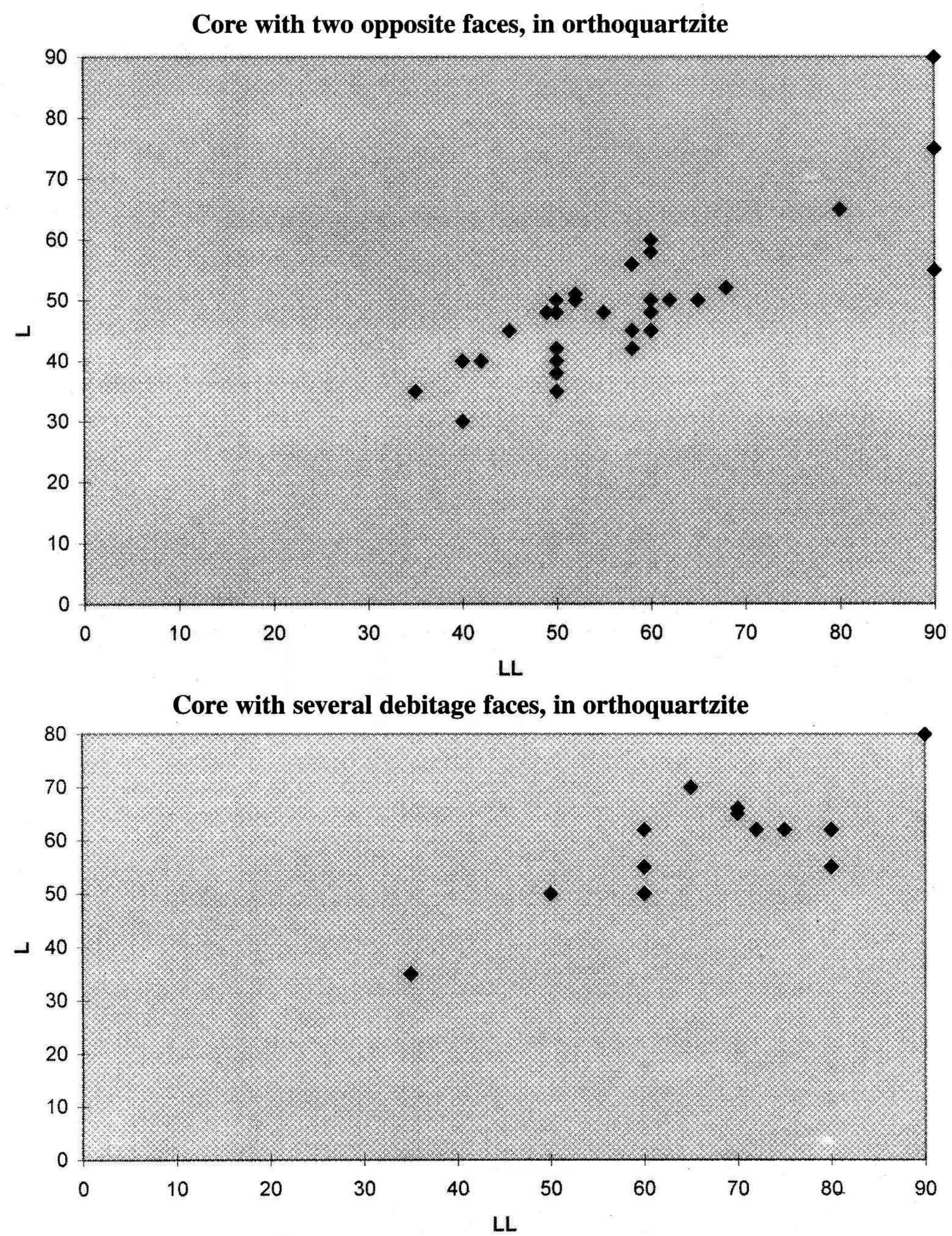

FIGURE 15. Orthoquartzite core sizes from the Kůlna level 11. Cores with two opposite faces: a more homogeneous population (choice of pebbles?), and cores with several flaking surfaces. LL – length, L – width.

well adapted angles all along the core debitage. The exploitation of two surfaces, on the contrary, results in wider and wider angles or it keeps good angles, and therefore to an abandoned core after a longer history. The debitage plays on two opposite faces, making it easier to maintain angles. The bifacial asymmetrical section of the cores often depends on the debitage kinds of the flaked surface.

The two core kinds could also be a voluntary variation in the debitage in order to produce the most numerous and the most different kinds of flakes and for the longest time possible (*Figures 17* and *18*).

LEVEL 11 AND THE UPPER AND LOWER LEVELS (9, 9B, 10, 13A, 13B AND 14)

The six assemblages, located below level 11 and above, are not rich (*Table 15*). However, they show the same variety of choice of raw materials. The flint and the stones of the same quality are numerous but not like in the Micoquian layers.

The processing systems and the debitage products are quite similar: small size flakes (10 to 50 mm long), some large flakes, thick and wide flakes, simple and steep retouches on side-scrapers and points, used broken flakes,

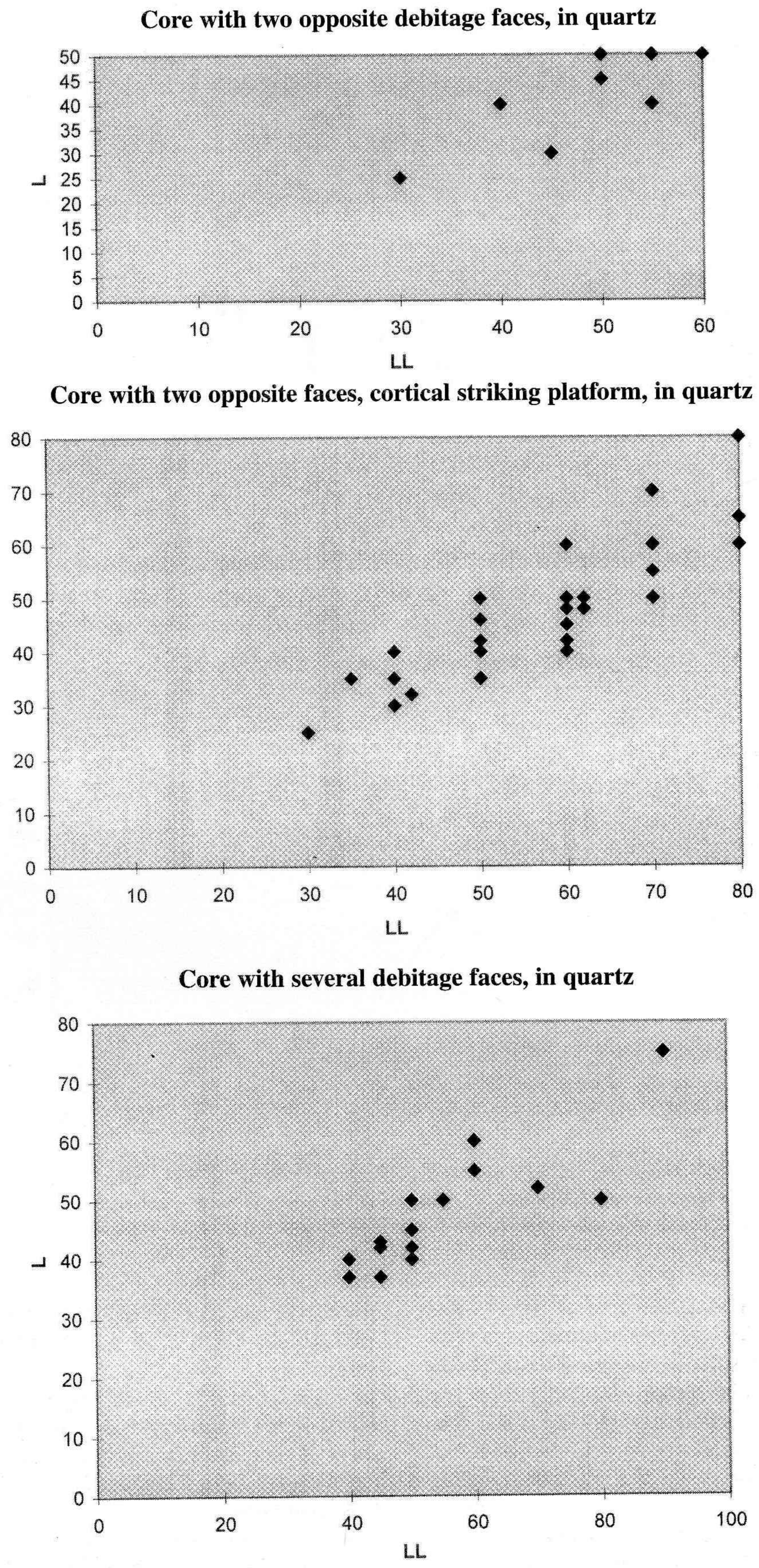

FIGURE 16. Quartz core sizes from the Kůlna level 11. Cores with two opposite faces, with a cortical face and with several flaking surfaces. LL – length, L – width.

TABLE 12. Removal size and core size compared on flint cores with two opposite faces.

Removals / Cores	5–10 mm	10–15 mm	15–20 mm	20–25 mm	25–30 mm	>40 mm
10–20 mm	**47%**	**53%**	–	–	–	–
20–30 mm	35%	**62%**	3%	–	–	–
30–40 mm	**27.8%**	**53%**	15.6%	0.8%	2.6%	–
40–50 mm	9.9%	**39.6%**	**25.7%**	15.8%	8.9%	–
50–60 mm	6.6%	**40.6%**	**19.7%**	15.4%	13.2%	4.4%
>60 mm	–	16%	**18.5%**	**23.4%**	17.3%	**24.7%**

TABLE 13. Removal size and core size compared on quartzite cores with two opposite faces.

Removals / Cores	5–10 mm	10–15 mm	15–20 mm	20–25 mm	25–30 mm	30–35 mm	>40 mm
20–30 mm	**33.3%**	**50**	16.7%	–	–	–	–
30–40 mm	**30.7%**	**34.6%**	**15.4%**	–	3.8%	**15.4%**	
40–50 mm	–	**63.3%**	**24.4%**	–	4.4%	–	7.7%
50–60 mm	–	–	**45.7%**	11.4%	**25.7%**	8.6%	8.6%
>60 mm	–	7.1%	**30.9%**	9.5%	9.5%	9.5%	**33.3%**

TABLE 14. Removal size and core size compared on quartz cores with two opposite faces.

Removals / Cores	5–10 mm	10–15 mm	15–20 mm	20–25 mm	25–30 mm	30–35 mm	35–40 mm	>40 mm
20–30 mm	**60.6%**	24.2%	9.1%	6%	–	–	–	–
30–40 mm	8.6%	**71.4%**	8.6%	2.8%	8.6%	–	–	–
40–50 mm	14.5%	**69.3%**	11.3%	3.2%	–	–	1.6%	–
50–60 mm	1.2%	**20.6%**	**17.7%**	12.6%	1.2%	3.8%	3.8%	–
>60 mm	9.4%	**25.8%**	**23.5%**	8.2%	8.2%	**18.8%**	3.5%	2.3%

TABLE 15. The artefacts of the levels 9, 9b, 10, 13a, 13b and 14. *orthoquartzite, +radiolarite and rock crystal.

Levels	Silicite flakes	Silicite blades	Silicite cores	Quartz flakes	Quartz cores	Quartz pebbles	Qzte* flakes	Qzte* pebbles	Others+	*Tools*
9	32	–	5	14	1	1	20	2	1	*28*
9b	8	1	2	–	–	–	–	–	–	*7*
10	3	–	–	–	–	1	–	–	–	*3*
13a	3	–	–	3	1	–	1	–	–	*1*
13b	–	1	1	2	2	–	4	–	2	*1*
14	14	–	–	22	4	14	16	11	42	*10*

small cores with two opposite flaked surfaces and polyedric cores, and core edges.

The pebble tools are rare. The few choppers are in the two richest levels, 9 and 14. The shaping is basic like for those of level 11. But the tool size is in levels 9 to 14, and in some cases, higher (80 to 120 mm long). Some very large ortoquartzite flakes are also present.

In level 9, some bifacial tools could not be explained because of the mixing sediment in some location of the cave between the bottom of level 9 and the top of level 11. They could be rather an evidence of Micoquian traditions or customs which already could have existed at the end of the last Interglacial. But, the technical behaviour in this level still belongs to the Taubachian tradition. Level 10 is dated, indeed, according to K. Valoch, to this period (Valoch 1988).

The oldest level, number 14, clearly seems to also belong to a microlithic custom with the same needs for the debitage products.

COMPARATIVE PATTERNS BETWEEN THE MICOQUIAN LAYERS AND THE TAUBACHIAN LEVEL

The main difference between the Micoquian levels and the Taubachian level 11 is, of course, based on the artefact size. We have also seen, at the beginning of this paper, the large use of silicites by the Micoquian people. The raw material available in the environment does not seem to explain the different stone choices. Taubachian people seem to have voluntarily chosen different kinds of stones and, moreover, they collected small pebbles. Bigger pebbles are, nevertheless, present in the level 11 assemblage, but the core analysis shows that the debitage always led to the production of small flakes.

It is hard to say whether the choice of different kinds of stones by the Taubachian is due to its abilities to perform some specific tasks, according to the temperate environment or the way of life. There are also no functional

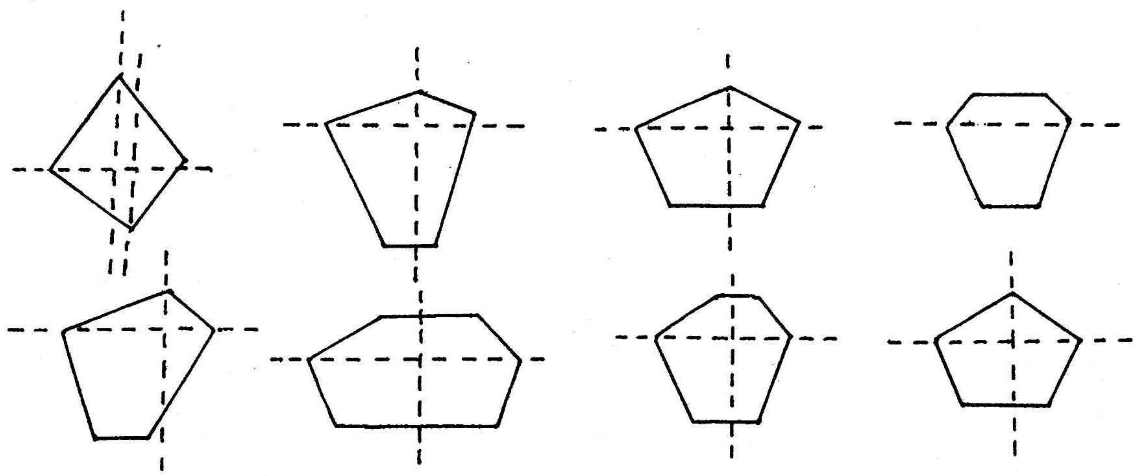

FIGURE 17. Different core shapes on cores with two opposite faces. The cores are not symmetrical and the flaking surface morphologies are pyramidal, trapezoid or flat. This diversity is the consequence of removal locations and of the use of core edges.

answers for the small tool size. Were the small tools used to make wooden tools in a forest country or used for specific work, according to the domestic behaviour?

The shaping operational schema is very secondary in the Taubachian assemblage. Pebble tools are rare.

The flake tool sections are quite similar. However, the kind of retouch distinguishes the tools from the Micoquian levels and the Taubachian one. Micoquian people produced different kinds of flakes which were intended for specific tools: points on "pseudo-Levallois" flakes or triangular flakes and side-scrapers on short flakes (Böeda 1995). In the Taubachian settlements, the blank choice seems to be quite similar. But thick and wide flakes and flakes with one or two backs were more produced. The demand was otherwise low. Broken flakes were indeed used, not only because of the bad quality for the debitage of quartz and orthoquartzite. We can find the same characteristics on silicite flakes.

The debitage operational scheme shows both similar aims and specific behaviours. In the two complexes, the debitage belongs to the "discoid" family. The pebble was exploited, in the great majority of cases, on two opposite flaked faces, and the core has a pyramidal or a trapezoid section. The use of the core edges and non convergent removals are also common to the assemblages. But in the Taubachian level, people seem to have wanted to maintain the flaked surface mostly flat. Was it a question of needs, customs or a technical necessity linked to small pebbles? This core flat section could give the illusion of a debitage in a "Levallois" system and explain this existence of some thin flakes. But, in fact, all the cores of this Taubachian level reflect the variability of a debitage processing system which belongs to the same family.

The debitage rules also seem to be more diversified in the Taubachian level than in the Micoquian ones, with cores having two opposite faces, cores having a third orthogonal debitage surface and polyedric cores. The part of each of these three categories is partially linked to the raw material and, perhaps, to the kinds of flakes that were needed. But all kinds of flakes could result from different core types. Could the specific technical behaviours of Taubachian people be explained by the products or were they just technical traditions? Now we know that all kinds of flakes could be produced by several different methods. Therefore, the Taubachian technical behaviour appears to have been a choice.

CONCLUSION: THE MICROLITHIC ASSEMBLAGES

The question of a link between environmental conditions and technical behaviours is asked today. And if that were the reality, to what degree?

The Kůlna Micoquian assemblages show numerous Rangifer bones while temperate species (forest and steppic forest environment) exist in level 11 (*Alces alces*, *Equus taubachensis*, *Cervus elaphus*, Bos, Rhinoceros) (Zelinková 1998). Moreover, bones were used like compressors, like raw materials in level 11, but also like in other microlithic sites (Bilzingsleben).

The species in the Taubachian sites in Central Europe were always big species, associated to smaller animals like *Cervus elaphus*: *Dicerorhinus mercki* (70% young) and *Bison priscus* in Taubach in a mixed forest context (110,000–116,000 BP by U/Th in Brunnacker *et al.* 1983, Mania 1988); *Dicerorhinus mercki* and *Elephas antiquus* in Gánovce. On the other hand, the mammoth is the dominant species in Tata (Hungary). The Kůlna levels 10 and 9 are, according to K. Valoch, also linked to a steppic forest at the end of the late Interglacial. We cannot determine the proportion of hunting to scavenging from the recuperation of these big animals.

Why were these large animals chosen by humans if the climate was temperate, in a great majority of the sites? We could believe that in a warmer climate, people would not

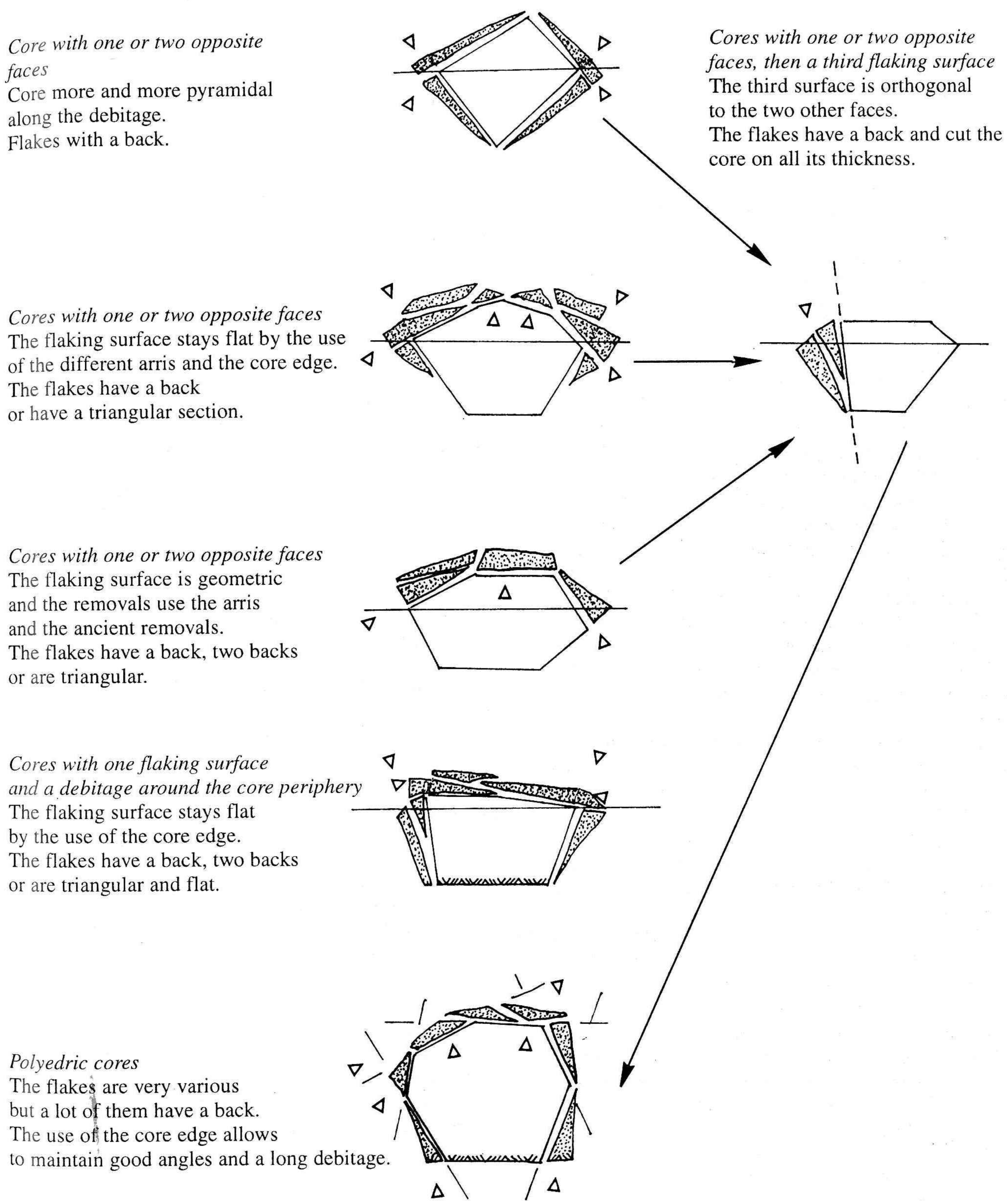

FIGURE 18. Six kinds of cores in the Kůlna level 11 on all kinds of stones. Diversity within a same family.

have needed the same quantity of fat, justifying the exploitation of big animals. This choice of animals, therefore, cannot be explained exclusively by reasons of food, but by commodity (dead animals near water points, like in Kůlna during the level 11 deposit according to K. Valoch). We can be surprised by the association between these big animals and the microlithic world. At the same period, other kinds of technical behaviours exist.

Consequently, a link to the environment does not seem to be a good hypothesis, even if the majority of these kinds of microlithic assemblages belong to a temperate context (in more ancient periods like Bilzingsleben or Eemian times). They also exist in different countries, more than we had previously thought: for example Ukraine, Crimea, Italy (Pontinian) (Kuhn 1990–1991, 1995). People could also collect big pebbles in these countries of different kinds of raw materials, except perhaps for the Pontinian in Italy. They also collected different kinds of stones, but only flint for the Pontinian in Italy.

In Kůlna, the presence of some large pebbles proves that the great number of small pebbles was a human choice and not imposed by the environment. How could the variety of raw material be explained? Is it linked to the stones' qualities? The technical behaviour was, nevertheless, quite similar for each kind of stone. Why did they not collect only flint and radiolarite which are better quality stones? Is this raw material diversity linked to easy collecting near the cave or to functional reasons? The qualities of quartz, orthoquartzite and silicites are quite different. For pebble tools, quartz seems to be better, because very hard.

No raw material used by humans in level 11, except for silicites, was easy to manage, especially for small pebbles. Moreover, the quartz and orthoquartzite flakes were often broken.

Are the reasons for the diverse collection linked to the pebble shape, to the different hardness of these kinds of stones or to the kinds of flake sharps produced by the debitage?

All these stones could be used like complementary raw materials, each one having its proper function. In addition, everything was used: pebble tools, flakes, broken flakes and cores.

The retouch is more intense on silicites, chert and radiolarite. Is it because of the quality of stone or of the longer distance required to collect some different kinds of flint and radiolarite and some original rare stones?

In Kůlna, level 11, the debitage seems to have taken place on the site, but not for all kinds of stones – for example, the rare stones and perhaps some kinds of silicites and radiolarite. But the debitage operational scheme seems to be similar for all raw materials.

Taubachian people managed the stones in the same fashion. The reason for the stone diversity must have another explanation than the flake shape or the kinds of flakes.

Lack of stones is not an explanation either. Cores have not been exhausted.

Kůlna Taubachian cores are closer to Pontinian cores than to Kůlna Micoquian cores: proceeding system, diversity, number of core flat section, even Pontinian cores are on flint.

In conclusion, the people's behaviour in their choice of small tool making cannot simply be explained by only one factor like environment, food needs, customs, site locations, physical characteristics and availability of raw materials.

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REFERENCES

BOËDA E., 1995: Caractéristiques techniques des chaînes opératoires lithiques des niveaux micoquiens de Kůlna (Tchécoslovaquie), *Paléo, Actes du Colloque de Miskolc*, p. 57–73.

DOBOSI V. T., 1988: Le site Paléolithique inférieur de Vertesszölös, Hongrie, *L'Anthropologie*, Paris, t. 92, n° 4, p. 1041–1050.

KOZLOWSKI J. K., 1990–1991: Le Charentien d'Europe Centrale et la place de la technique pontinienne, *Quaternaria nova I*, p. 605–621.

KUHN S. L., 1990–1991: Functional variability and chronological change in Pontinian Mousterian assemblages, *Quaternaria nova I*, p. 529–549.

KUHN S. L., 1995: *Mousterian Lithic Technology. An Ecological Perspective*, Princeton University Press, 209 pp.

MANIA D., 1988: Le paléolithique ancien et moyen de la région de la Saale et de l'Elbe, Allemagne de l'Est, *L'Anthropologie*, Paris, t. 92, n° 4, p. 1051–1092.

NERUDA P., in press: Le Taubachien de la grotte Kůlna (couche 11) et l'exploitation des matières premières, *Instrumentum*.

PATOU-MATHIS M., 1993: Les comportements de subsistence au Paléolithique inférieur et moyen en Europe centrale et orientale, in: *Exploitation des animaux sauvages à travers le temps, XIIIèmes Rencontres d'Antibes*, APDCA, p. 15–28.

RINK W. J., SCHWARCZ H., VALOCH K., SEITL L., STRINGER C. B., 1996: Dating of Micoquian Industry and Neanderthal Remains at Kůlna Cave, Czech Republic, *J. of Archaeological Science*, 23, p. 889–901.

SCHÄFER D., 1981: Zur Merkmalsanalyse von Feuersteinartefakten der mittelpaläolithischen Travertinfundstelle sowie zu ihren Verhälnis zur Technologie anderer alt-and mittelpaläolithischer Fundplätze, *EAZ Ethnogr. Archäol. Z.*, 22, p. 369–396.

STEPANCHUK V. N., 1994: The eastern Taubachian: preliminary remarks, *Archeologické rozhledy*, vol. 46, n° 4, p. 533–540.

SVOBODA J., 1984: Cadre chronologique et tendances évolutives du Paléolithique tchécoslovaque. Essai de synthèse, *L'Anthropologie*, Paris, t. 88, n° 2, p. 169–192.

VALOCH K., 1984: Le Taubachien, sa géochronologie, paléoécologie et paléoethnologie, *L'Anthropologie*, Paris, t. 88, n° 2, p. 193–208.

VALOCH K., 1987: Raw Materials used in the Moravian Middle and Upper Palaeolithic, *International Conference on Prehistoric flint mining and lithic raw material identification in the Carpathian Basin, Budapest–Sümeg*, 1986, p. 263–268.

VALOCH K., 1988: Le Taubachien et le Micoquien de la grotte Kůlna en Moravie, in: M. Otte (Ed.): *L'Homme de Néanderthal*, vol. 4, La Technique, Liège, p. 205–217.

VALOCH K., 1988: *Die Erforschung der Kůlna-Höhle 1961–1976*, Anthropos Band 24 (N.S. 16), Brno, 318 pp.

VALOCH K., 1995: La variabilité typologique du Paléolithique moyen de la grotte Kůlna en Moravie, *Paléo, Actes du Colloque de Miskolc*, p. 73–79.

VALOCH K., 1996: *Le Paléolithique en Tchéquie et en Slovaquie*, série "Préhistoire d'Europe", n°3, J. Million (Ed.), Grenoble, 205 pp.

ZELINKOVÁ M., 1998: Osteological material from the inside parts of the Kůlna Cave, *Acta Mus. Moraviae, Sci. geol.*, LXXXIII, p. 147–157.

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