EXPLORATION OF THE MINING FIELD "ZA GARNCARZAMI" IN OŻARÓW, TARNOBRZEG VOIVODSHIP. PRELIMINARY REPORT

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The prehistoric mining field in Ożarów was discovered in 1923 by S. KRUKOWSKI. In the years 1929–39 it remained under the care of wardens from the nearby archaeological reserve in Krzemionki whom KRUKOWSKI instructed to collect material from the surface of the site at least twice a year. The result of this action was a collection of about two thousand artifacts. Unfortunately, the materials were not analysed at that time and, what is more, the site was never mentioned in print. Because of this, it remained forgotten for long years after the Second World War. It was only in the 1960s that the site was surveyed by T. ŻUROWSKI and soon afterwards by Z. KRZAK. The latter archaeologist published his results in two short articles.[4, 5] The next stage in the study of the Ożarów site is connected with the extensive program of research of the Eastern Holy Cross Mountains Region of Prehistoric Flint Exploitation launched by the Institute of Archaeology, Warsaw University. In 1978–79 the then available part of KRUKOWSKI's pre-war collection was analysed. At the same time there were preliminary surveys performed of the site surface again, and of the geology of the immediate vicinity. The distribution of artifacts manufactured in the Ożarów workshops on the mine was also studied and the results published in three brief reports.[1, 2, 3]

The mining field in Ożarów is a particularly valuable object of palaeoeconomic studies since it is the only place of exploitation of a relatively easily identifiable raw material, and because the relics from the workshops on the mine are exceptionally homogeneous culturally. This prompted the decision about commencing more detailed studies there. The work in Ożarów also provides an experimental basis for elaborating an algorithm of studies of prehistoric mining sites with destroyed anthropogenic surface relief. The strong need for this kind of methodological research emerges from the experience accumulated to date. Studies performed with conventional methods cannot lead to a credible reconstruction of the character of the entire prehistoric mining sites, providing a vast amount of poorly distinctive material requiring time-consuming analyses. Accordingly, the plans of the study of the "Za garncarzami" mining field put the main emphasis on methods of general site survey, and on methods permitting the limitation of excavations to a cognitively justified minimum. To this end the following studies were performed:

1. *The geology of the site environs.* The analysis of profiles in nearby stone quarries served to determine the character of local sediments and the rhythm of siliceous rocks occurrence in them (Fig. 2). This enabled a fairly accurate determination of the stratigraphic position of the deposits exploited in Ożarów. Studies of the origin of the siliceous rocks present there and of their subsequent transformations are now beginning. They are aimed at providing more objective methods of identifying the Ożarów raw material and at a better corelation of the local forms with the other Turonian profiles of the north-eastern Mesozoic peripheries of the Holy Cross Mountains.

2. *Analysis of the site surface morphology.* A 1:500 scale plan of the mining field surface with contour lines every 25 cm was drawn on the basis of height measurements in a 2.5 m square grid. Contrary to earlier expectations, the plan did not reveal any preserved traces of exploitation structures. Its mathematic processing made it possible to distinguish three principal parts of the mining field which are well visible on the generalized plan of the site's morphology (Fig. 3).

3. *Detailed analysis of the surface material distribution.* This was based on a representative sample of the materials. Making use of the fact that the entire area of the mining field is today cultivated land, the whole stone material was collected from the surface of a specific square meter of every are. The preliminary analysis of the specimens thus obtained enabled the formulation of principles of their classification and the drawing of the general distribution of chipped forms. Detailed analyses are continuing of the mutual relations between the occurrence of various categories of forms (siliceous limestone fragments, Scandinavian boulders, natural and chipped chert fragments, etc.) aimed at precise charting of both geological facts and the intensity of traces of prehistoric economy.

4. *Geophysical studies.* These are performed by a team of the Institute for the History of Material Culture, Polish Academy of Sciences, headed by T. HERBICH. Nine lines of geoelectrical electro-resistivity tests along a total of 860 m and geoelectrical electro-resistivity profiles in a metric grid covering about 65 ares have so far been completed (Fig. 4). On the basis of these measurements nine geoelectrical sections were drawn covering the alleged area of the mining field with a network, and also maps of distribution of ground resistivity for two prospection depths. The network of geoelectrical sections provided a number of data about the geology of the studied region,

while the maps of ground resistivity distribution delimited the extent of the mining field with an accuracy of several meters (Fig. 5). In view of this, the maps were of decisive importance in situating the research excavations. The mathematic processing of the profile results continues with the purpose of a still more precise reconstruction of the borders and character of the mining field. It is also planned to determine the geoelectrical electro-resistivity profiles in the remaining part of the site.

5. *Excavations.* A principal excavation unit of 10—24 square meters was sunk in each of the three parts of the mining field distinguished in the course of earlier analyses. These were augmented in the central and northern parts of the site by five small ditches measuring one by two meters. In the southern part supervision of foundations being dug for a farm building (Fig. 6). During excavations one shaft in each of the mining field parts was explored completely. Also studied were fragments of 11 other shafts revealed in the ditches. Although the excavation units covered a mere 0.5% of the site's surface, they yielded over 101 000 chert artifacts and 200 relics made of other rocks. Other finds included four fragments of prehistoric ceramics and several faunal remains, one of which was an antler mining tool. Almost 60 rock and soil samples were collected, also then charcoal samples were taken for absolute age determinations. The full analysis of the above material requires extensive interdisciplinary cooperation. The studies are only beginning and are bound to last several years. Their first result are three radiocarbon dates obtained in the Gliwice Radiocarbon Laboratory. Thanks to the previous studies of KRUKOWSKI's prewar collection, there has also been developed a method of analysing chipped artifacts adapted to the voluminous remains of technological processes in the local workshops on the mine. Due to the character of the material, the method is considerably different from the standard canons of analysing inventories from settlement sites or those connected with blade production. It consists in disregarding the morphology of the specimens in the initial stages of analysis and in concentrating on technological properties. On the basis of the latter, the forms are divided according to the extent of processing. It is only later that, taking into consideration the regularities of processing, the state of preservation of the specimens (whole pieces or their fragments), and comparing the forms in most advanced stages of processing with finished tools from settlement sites, the specimens are grouped in production cycles of concrete forms. The on-the-spot preliminary analysis of chipped artifacts discovered during excavations enriched the method in new experiences. Thanks to this work, we are today able to indicate the main objective of production in the local workshops and to reconstruct the main stages in the production of the forms in question.

It is clear from the above remarks that the studies are far from being completed. However, their complex character makes it possible to present the basic problems connected with the analysed mining field already today.

The site "Za garncarzami" in Ożarów lies on an outcrop of Lower Turonian (Upper Cretaceous) siliceous limestones.[8] The siliceous rhythm in these deposits is as follows. In their lower parts there are infrequent levels of small chert nodules of several-centimeter diameters. Towards the top of the profiles, these levels become more frequent and abundant. They take the form of one-meter thick lenticular beds, but the dimensions of the nodules they contain remain unchanged. Only in the upper parts of the Lower Turonian profiles there appear much bigger nodules, with diameters of up to several dozen centimeters, among the beds of the smaller ones. In the top part of the profiles they are replaced by large tabular cherts, upwards of a dozen or so meters in diameter and several dozen centimeters thick. They appear in several levels (Fig. 1). The surveys of the "Za garncarzami" mining field demonstrated that siliceous rocks from the topmost levels of the presented rhythm were exploited there. Among the multitude of micro-nodules unfit for chipping, there are specimens found, proving the utilization of both the large nodules and the tabular cherts.

The mining field "Za garncarzami" lies on the south-western slope of an elevation gently descending to an extensive dry valley of Old Pleistocene age (Fig. 1). The elevation is built of the siliceous limestones described above, covered with a thin (several dozen centimeters) layer of Quaternary deposits. Detailed microgeomorphological studies revealed that the site lies in a barely visible trough running obliquely to the elevation slope and divided by two indistinct thresholds. Geophysical studies suggest that the upper threshold reflects a tectonic fault whereas the lower one apparently marks the border between the in situ rock and siliceous limestone rubble lying in a secondary deposit at the valley edge. In all, the thresholds divide the mining field of interest to us into three main parts (Fig. 3).

The highest part of the "Za garncarzami" site lies on weather-cracked siliceous limestones. This is the least explored part of the site. Its analysis based on geophysical research is hindered by the extremely variegated relief of the top of the siliceous limestone deposits due to Quaternary geological processes. It may be surmised, however, that the mining field here is of a loose character. The shafts are scattered randomly and are variously but considerably spaced apart. One shaft was discovered in the principal excavation unit covering 10 m^2. The shaft was in the form of a pit, 130 cm in diameter and about 260 cm deep. It had a step at a depth of about 130 cm. It turned out, however, that the shaft was dug outside the range of in situ occurrence of chert nodules fit for processing, and it therefore seems that its shape represents a certain stage of digging a shaft rather than the planned final form. This does not mean that it was completely useless for its makers. Processable chert fragments are not confined in this area to in situ rocks but are also found in two levels lying on the secondary deposit at the bottom of Quaternary forms. The chert fragments are sizeable and their use is evidenced by the workshop materials. Given the geological conditions we may be certain that the shafts in this part of the mining field were mostly of the niche kind. It is possible,however, that parts of the field were exploited with more complex underground methods, but further studies are needed to prove this. Noteworthy among mining tools from the highest part of the site are those made of Scandinavian boulders.

The central part of the mining field lies on in situ but completely weathered siliceous limestone. The consistence of the rocks here resembles that of chalky putty, and less weathered rock fragments are rare. Weathering of this kind is known from Cretaceous rocks underlying the bottoms of dry valleys.[7] It creates extremely difficult technical conditions for mining and the cherts in such rocks were usually left unexploited. This is not the case in Ożarów but any developed underground exploitation is out of question the more so since the entire area is virtually shattered tectonically. Remnants of original chert levels are preserved in no more than a dozen or so sections. The mining field is packed and chaotic. Packed because completely covered with shafts, and chaotic because the shafts were not arranged according to some pattern but were sunk at random. The border of the mining field is, quite obviously, bound to be unlinear and there must be scattered unsuccessful shafts on the field's periphery. The 24 m^2 main excavation unit was sunk in an area densely packed with shafts. Fragments of five exploitation shafts were uncovered, four of which were connected stratigraphically. One of the shafts was explored completely (Fig. 7). It is of the maximally developed niche kind with a counter-niche to accomodate the internal tip. It is slightly over 3 m deep, oval-shaped, measuring 2X2.5 m. Inside there, were traces of exploitation of one large chert nodule, and of unsuccessful attempts at extracting a second nodule. The fill of this shaft contained the only antler mining tool found on the site. Charcoals retrieved from the anthropogenic fill gave the radiocarbon date of 3430 ± 80 BP (Gd—2115). Two more dates were provided by charcoals taken from the fills of the adjacent shafts: 3520 ± 80 BP (Gd—2114) and 3370 ± 80 BP (Gd—2108).

The lowest part of the "Za garncarzami" mining field lies on completely weathered siliceous limestone rubble apparently belonging already to the littoral part of the valley. All of this rubble contains abundant quantities of chert fragments, but the richest level is marked by the rubble of large fragments of tabular cherts. As in the central part of the site, the mining field here is packed and chaotic. A 12 m^2 excavation was sunk on the edge of an area densely covered with shafts. Six shafts of various form and size were uncovered and partly explored. One was explored completely. It is a simple mining pit, about 140 cm in diameter and 170 cm deep (Fig. 8). It is interesting to note that not even half of the available chert has been exploited. The shaft appears to have been an ad hoc venture undertaken by a single person. The fact that it lies among shafts several times larger casts new light on problems of interpretation of mining structure forms.

The preliminary analysis of the chipped artifacts obtained in the course of the excavations confirmed the earlier conclusions that the local workshops on the mine were geared to the production of virtually one tool form — sickle-shaped knives. The adopted method of analysis makes it possible to reconstruct the principal stages of the production of these forms already at this point (Figs. 9—11). A very small number of specimens indicate that bifacial axes and fairly massive flakes were sporadically manufactured as well. The latter came from exploitation of decidedly amorphous cores. All these forms are no doubt connected with the Early Bronze Age Mierzanowice culture.[6] The connection of the "Za garncarzami" mining field with the Mierzanowice culture is confirmed by the mentioned radiocarbon dates which correspond to the youngest developmental phase of this culture.

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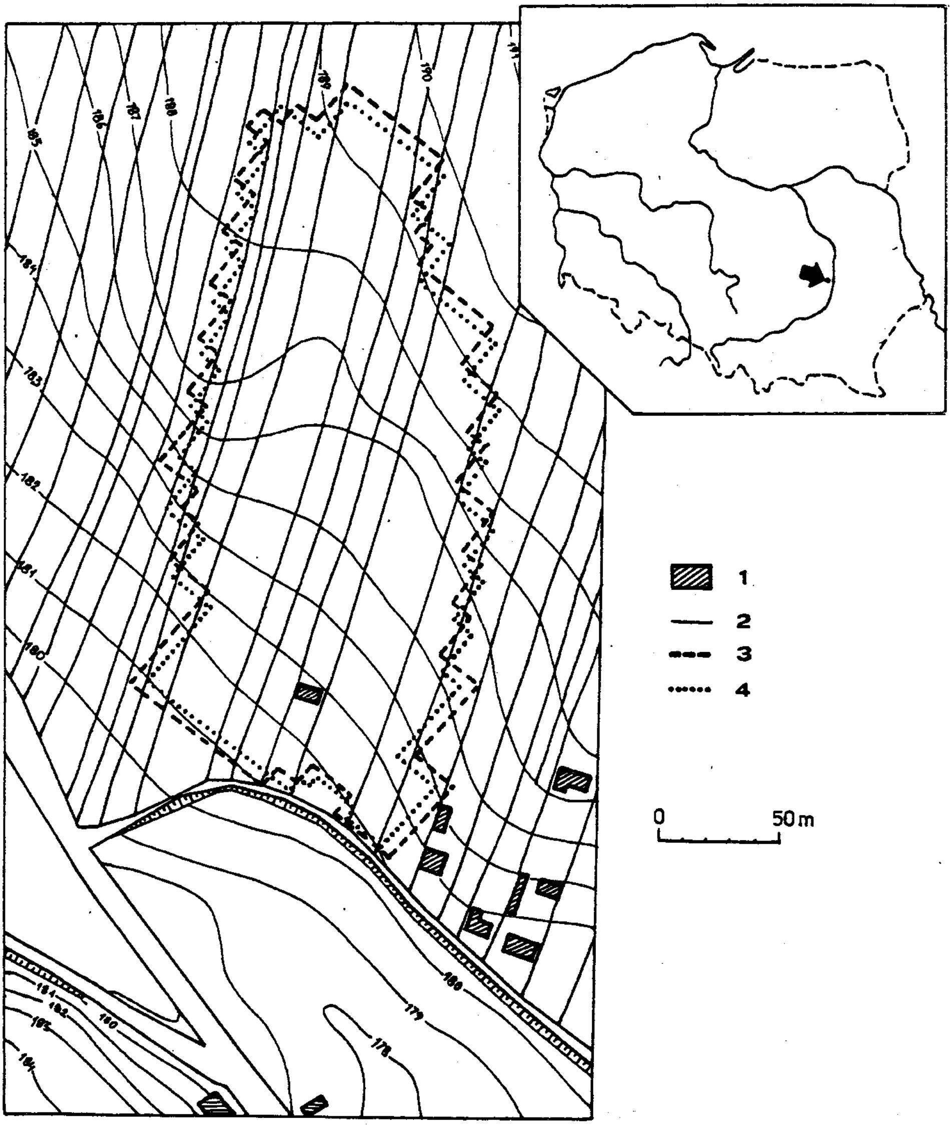
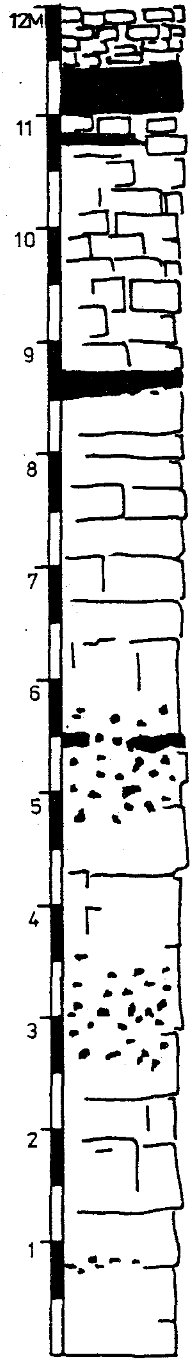


Fig. 1. Location of the "Za garncarzami" mining field in Ożarów, Tarnobrzeg voivodship
1 – bulindigs; 2 – field boundaries; 3 – boundary of the area of detailed surveys; 4 – boundary of the area of detailed geomorphological studies



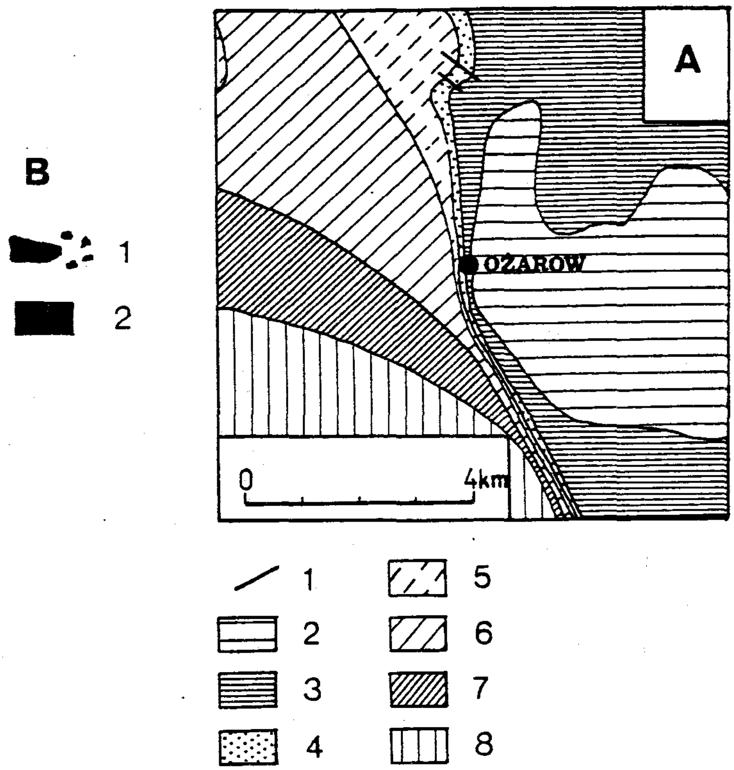


Fig. 2. A. Geological map of the environs of Ożarów after POŻARYSKI 1948 (without the Quaternary forms)

1 — faults; 2 — Lower Turonian: Bryozoan limestones; 3 — Lower Turonian: siliceous limestones; 4 — Cenomanian and Albian: sands, sandstones, gaizes and marls; 5 — Kimeridgian: oolithes, limestones, marls and lumachelles; 6 — Upper Oxford: oolithic and fine pelithic limestones; 7 — Lower Oxford: marly limestones and silicified spongian limestones; 8 — Callovian: rusty sands, sandstones and marls

B. Profile showing the rhythm of siliceous rocks in the Lower Turonian

1 — chert nodules; 2 — tabular cherts

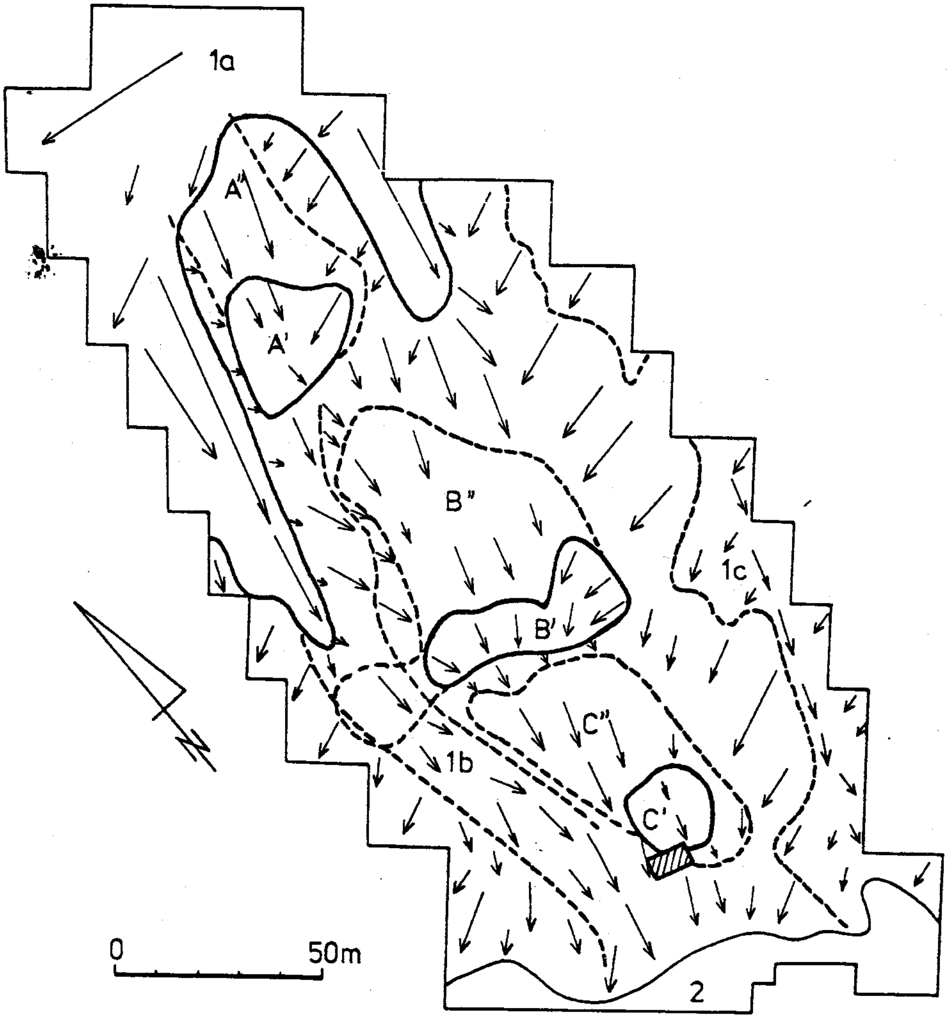


Fig. 3. Generalized plan of the morphology of the "Za garncarzami" mining field area

1a – flattening of the top part of the elevation; 1b – hump limiting the trough cutting the slope; 1c – gentle slope of the elevation; 2 – flattening due to the embankment of a modern road running next to the slope; A, B, C – flattenings in the trough cutting the slope: mining field area. Arrows indicate the directions of sloping

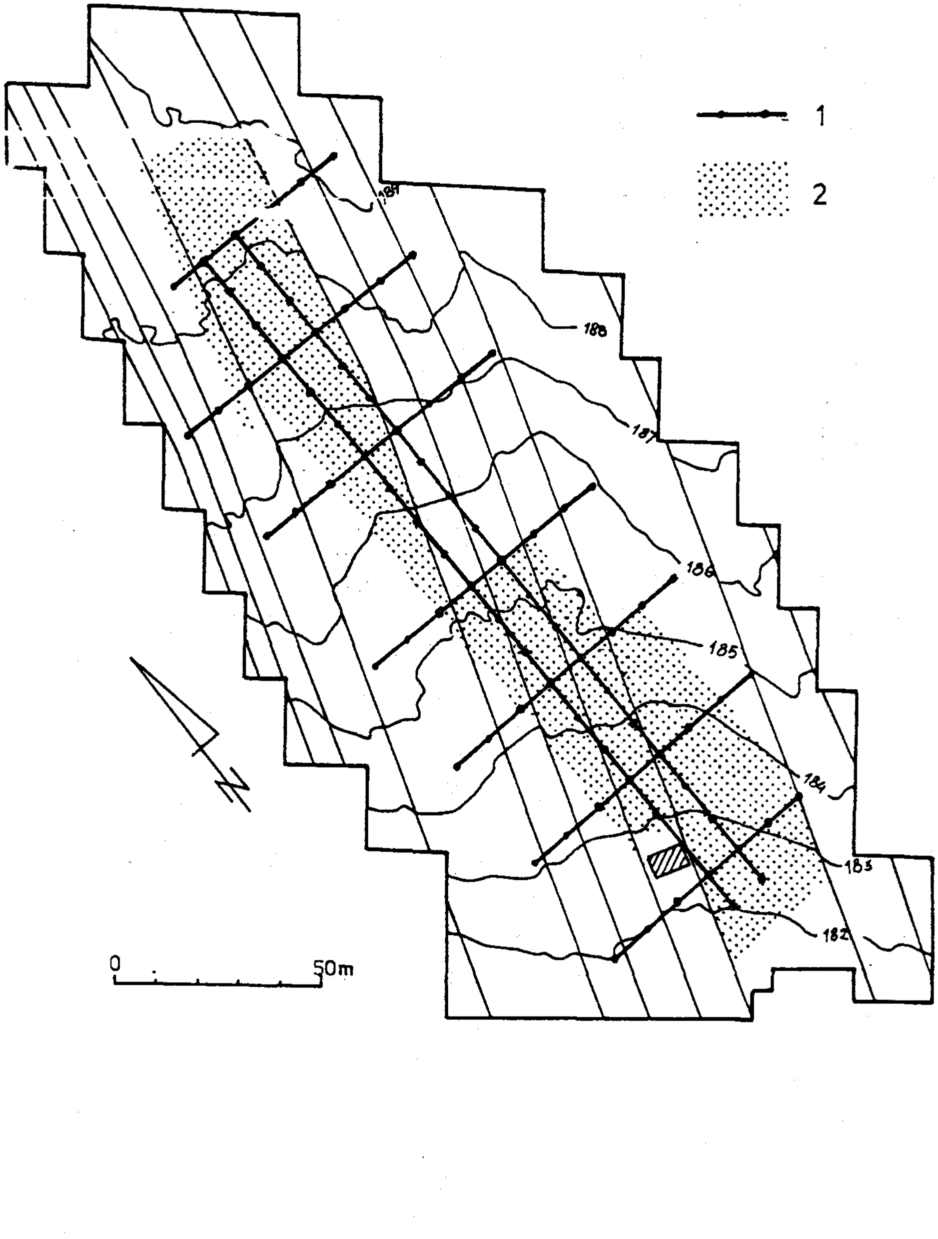


Fig. 4. The extent of the performed geophysical studies of the "Za garncarzami" mining field
1 — lines of geoelectrical electro-resistivity tests; 2 — area covered with geoelectrical electro-resistivity profiles

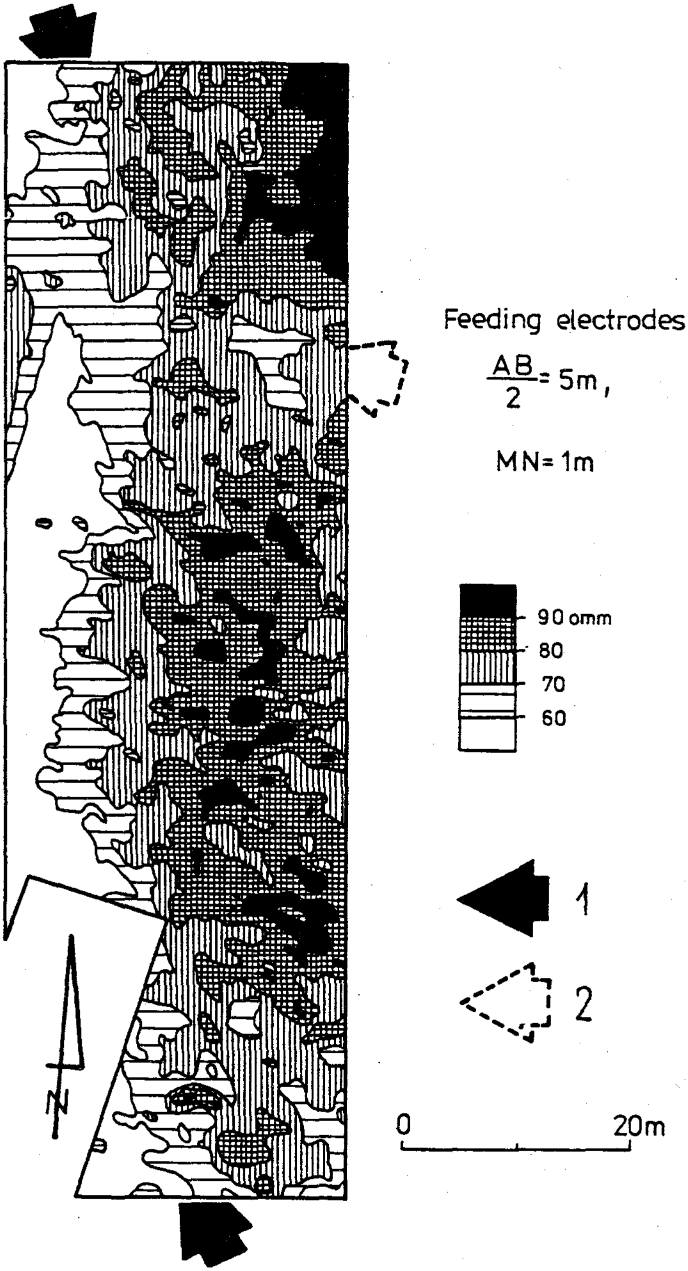


Fig. 5. Distribution of ground resistivity of the S—W part of the "Za garncarzami" mining field
1 – approximate boundary of the mining field; 2 – border between the central and the southern part of the mining field

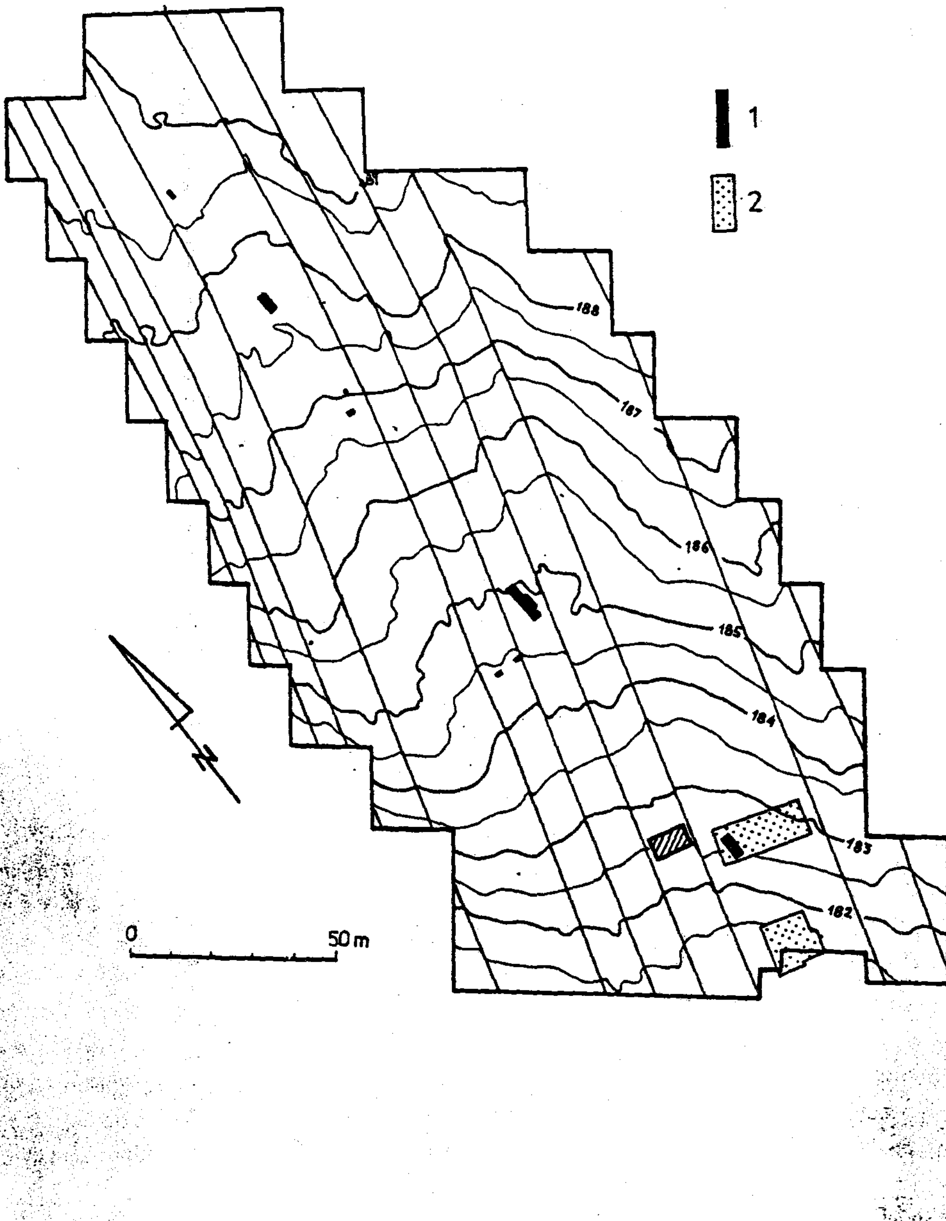


Fig. 6. Location of excavations of the "Za garncarzami" mining field
1 — excavation units; 2 — area of construction work supervised archaeologically

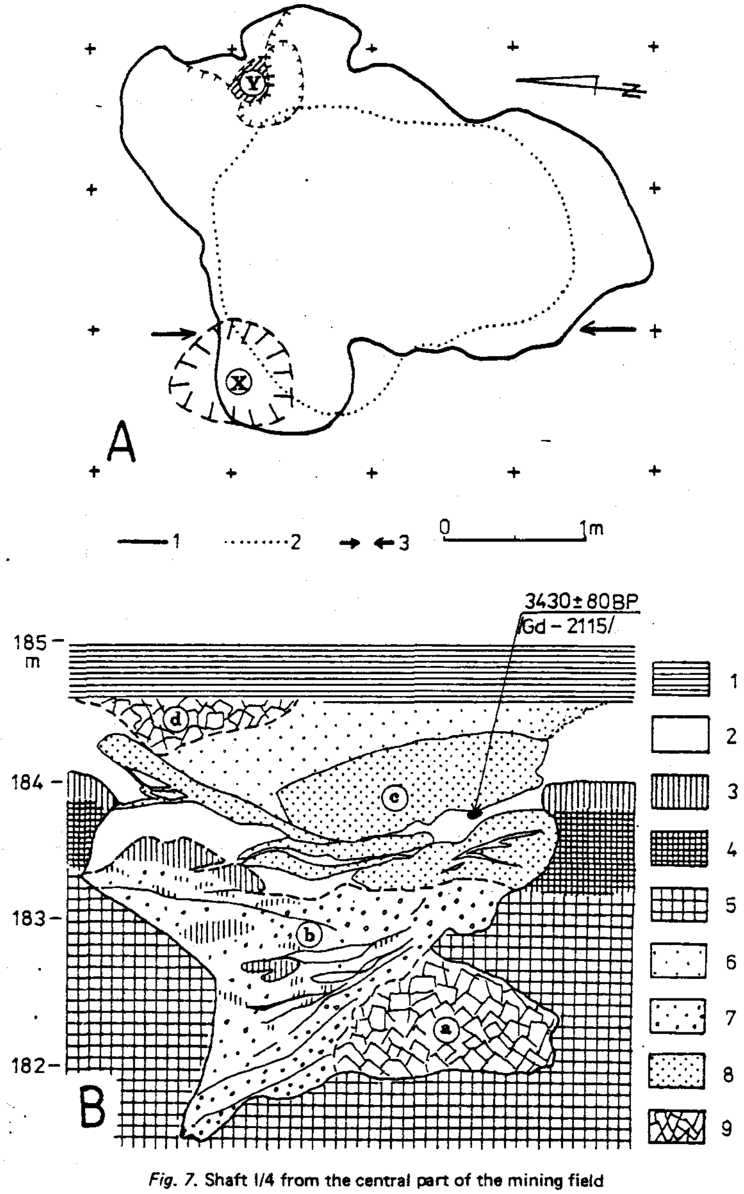


Fig. 7. Shaft I/4 from the central part of the mining field

A. Plan of the shaft

1 — maximum range of mining fronts; 2 — present shape of shaft opening at a depth of about 2.5 m; 3 — course of the profile shown beside; x — depression left by extracted chert nodule; y — traces of work aimed at extracting another chert nodule

B. shaft profile

1 — humic horizon; 2 — sand; 3 — karstic clay; 4 — intensely weathered siliceous limestones; 5 — weathered siliceous limestones; 6 — natural sandy fill with infrequent siliceous limestone fragments; 7 — natural fill of intensely weathered siliceous limestones; 8 — anthropogenic fine-rubble fill; 9 — anthropogenic coarse-rubble fill; a) internal tip of shaft I/4, b) rockfall off the walls of shaft I/4, c) anthropogenic fills of shaft I/4, d) anthropogenic fill of shaft I/2

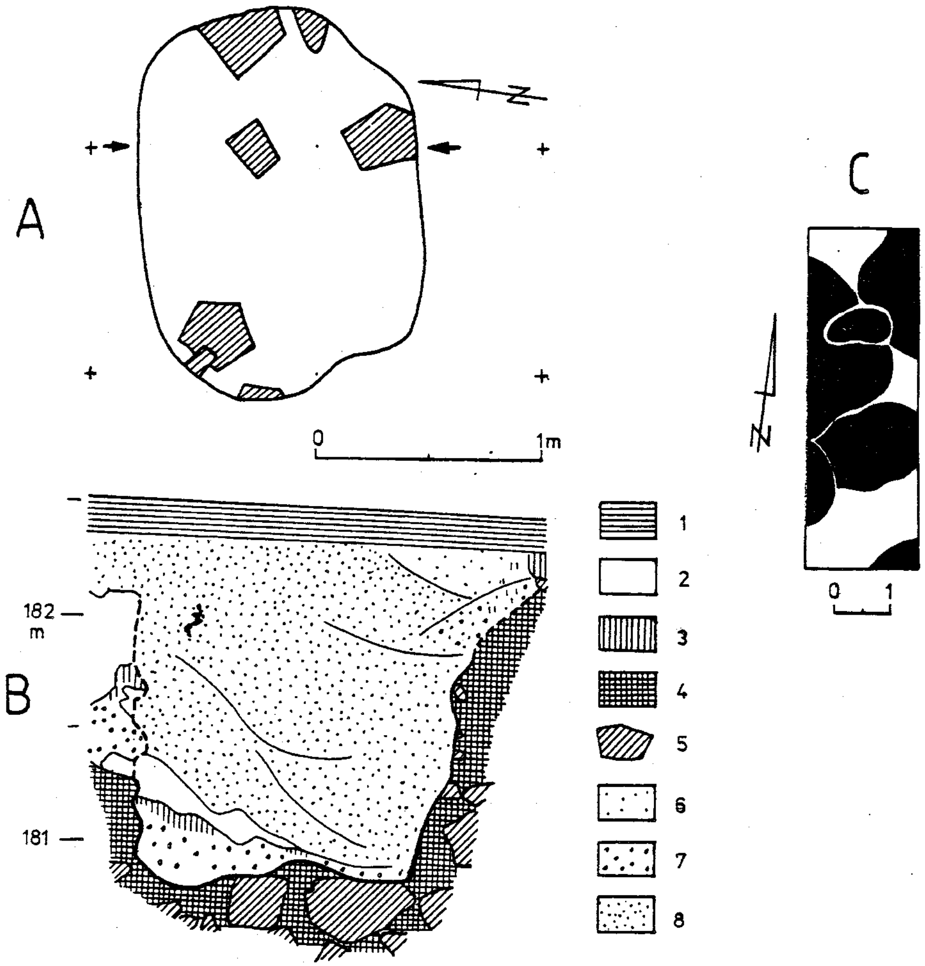


Fig. 8. Shaft IV/3 from the southern part of the mining field
A. Plan of the sahft bottom
B. Profile of the shaft
1 — humic horizon; 2 — sand; 3 — weathered clay; 4 — natural rubble of intensely weathered siliceous limestones; 5 — fragments of tabular cherts; 6 — natural sandy fill with infrequent fragments of siliceous limestones; 7 — natural fill of intensely weathered siliceous limestones; 8 — anthropogenic fine-rubble fill
C. Ditch IV (southern part of the mining field)
contours of shaft at depth of about 0.5 m

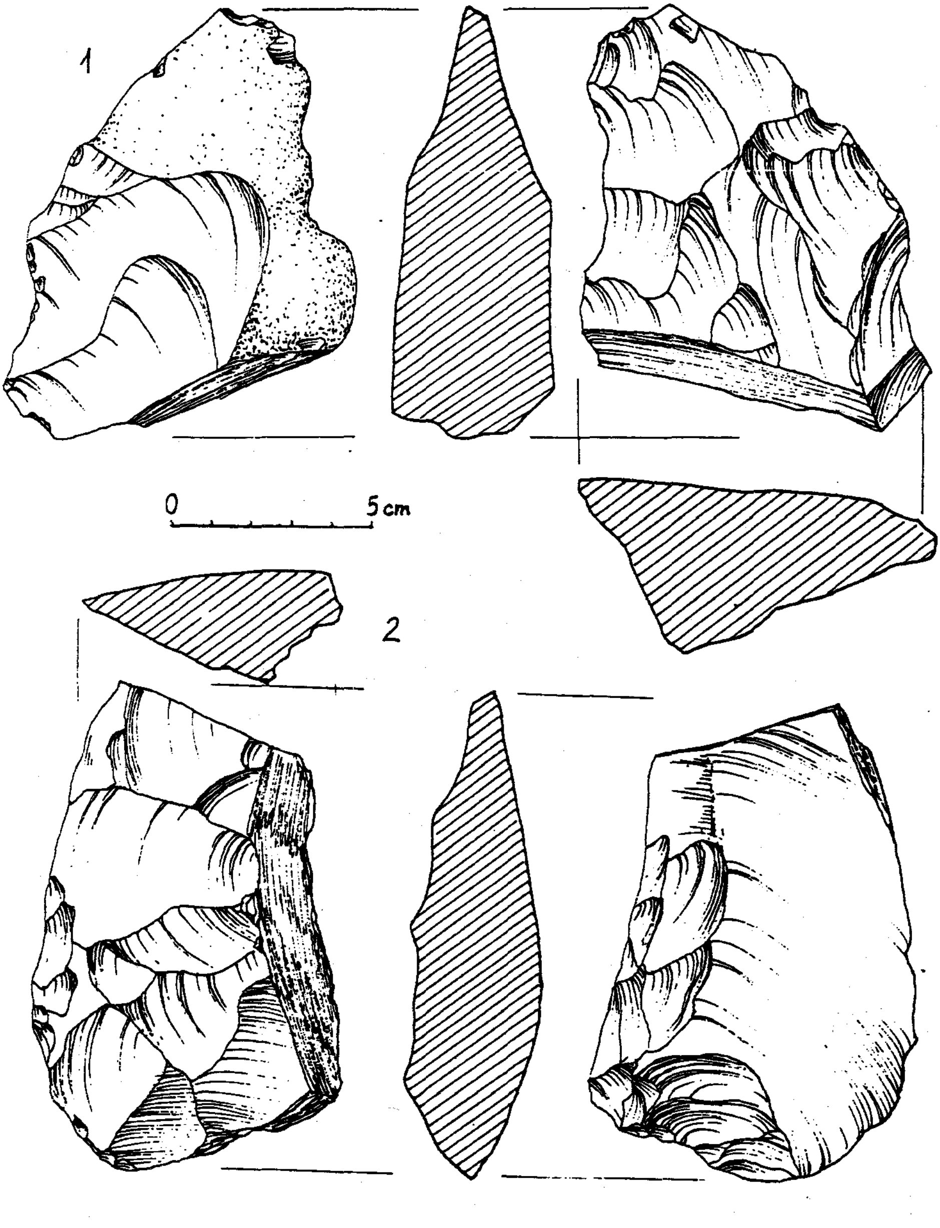


Fig. 9. Unfinished sickle-shaped knives from the first phase of processing

1 – fragment of the distal part; 2 – fragment of base

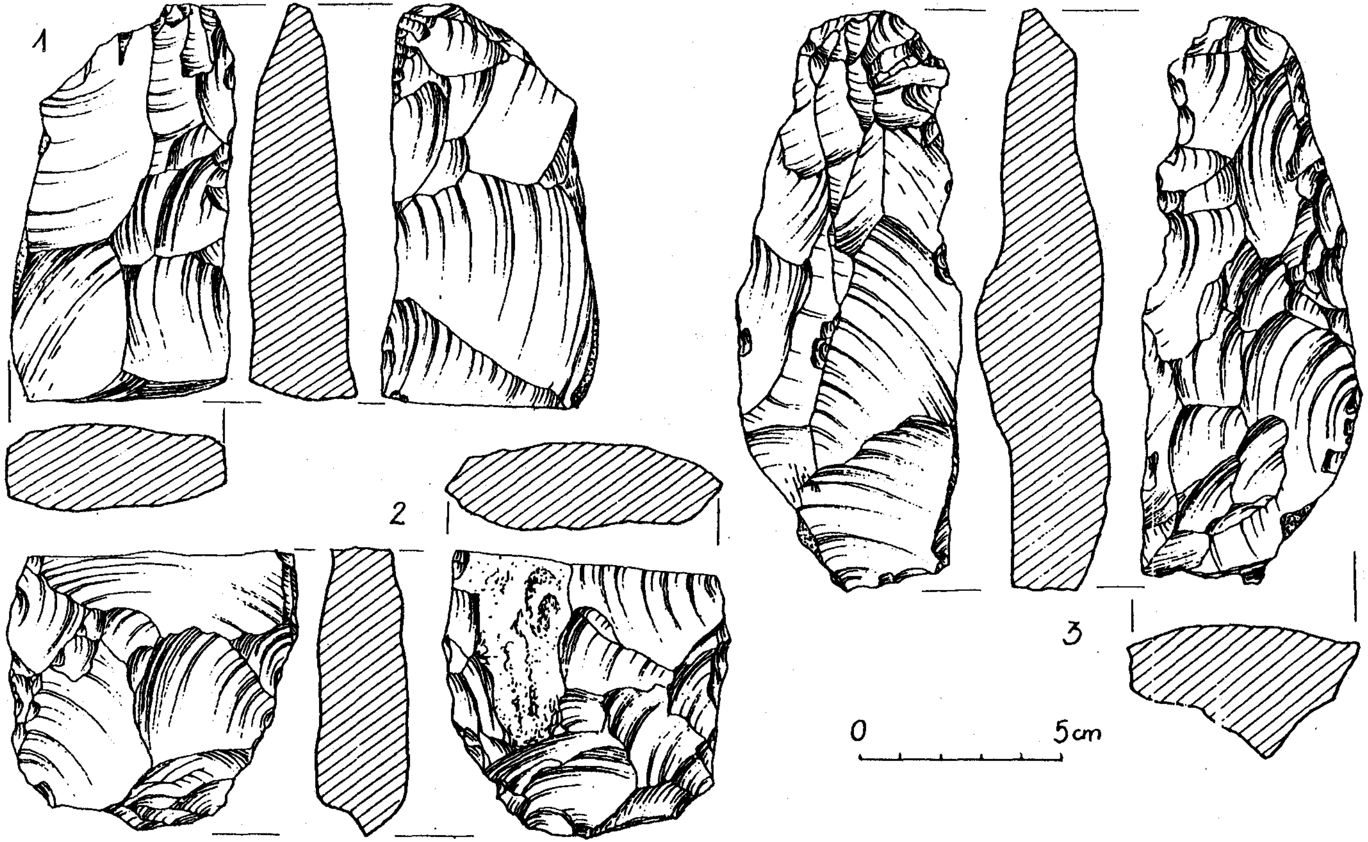


Fig. 10. Unfinished sickle-shaped knives from the second phase of processing

1 – fragment of the distal part; 2 – fragment of base; 3 – abandoned whole specimen

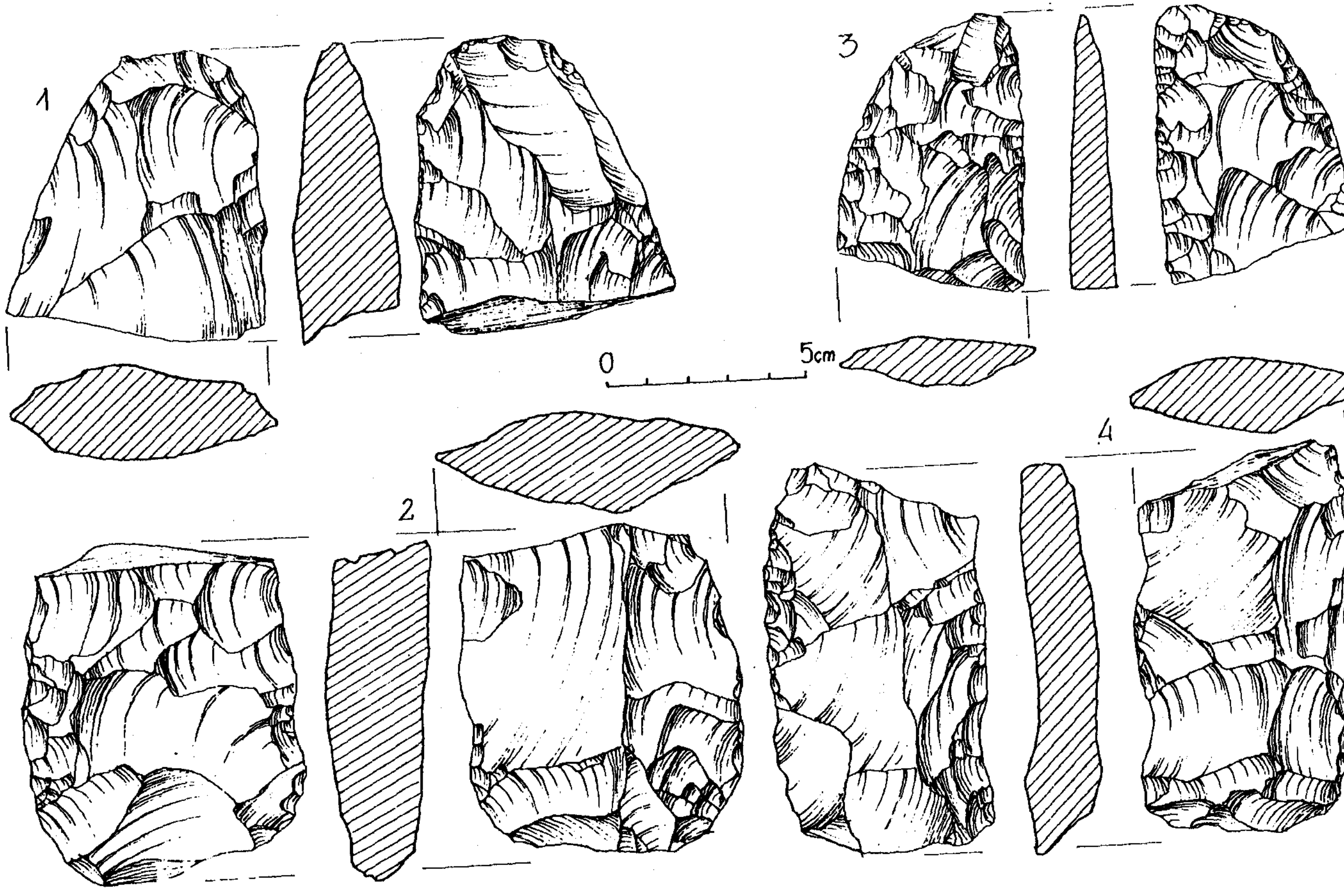


Fig. 11. Unfinished sickle-shaped knives from the third (1, 2) and fourth (3, 4) phases of processing
1, 3 – fragments of distal parts; 2, 4 – fragmetns of base parts

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