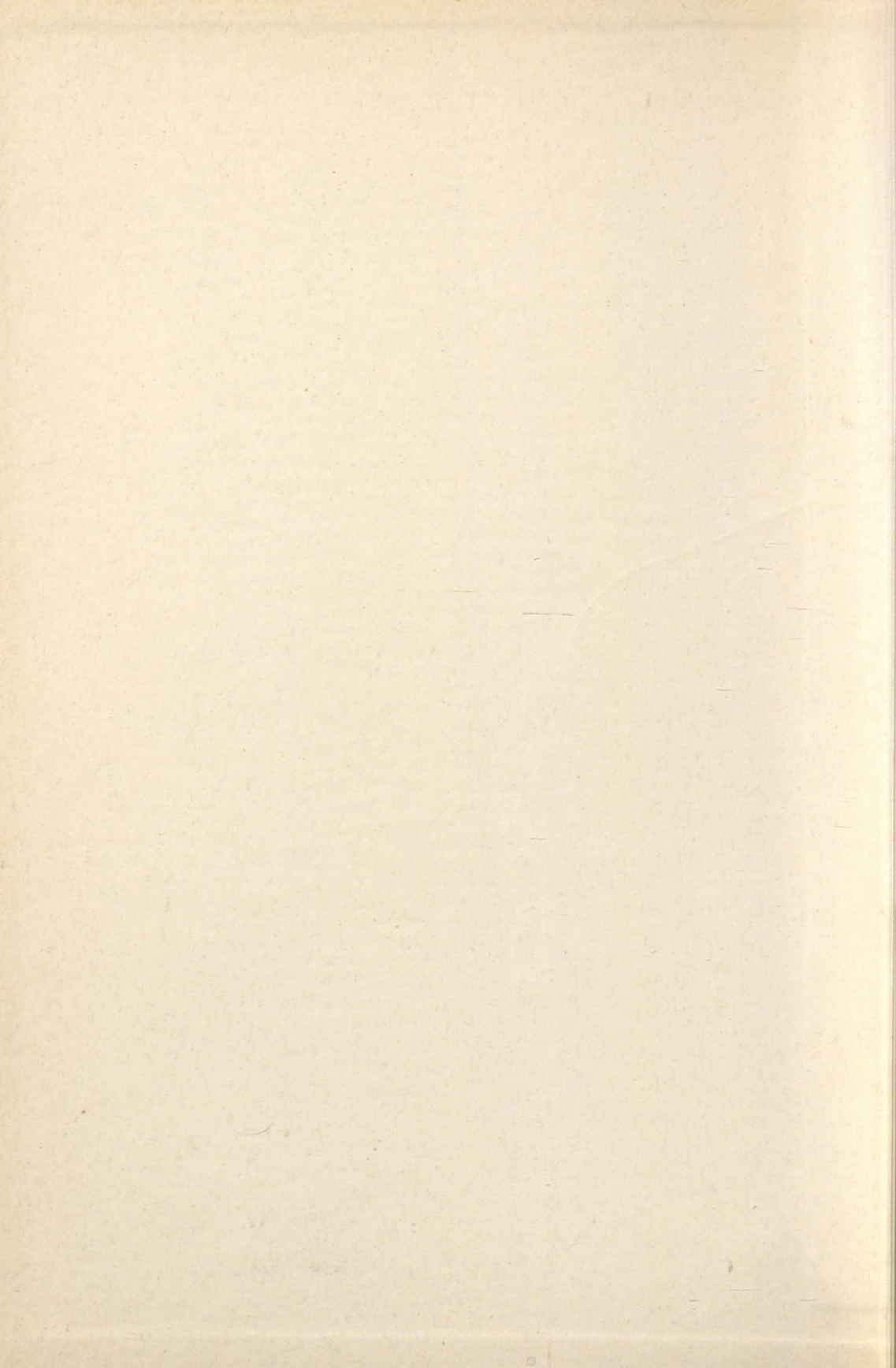


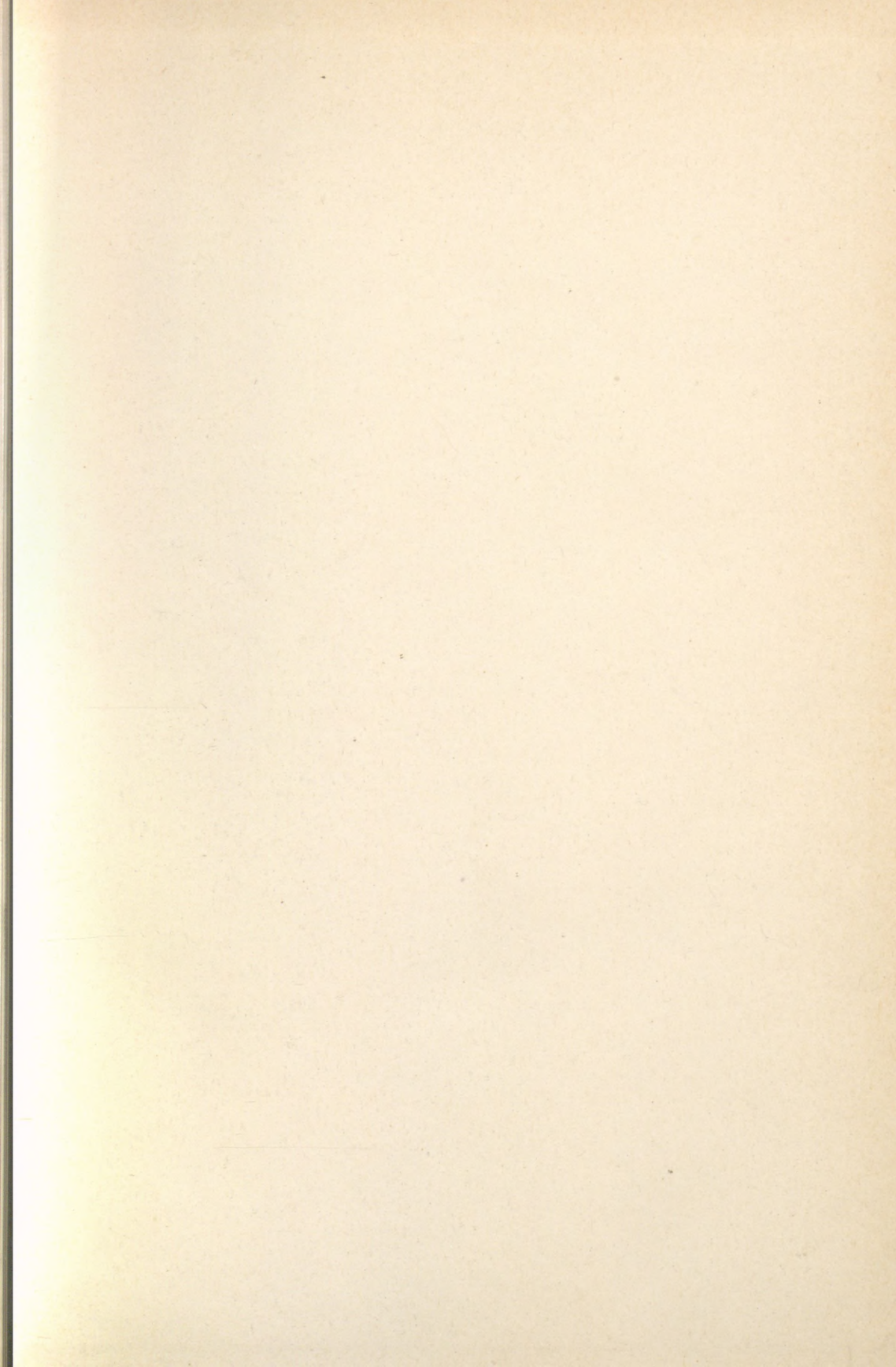
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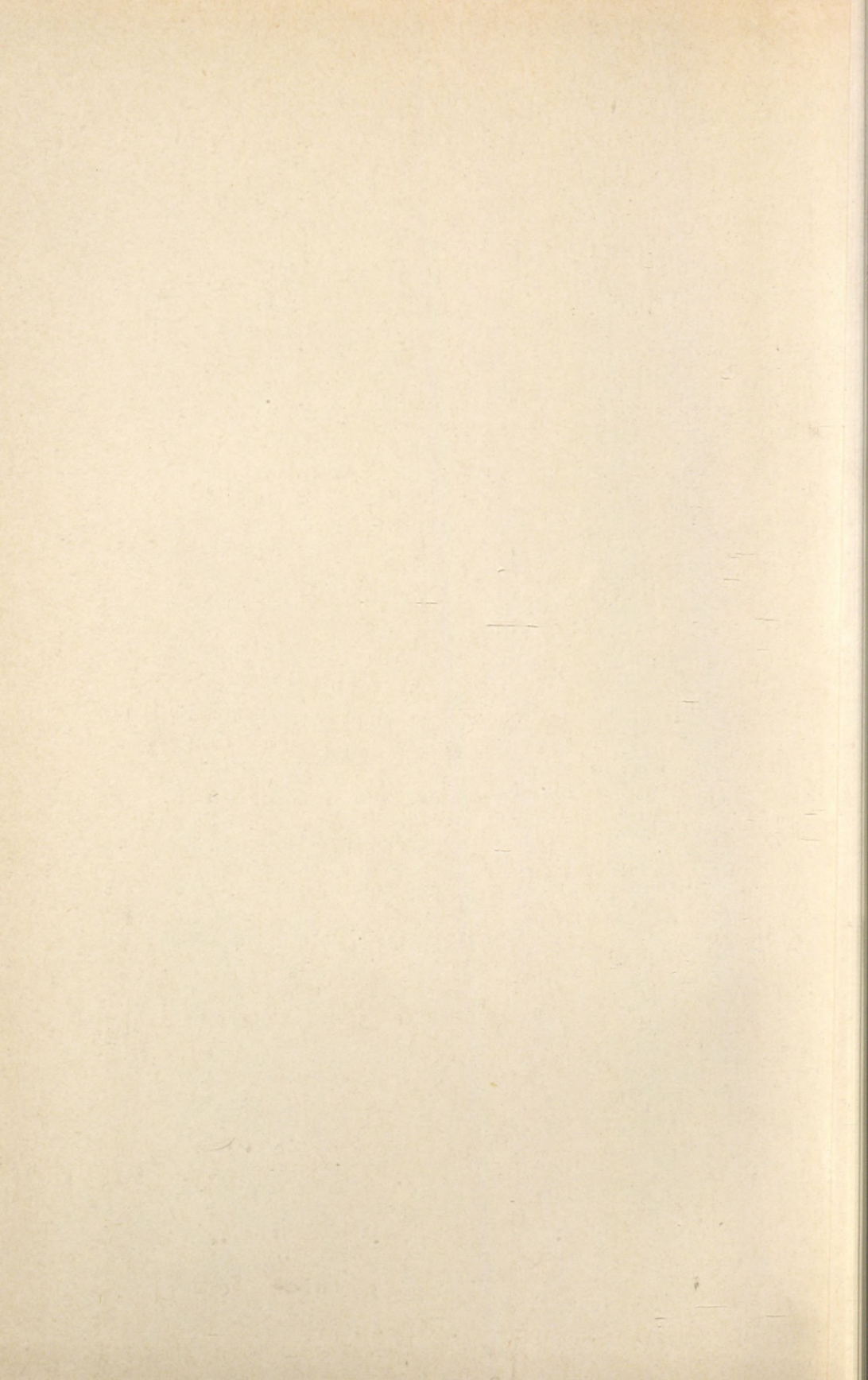
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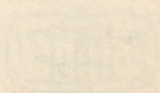






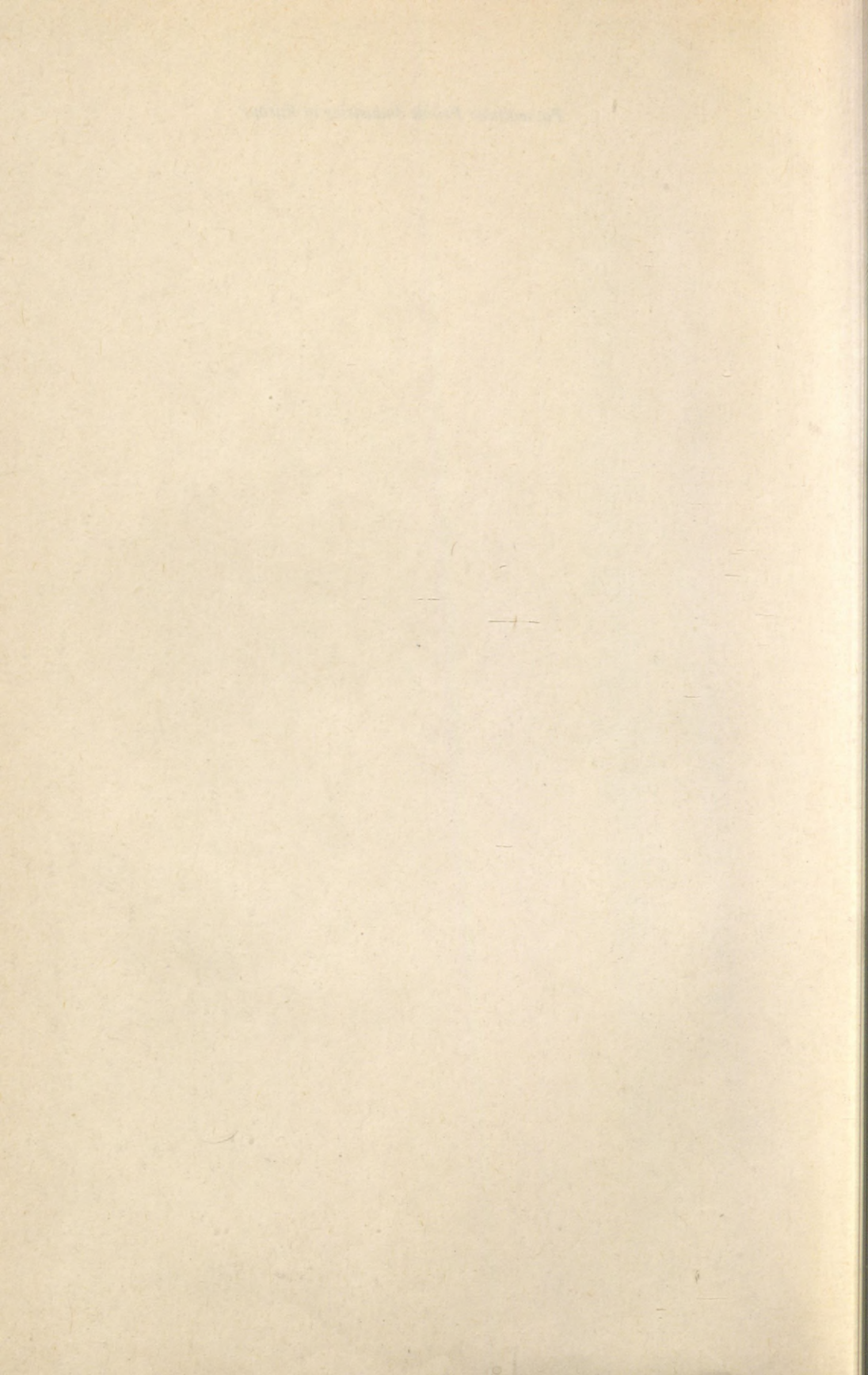
Palaeolithic Pebble Industries in Europe

Lau Yuen Teu



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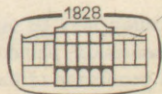
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Luu Tran Tieu



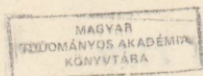
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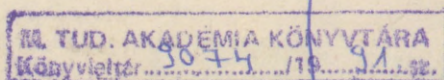
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Introduction

Detritus rolled by rivers or moved by the waves of the sea becomes rounded pebble with worn edges. The form of the pebble is highly dependent on the structural composition of the rock. Rocks of dense structure (granite, porphyry, andezite, etc.) disintegrate into more isometrical pebbles than schisty rocks (gneiss, mica, phyllite, claysand, schist, etc.) do. Their size is also various. The large-sized pebbles are frequent in the mountains, getting smaller on their way downwards. The harder the rock type the longer it resists wearing, which is really the reason why pebbles form only from harder rock types.

Pebble as a tool plays an important role in Palaeolithic cultures, and even in the Mesolithic and Neolithic of some territories. Choppers from astonishingly young layers have been unearthed on several sites in Africa and Asia, and even contemporary peoples make similar tools for specific work processes. Bordes saw large choppers in the hands of Spanish charcoal-burners who used them for wood working. Obermaier had stated even earlier that similar tools had been found among the primitive peoples of Australia.

Pebble-tool is an often debated, problematic concept in itself, with several unclarified features. We may mention e.g. that there has been a debate on the so-called 'eolith-question' since 1870. Some researchers proved that the 'tools' were formed by stratum pressure, frost and other physical factors and not by man. With this result the debate calmed down in the first decades of the century, and the eoliths were not mentioned by the archaeologists until recent times, when the problem was revived, though in a somewhat altered form. The eolith-problem was once more taken up and some specialists were inclined to refer, at least in theory, to some pebbles as tools.

From what stage of development is a pebble to be called a tool—and until what limit is it a 'pseudo-tool'? There are sites, where the two are found together. Among others Krüger, Linder and Feustel wrote about the typology of pebble-tools, the difference between pebble-tools made by man and produced by the forces of nature, while Cordier examined pebble-tools found in a closed layer, but could not make the above distinction, either (Cordier 1965:166). Gagnière at the same time found a closed layer, too, in the Baume-Bonne cave, and he could make a clear distinction between the two pebble types (Gagnière 1959:233). Alimen arrived at a similar result in his manual (Alimen 1965:46).

Pebble-tools were made with high technical and aesthetical skill, surprising the researchers of our times with their simple, yet practical features.

Pebble-tools are special variants of the stone age implements, and they have attracted the attention of the researchers for a long time. The reference contains the books and articles which published the pebble-tools of the different sites (Hugot 1955, Kretzoi and Vértés 1964, 1965, Gábori-Csánk 1968a-b, Okhladnikov 1972, etc.). Some authors write about a culture or a cultural zone containing pebble-tools (Sen 1957, Ramendo 1963, Biberson 1968, etc.). Some studies deal with the role of pebble-tools in a geographical zone (Ranov 1970a-b, Abramova 1972, etc.). Some authors examine the function of pebble-tools with the help of striking traces or elevations visible on the surface of the object (Ranov 1970a, Shchelinsky 1972, Korobkova 1972). Lastly the names, terminology of pebble-tools can be found first of all in studies by Movius and Bordes (Movius 1957, Bordes 1971).

Lately industries belonging possibly to the most ancient man (*Homo habilis*) have been reported from Africa, Asia and Europe. These tools were made usually not of flint but from volcanic or sedimentary rocks; they are called 'Pebble Culture' ('Civilisations à galets aménagés'). This means also that the expressions 'Pebble Culture' or 'Civilisations à galets aménagés' used by the majority of researchers do not denote pebble-tools of different ages but cover only the oldest phase of Palaeolithic technique.

In Africa the tools of the undoubtedly identified 'pebble industry' are connected with the *Australopithecus*. As *Australopithecus* was found together with tools, some researchers presume that one of the *Australopithecus* types had human characteristics.

Stone age cultures in Asia cannot be understood if we disregard pebble-tools. They are the most characteristic, most common objects of the Asian stone age. The pebble technique developed locally in Central Asia, Siberia and mainly in Southeast Asia, surviving from the Lower Palaeolithic until the Upper Palaeolithic and even into the Neolithic.

In America pebble-tools were widespread, surviving until the protohistoric cultures. In the New World, however, the stone age appeared much later than in the Old World.

Vaufrey noticed the oldest, Villafranchian trimmed pebbles in Europe in 1951 (Vaufrey 1951:162). The existence of pebble-tools/pebble industries has since then been proved on the territory of several European countries, especially in France. 'Galets aménagés' is the commonly used expression of the technical literature, and the results of the excavations of the last years have broadened our knowledge concerning the oldest man in Europe.

The existence of the oldest man is proved first of all by pebble-tools, which are represented in most of the European countries by the characteristic types of choppers, chopping-tools.

*

Though the expression 'Pebble Culture' and 'Civilisations à galets aménagés' and even the word 'culture' were not accepted by the Burg-Wartenstein conference in 1965, they still can be found even in recent studies.

What does 'Pebble Culture' denote really? Some authors group here only tools made of pebbles; according to others the oldest tools, even if made of different raw materials belong here.

In this study we use the expression 'Pebble Industry' instead of 'Pebble Culture'. So the concept of Pebble Industry contains and comprises not only the oldest industries, but also those using pebbles in different ages.

As it is known the pebble-tools are the most important items of the Siberian Upper Palaeolithic and the Asian Mesolithic, Early Neolithic. Series of sites, civilizations yielded tool assemblages containing nearly exclusively pebbles. They are the ones to be called 'Pebble Culture' with respect to the raw material as well as to technocultural and traditional connotation. We think, however, the expression 'Pebble Industry' more useful. The concept of pebble industry cannot really replace the names of cultures of different ages using pebbles as raw material (e.g. Soanian, Olduvaiian, Pontiniano, etc.). The expression pebble industry seems to be more justified than Pebble Culture, as it is a comprehensive notion, containing civilizations and sites of different ages, characterizing the raw material and the technology of the find assemblages. It covers, as we have already mentioned, cultures of various features from different ages and territories.

Some studies, especially in the French technical literature, often make a distinction between the 'first industries' ('les premières industries'), their sites and the Lower Palaeolithic Cultures ('les civilisations du paléolithique inférieur') (Alimen 1965:7, de Lumley, 1976a-b, etc.). Though the problem of the oldest tools is not yet settled, we think it illogical that the oldest pebble industries and tools should be separated from the Lower Palaeolithic finds. In this case, namely, a new age should be put in before the Lower Palaeolithic, and the triple classification of the Palaeolithic.

The above theory by Alimen and others could be supported only by the fact that the oldest pebble industries cannot be fitted into the classical, so far accepted sequence of European cultures. It is actually only the frame of the Lower Palaeolithic that shifted to more remote times and no change can be noticed, for example in the system of economy. More clearly: there is practically no dividing line between the 'oldest pebble industries' and the Lower Palaeolithic.

The research of the pebble industries faces several obstacles during the classification and systematization of the implements. Therefore the first part of the study will give a short introduction of classificational systems of different scientists. The next part will describe the main diffusion areas of pebble-tools in Europe, containing also the sporadic finds. Then the most important, stratigraphically dated, European sites of the pebble industries will be introduced in chronological order. We shall write about the development, the conservatism, the local features of pebble industries and also their relation to other cultures, as well as their origin in Europe, based on the so far obtained data.

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I Classificational methods of pebble-tools

Pebble-tools are undoubtedly tool types which are most difficult to be classified. The problems of the classification of pebble-tools are rooted in the variability of their form, the complexity of type definitions, the difficulty of defining the function and lastly in the conservatism of the tools. It is no wonder that similar pebble-tools have different names on different geographical territories. In practice the words we use for tool types indicate usually the function, though no real function is actually supposed by them. Vértés was correct in saying: "We cannot tell if prehistoric man used the tool, separated by us as a type, really for a definite purpose, the fulfilment of a certain type of working process" (Vértés 1965b:45).

During the last years some researchers defined the various functions of the pebble-tools on the basis of the traces of usage on the surface of the tools (Ranov 1970b, Shchelinsky 1972, Korobkova 1972). This, however, is not as easy as that, and it cannot be considered as an ultimate classification.

Researchers often say that two main methods of describing pebble-tools can be found in the up-to-date technical literature. Archaeologists dealing with the Asian find materials investigate first of all the original form of the pebble, the position of the cutting edge as compared to the longitudinal axis of the pebble and the characteristics of the elaboration of the cutting edge (Movius 1944, 1948, Lal 1956, Paterson and Drummond 1962). Archaeologists dealing with African finds (Biberson 1961, 1968, Alimen and Chavaillon 1962, Ramendo 1963) base their classification on the technique of manufacture instead of the form of the pebble and the position of the cutting edge. We think that there is a slight difference between the methods of researchers dealing with African or Asian pebble-tools, but this difference is not to be considered as a rigid, absolute one, as not all the African pebble-tools can be classified on the basis of the technique of manufacture, and, vice versa, not all the Asian pebble-tools can be classified starting from the form of the pebble and the cutting edge. Movius himself wrote that "the terminology used throughout this paper to describe the archaeological material from Eastern Asia and Northwestern India is based entirely on the form and technique of manufacture of the tools themselves. These rather than any hypothetical functions, are considered to be primary criteria" (Movius 1948:349). Similar thoughts were put on paper by Paterson and Drummond as well (Paterson and Drummond 1962:48, 106).

The classificational systems of the pebble-tools vary according to the personal ideas of the authors. So we shall describe only some major systems used for pebble-tool

classification on the three great geographical territories: Asia, Africa and Europe. The order was granted by the history of systematization of the pebble industries.

The Asian pebble industries are known from the 20s of our century. The three main expressions, 'choppers', 'chopping-tool' and 'hand-adze' were used for the first time in the classification of the tools of the Soanian culture by Movius in 1944 (Movius 1944:10-11). Movius' terms are generally accepted. In his work "The Lower Palaeolithic Cultures of Southern and Eastern Asia" published in 1948 the author describes already four large type groups in the part on the Palaeolithic cultures of Northwestern India: choppers, chopping-tools, flake-tools and cores (Movius 1948:377-379). Besides he used other terms like 'hand axe', 'proto-hand axe', 'scraper', 'hand-adze', 'pick-shaped tool' for the classification of the Javanese Patjitan, the Burman Anyathian, etc. cultures (Movius 1948:355, 366, 371). The criteria of the further classification by Movius are the size of the cutting edge, the number of the cutting edges, their form, and partly the technique of manufacture.

Another classificational method was elaborated for Asia by Lal who in 1956 grouped the tools of the Guler site (Punjab) into six groups:

(A) Facial chopper. The group can be separated into four types according to the form and position of the cutting edge: AI—straight, AII—crescentic, AIII—fan-shaped, AIV—lateral;

(B) Bifacial chopping-tool. The group can be subgrouped into two types according to the position of the cutting edge: BI—one part of the edge is manufactured; BII—the whole cutting edge is manufactured;

(C) Pebble hand axe;

(D) Hand axe (DI—Abbevillian hand axe, DII—Acheulean hand axe?);

(E) Core (EI—discoid, EII—non-discoid);

(F) Flakes (FI—unretouched Clactonian, FII—retouched Clactonian, FIII—oval proto-Levalloisian, FIV—proto-Levalloisian, elongated type).

Another classificational system is given in the pebble-tool grouping of Soanian industry by Paterson and Drummond (Paterson and Drummond 1962:54-58). According to them the Soan civilization consists of three main groups: tools, cores and flakes. They classify the tools into three groups, which are divided into further smaller ones:

(A) Flat-bases

1. Soanian type: trimming on the end;
2. Soanian type: unidirectional trimming;
3. Soanian type: bidirectional trimming;

(B) Oblates

4. Soanian type: arched;
5. Soanian type: pointed;

(C) Nucleates

6. Soanian type: unidirectional;
7. Soanian type: multidirectional;
8. Soanian type: tortoise-core shaped tool.

The Soanian cores belong to the following subtypes: pebble core, asymmetrical core, biconical core, proto-biconical core, spindle-shaped core, proto-tortoise core, tortoise core and discoid core.

In the followings two classificational systems of the Soviet research will be presented.

Ranov dealing with Central-Asian Palaeolithic gives the classificational system of the Central-Asian Mousterian pebble industries. The tools, he holds, can be separated into four groups according to the position of the cutting edge as compared to the longitudinal axis of the tool: transversally edged, longitudinally edged, curved edged and atypical tools. These groups can be divided into ten smaller ones. He chose the form of the cutting edge as a criterium of type discrimination: convex, straight, oblique, and concave edges. Other criteria are the striking platform of the tool and the angle of the cutting edge (Ranov 1870a:232). The following figure shows the scheme of systematization of the Kara-burun pebble-tools, set up by Ranov (Fig. 1).

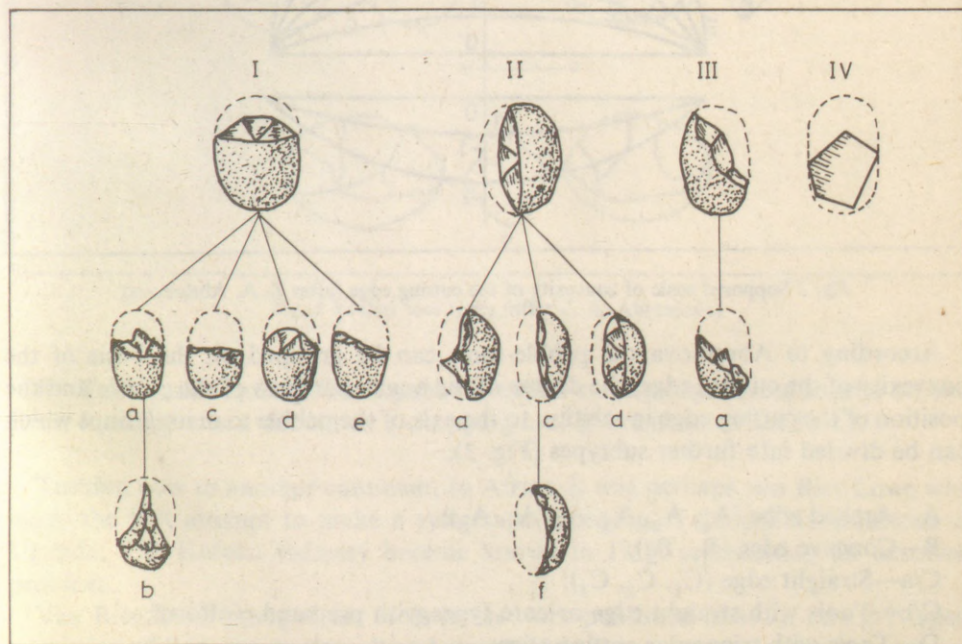


Fig. 1 Basic typology of Kara-burun pebble-tools. I—transversally edged, II—longitudinally edged, III—curved edge, IV—atypical; a—point, b—pebble-hand axe, c—straight edge, d—convex edge, e—oblique edge, f—concave edge (after V. A. Ranov)

Another researcher, Abramova sets up the following criteria for classification of the Upper Palaeolithic pebble-tools of the Yenisey region: the form of the cutting edge, its related position to the longitudinal axis of the pebble, the degree of the angle between the pebble surface and the flaking surfaces. According to the author the cutting edge can be classified with the help of a supposed extent scale of the convexity of the cutting edge (Fig. 2). According to Abramova the average width of the cutting edge of the Yenisey pebble-tools is 10 cm. This gives the diameter of the arch which can be divided into equal units (degrees) per centimetres. The arches above the diameter can be indicated by a plus sign, showing the convex cutting edge, which does not overstep the 3rd arch. Similarly, the arches below the diameter can be given a minus sign showing the concave edge, which does not go lower than the 1st arch. The straight edge corresponds to the '0' (zero) arch (Abramova 1972:126).

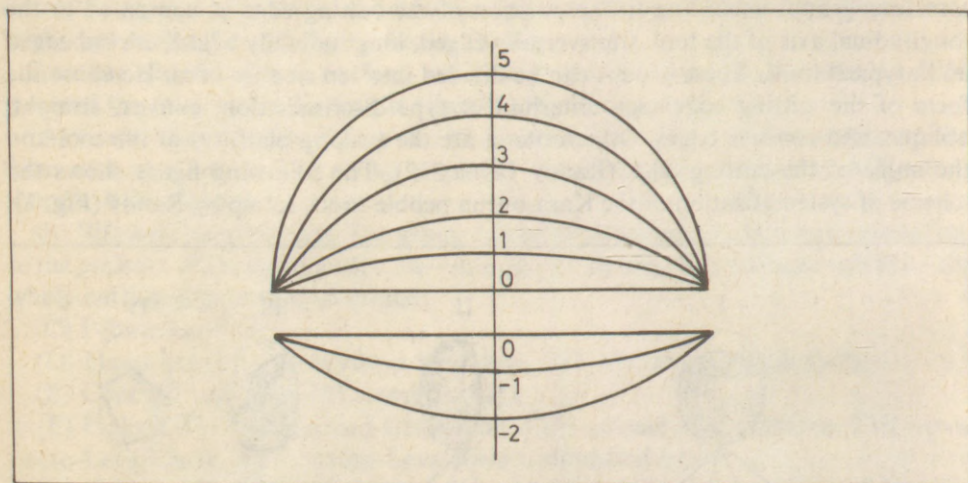


Fig. 2 Supposed scale of convexity of the cutting edge (after Z. A. Abramova)

According to Abramova the pebble-tools can be grouped on the basis of the convexity of the cutting edge, the degree of the angle, the form of the pebble and the position of the cutting edge in relation to the axis of the pebble to main groups which can be divided into further subtypes (Fig. 3):

- A—Arched edge ($A_1, A_2, A_3, A_4, A_5, A_6$);
- B—Concave edge (B_1, B_2);
- C/a—Straight edge (C_1, C_2, C_3);
- C/b—Tools with straight edge or core types with prepared platform;
- D—Tools with triangular cutting edge;
- E—Tools made from globular pebbles, trimmed along the largest diameter, manufactured on this platform with centripetal trimming;

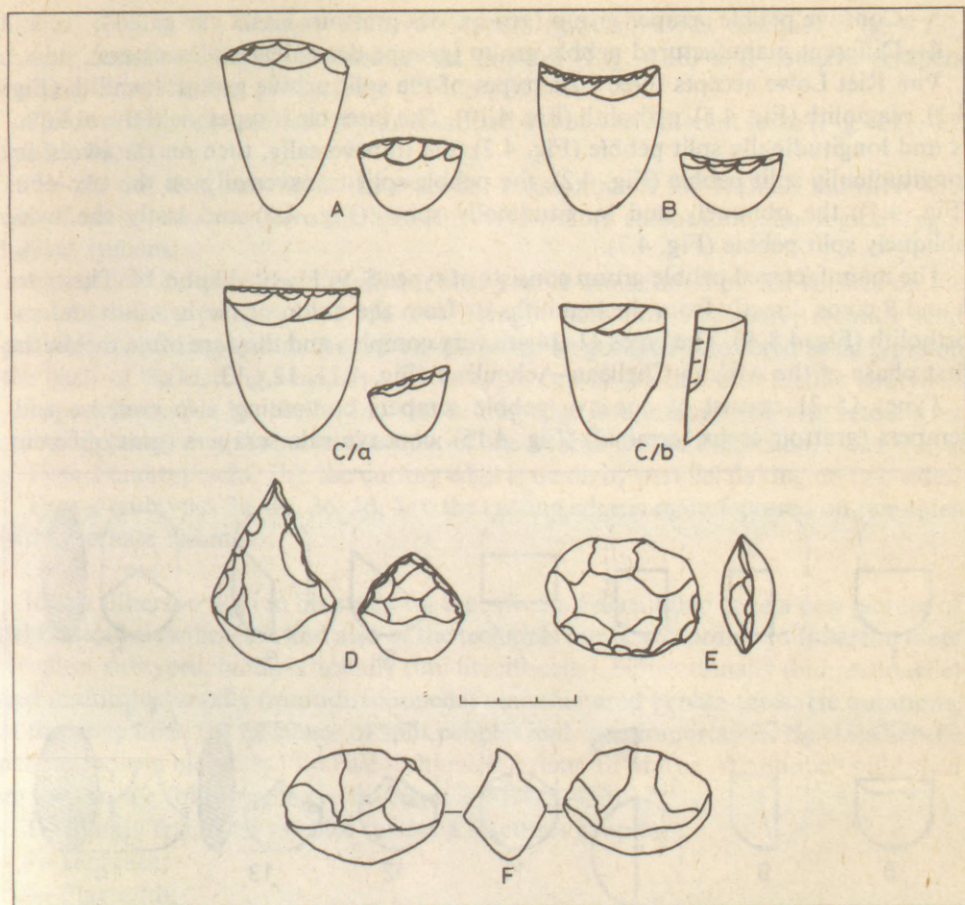


Fig. 3 Yenisei tool types (after Z. A. Abramova)

F—Tools made from globular pebbles, with a cutting edge manufactured on two sides; formally it is a discoid or a chopping-tool (Abramova 1972:126–137).

Turning now to another continent, to Africa, it was perhaps van Riet Lowe who made the first attempt to make a systematic grouping of the pebble industries of Uganda. The Kafuan industry became known in 1919, representing an unsolved problem.

Van Riet Lowe grouped the tools in his work published in 1952, into 2-7 types, consisting of four groups (van Riet Lowe 1952:113):

- 1—Split pebble group (groupe des galets fendus);
- 2—Manufactured pebble group (groupe des galets taillés);

3—Concave pebble scraper group (groupe des grattoirs creux sur galets);

4—Different manufactured pebble group (groupe des galets taillés divers).

Van Riet Lowe accepts three basic types of the split pebble group: hemilith (Fig. 4.1), plagiolith (Fig. 4.5), ortholith (Fig. 4.10). The three clear types yield the obliquely and longitudinally split pebble (Fig. 4.2), the transversally, then on the two sides longitudinally split pebble (Fig. 4.2), the pebble split transversally on the two ends (Fig. 4.4), the obliquely and longitudinally split (Fig. 4.6) and lastly the twice obliquely split pebble (Fig. 4.7).

The manufactured pebble group consists of types 8, 9, 11, 12, 13 and 14. The types 8 and 9 come directly from the hemiliths or from the union of the hemilith and the ortholith (Fig. 4.8, 9). The types 11–14 are very complex and they are often met in the first phase of the African Chelléan–Acheuléan (Fig. 4.11, 12, 13, 14).

Types 15–21 consist of concave pebble scrapers containing also concave end-scrapers (grattoir creux terminal) (Fig. 4.15), concave side scrapers (grattoir creux

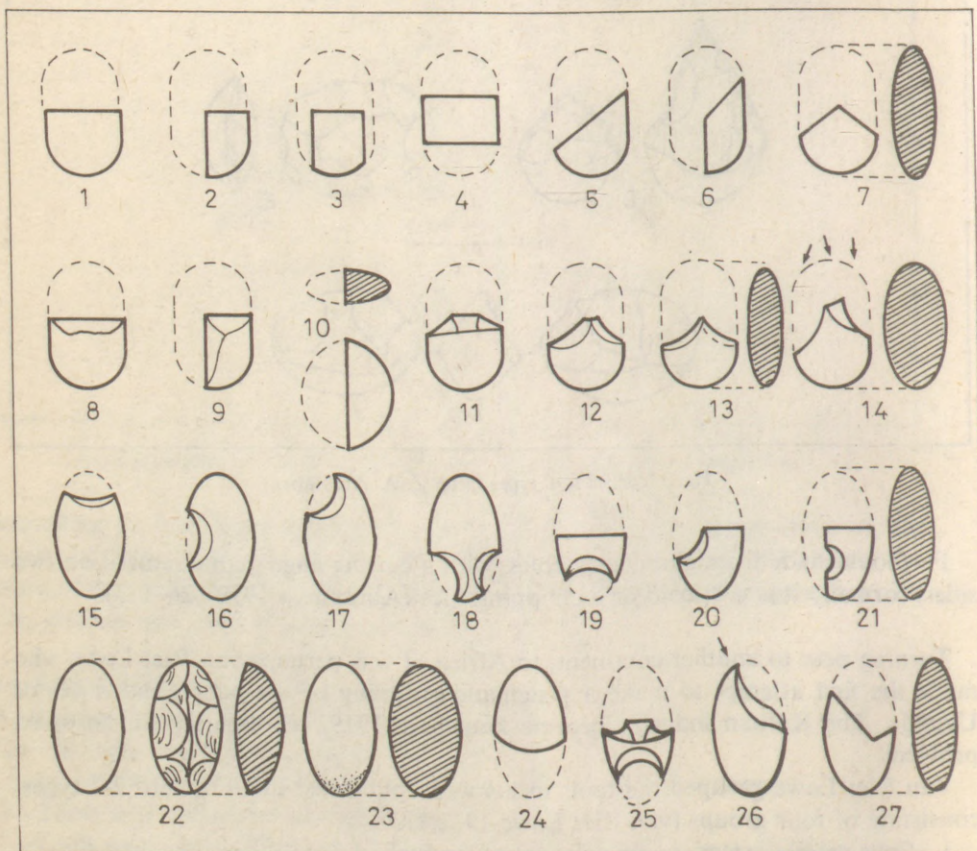


Fig. 4 The Kafuan split and manufactured pebble types (after C. van Riet Lowe)

latéral) (Fig. 4.16), oblique concave scrapers (grattoir creux oblique) (Fig. 4.17), double concave scraper (grattoir creux double) (Fig. 4.18) and concave scrapers coming from the first group (Fig. 4.19, 20, 21).

The fourth group consists of manufactured pebbles of different form (Fig. 4.22, 23, 24, 25, 26, 27).

We do not deal now with the essential estimation of the Kafuan industry, this classification, anyhow gave the basis for other, more elaborate technological–typological systems.

Hugot in 1955 gave the classification of pebble-tools found on the surface on the Aoulef territory (Hugot 1955:136–144). Hugot does not, any more, mention split pebbles. According to him the pebble-tools can be grouped into three basic types on the basis of the cutting edge, and all the types can be divided into further subtypes.

Type 1 (subtypes 1a, 1b, 1c, 1d): the cutting edge is manufactured with retouch on one side, preserving the natural cortex of the pebble on the other side.

Type 2 (subtypes 2a, 2b): the cutting edge is made by parallel flaking on two sides.

Type 3 (subtypes 3a, 3b, 3c, 3d, 3e): the cutting edge is manufactured on two sides with alternate flaking.

Other types.

It was Biberson who in his study on the African Palaeolithic gave a new picture of pebble-tool classification and also of the technical terms. According to Biberson there are three subtypes: unidirectionally (unidirectionelle), bidirectionally (bidirectionelle) and multidirectionally (multidirectionelle) manufactured pebble-tools. He questions, at the same time, the existence of split pebbles and their importance. He classifies the pebble-tools in his study “Le Paléolithique inférieur du Maroc Atlantique” published in 1961 in the following way (Biberson 1961:413–433):

1—Simply fractured pebbles (galets à fractures simples)

- Hemilith;
- Plagiolith;
- Ortholith;

2—Unidirectionally manufactured pebbles (galets à taille unidirectionelle);

- Pebble with one flaking (galets à un seul enlèvement);
- Unifacial chopper (tranchoir uniface), pebble point (galet appointi);
- Pebble of stepped fracture (galet à fracture ‘en gradins’);
- Pebble trimmed on one side (galet épannelé sur une seule face);

3—Bidirectionally manufactured pebbles (galets à taille bidirectionelle);

4—Multidirectionally manufactured pebbles (galets à taille multidirectionelle).

Besides we can get acquainted from Biberson’s study with different types like bifacial tools made of pebbles (bifaces sur galets), trilaterally manufactured pebbles (triedre sur galets), pebble cleavers (hachereaux sur galets).

Biberson, Balout and Tixier grouped the Ternifine pebble-tools into four categories accompanied by typologies in their paper read at the Congrès International des Sciences Préhistoriques et Protohistoriques in 1966 (Fig. 5):

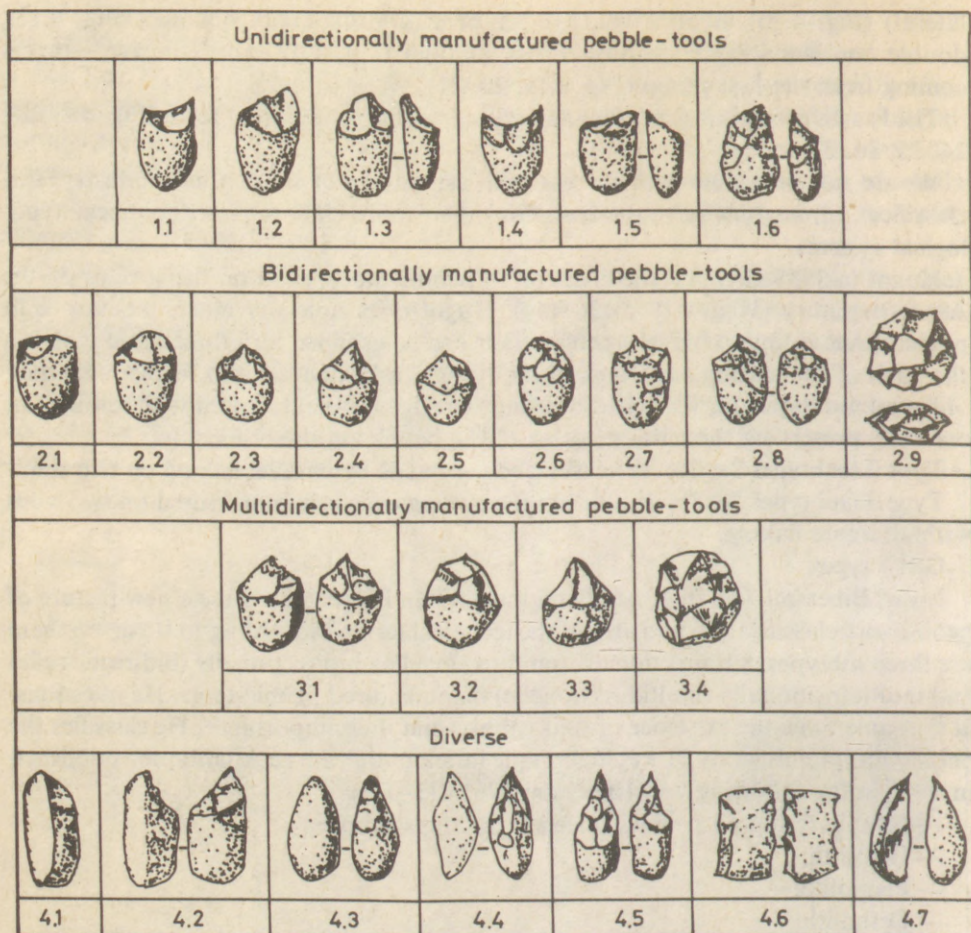


Fig. 5 Typology of the Ternifine pebble-tool types (after L. Balout, P. Biberson and J. Tixier)

Series I: unidirectionally manufactured pebbles (1.1, 1.2, 1.3, 1.4, 1.5, 1.6);

Series II: bidirectionally manufactured pebbles (2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9);

Series III: multidirectionally manufactured pebbles (3.1, 3.2, 3.3, 3.4);

Series IV: others (4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7) (Balout, Biberson and Tixier 1970:55-256).

Biberson published another interesting study in 1968, which contains the basic forms of the African pebble-tools, and an interesting method of their description (Biberson 1968). The author mentions here 64 examples of the African pebble-tools, grouping them into three series:

Series I: unidirectionally manufactured pebbles (I.1-I.8);

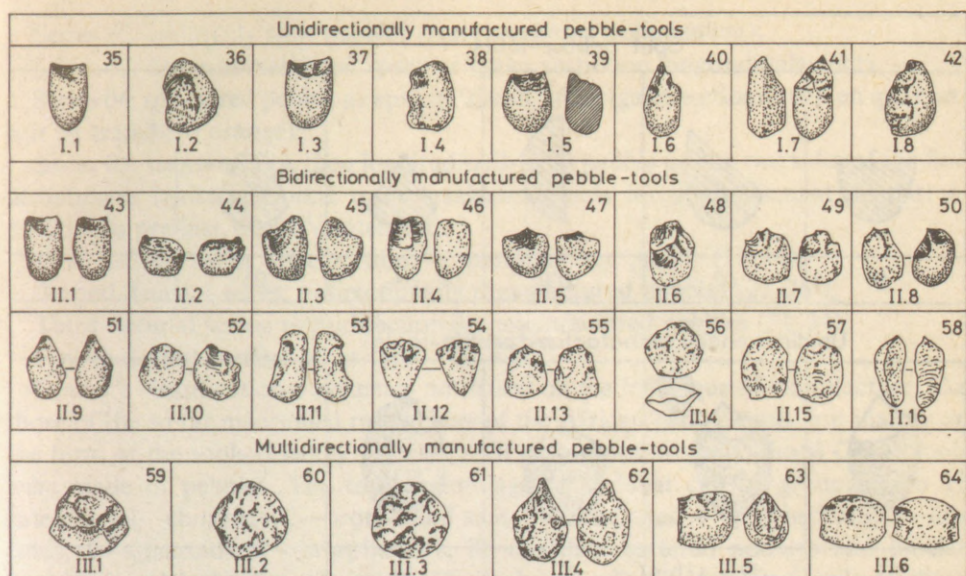


Fig. 6 Basic pebble-tool types of Maghreb and the Sahara (after P. Biberson)

Series II: bidirectionally manufactured pebbles (II.1–II.16);

Series III: multidirectionally manufactured pebbles (III.1–III.6) (Fig. 6).

Biberson is willing to make the classification of the pebble-tools simpler. He says, one should attempt a systematic and exact description, rather than give different names to the different types of the pebble-tools, as their function is usually no more than guesswork (Biberson 1968:1).

We have to mention Alimen and Chavaillon from among the researches of the African pebble-tools, who published their classificational system in 1962 (Alimen and Chavaillon 1962:5–6). According to them pebble-tools consist of the following types:

Type (A): simply split pebbles (galets simplement fendus);

Type (B): pebbles split on one side (galets aménagés par des enlèvements pratiqués d'un seul côté);

Type (C): split pebbles, posteriorly manufactured on the surface of detachment (galets fendus, puis aménagés par des enlèvements pratiqués à partir de la surface d'éclatement);

Type (D): pebbles flaked on alternate sides (galets à enlèvements alternés);

Type (E): pebbles retouched by flaking, then split (galets aménagés par enlèvement, puis fendus).

The above categories can be divided into subclasses according to the number of elevations: one, two, three or more detachments. All the subclasses contain types with cutting edge (type bord-tranchant), point types (type pointée), point type combined with cutting edge regarding the form of the applied part of the tool.

Split pebble-tools					
					
01	02	03	04	05	
Unidirectionally manufactured pebble-tools					
					
11	12 12 bis	13	14		
Bidirectionally manufactured pebble-tools					
					
21 21bis	22	23 23bis	24	25	26 26bis
Multidirectionally manufactured pebble-tools					
					
31	32	33	34		

Fig. 7 Ramendo's typology of pebble-tool types

We have to mention Ramendo's study. His classificational system does not differ basically from the previous ones (Ramendo 1963:50-52) (Fig. 7).

Series 0: split pebbles (from 01 to 05);

Series 01: horizontally split pebbles (galet sectionné dans le sens horizontal);

Series 02: obliquely split pebbles (galet sectionné obliquement);
Series 03: longitudinally split pebbles (galet sectionné longitudinalement);
Series 04: quartered pebble or split in 'zitron' form (galet sectionné soit en quartier, soit en tranche d'orange);

Series 05: transversally, then longitudinally split pebble on the two sides of the first detachment (galet sectionné transversalement, puis longitudinalement de part et d'autre du premier plan d'éclatement);

First decimal series: unidirectionally manufactured pebble (11-14);

Second decimal series: bidirectionally manufactured pebbles (21-26^b);

Third decimal series: multidirectionally manufactured pebbles (31-34);

Fourth decimal series: other types (41, 42).

Leakey's classificational system is not based on the technique of manufacture, like those of the so far mentioned researchers of the African pebble-tools, but mainly on the form of the tools (Leakey 1971:4-7). Of course not all the Olduvai Gorge tools were made of pebbles. The tool assemblage of Olduvai can be grouped into 13 categories: 1—choppers, 2—proto-hand axes, 3—hand axes, 4—polyhedrons, 5—discoids, 6—spheroids, 7—subspheroids, 8—modified battered nodules and blocks, 9—scrapers, 10—burins, 11—awls, 12—scaly manufactured tools (outils écaillés), 13—laterally trimmed flakes.

Some categories can be divided into subtypes. E.g. the choppers: a—side-choppers, b—end-choppers, c—two-edged choppers, d—pointed-choppers, e—chisel-edged choppers, or e.g. the hand axes: a—irregular oval hand axes, b—trilateral hand axes, c—double-pointed hand axes, d—smooth or quadrate end-hand axes, e—cleavers, f—picks, oblongs, g—picks from bulky hand axes, e.g. the scrapers: a—end-scrapers, b—side-scrapers, c—discoid scrapers, d—circular scrapers, e—nosed scrapers, f—concave scrapers.

Let us now turn to Europe. Regarding the classification of the tools the researchers of the European pebble industries stand close to those of the Asian ones. They often use technical terms denoting the form and the function of the tools in their classificational systems, but the classificational schemes, the type-schemes are rarely published. It seems that Krüger's, Vértes' and Zotz's and Freund's schemes are the only ones to be found.

Krüger grouped the Oberhessen pebble-tools into the following types in his work published in 1959 (Fig. 8):

- 0—pebble with traces of trimming (Geröll mit Schlagmarken);
- 1—pebble with cutting edge (Geröll mit Schneidscharte);
- 2—pebble with cutting point (Geröll mit Schartenspitze);
- 3—pebble with notched edge (Geröll mit Kerbe);
- 4—pebble with blunt nose (Geröll mit stumpfer Nase);
- 5—horizontally halved pebble (Waagrecht halbiertes Geröll);
- 6—pebble quartered at right angles (Rechtwinklig gevierteltes Geröll);
- 7—diagonally halved pebble (Diagonal halbiertes Geröll);

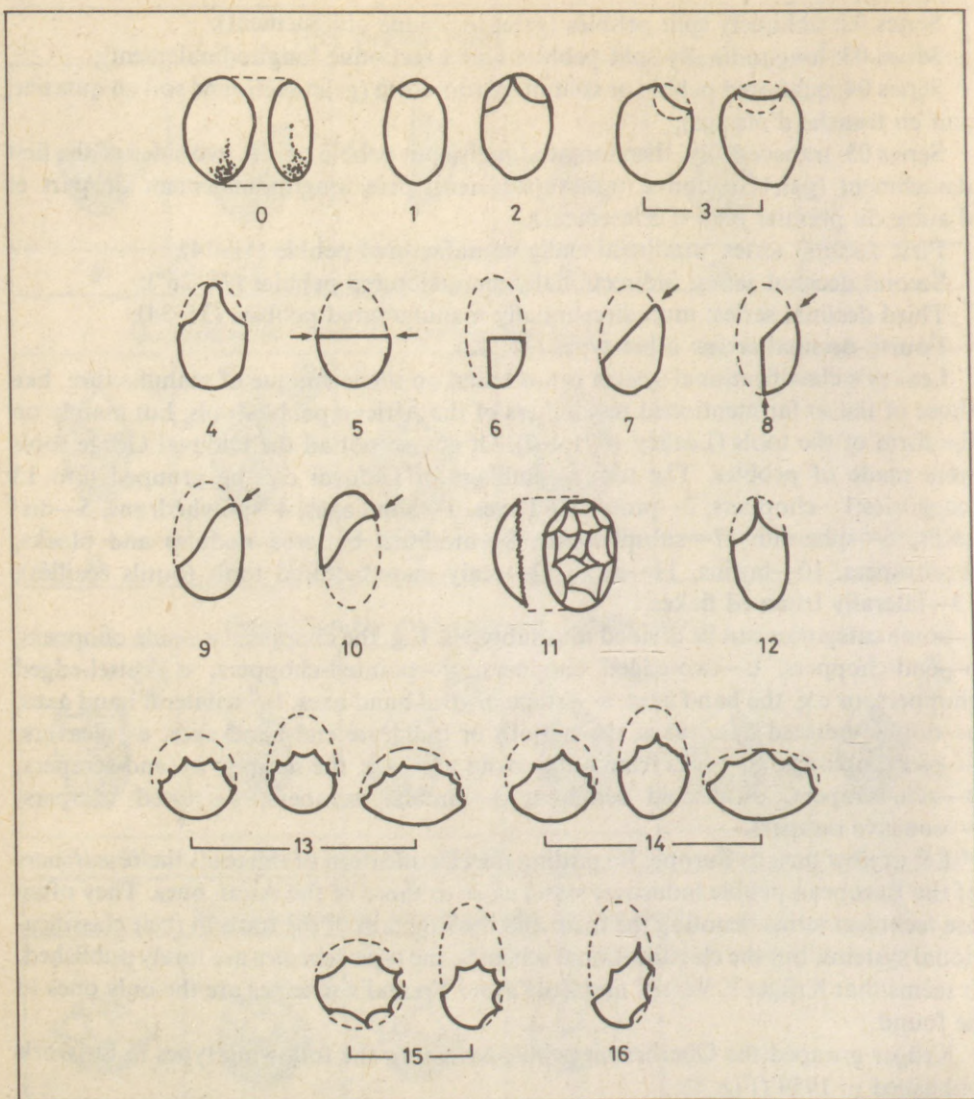


Fig. 8 Typology of the Hessen pebble-tools (after H. Krüger)

- 8—diagonally quartered pebble (Diagonal geviertes Geröll);
- 9—diagonal tool (Diagonal Gerät);
- 10—diagonal flake (Diagonal Abschlag);
- 11—lamellar pebble (Scheibenförmiges Geröll);
- 12—bilaterally notched tool (Zweiseitig gekerbtes Geröll);

13—chopper with a cutting edge (Chopper mit Schneiden);

14—chopper with point (Chopper mit Spitze);

15—polygon;

16—point (Spitze);

So—other forms;

A—flakes (Abschlagscherbe).

Vértes first of all gave in his study on the Buda culture the criteria of type definition:

a—the definition of type is to comprise the majority of attributes,

b—the system must be flexible enough to accomodate new types recovered from new excavations,

c—the system must be adequate to describe other pebble industries as well,

d—the system must be fit for statistical calculations, perhaps for computer programs as well (Vértes 1965a:186).

Afterwards Vértes divided the find material into five groups, which 'groups' contain, however, different parameters (Figs 9 and 10).

Group A shows the original raw material (1–9),

Group B indicates the form of the tools (0–9),

Group C shows the nature of the trimming (0–9),

Groups D–E show the tool types (1–40),

Groups F–G show the possible forms (retouched varieties of all the types) (1–30) (Vértes 1965a:186–190).

The author gave at the same time the list of the Vértesszőlös tool assemblage consisting of 86 types (Vértes 1965a:190–193).

Dobosi carried on Vértes' work and published the Vértesszőlös find material. Dobosi divided the tools of the settlement into two great groups, standardized and non-standardized tools. The standardized tools consist of 49 types, the non-standardized tools can be grouped into 14 types. All the types comprise several subtypes.

Vértes' and Dobosi's classificational system and nomenclature is basically identical. It contains the terms 'chopper' and 'chopping-tool' used first by Movius and introduced words like 'chopper-chopping-tool combination', 'chopper-scraper combination' and also 'hemilith', 'ortholith', 'plagiolith' definitions used by the African pebble industry researchers. One can meet words denoting form and function like 'bifacial', 'pyramidal', 'hand axe' 'piercer', 'burin', 'scraper' and combined definitions like 'crescentic scraper', 'flake-scraper'. There are also culture indicating expressions like 'Mousteroid point', 'Tayac point', 'Clactonian flake', etc.

Researchers dealing with the Italian pebble industries often use familiar expressions for the pebble-tools like 'simply split pebble', 'spheroid', 'chopper', 'chopping-tool', 'flake', 'core', etc. (Palma di Cesnola and Zorzi 1961:291–344, Bianchini 1969:171–180, etc.).

The majority of the French technical literature on pebble industries uses general expressions of tool types: 'chopper', 'chopping-tool', 'pick', 'burin', 'denticulated tool', 'core', 'percuteur', 'scraper', 'end-scraper', etc. Sometimes one can meet tenden-

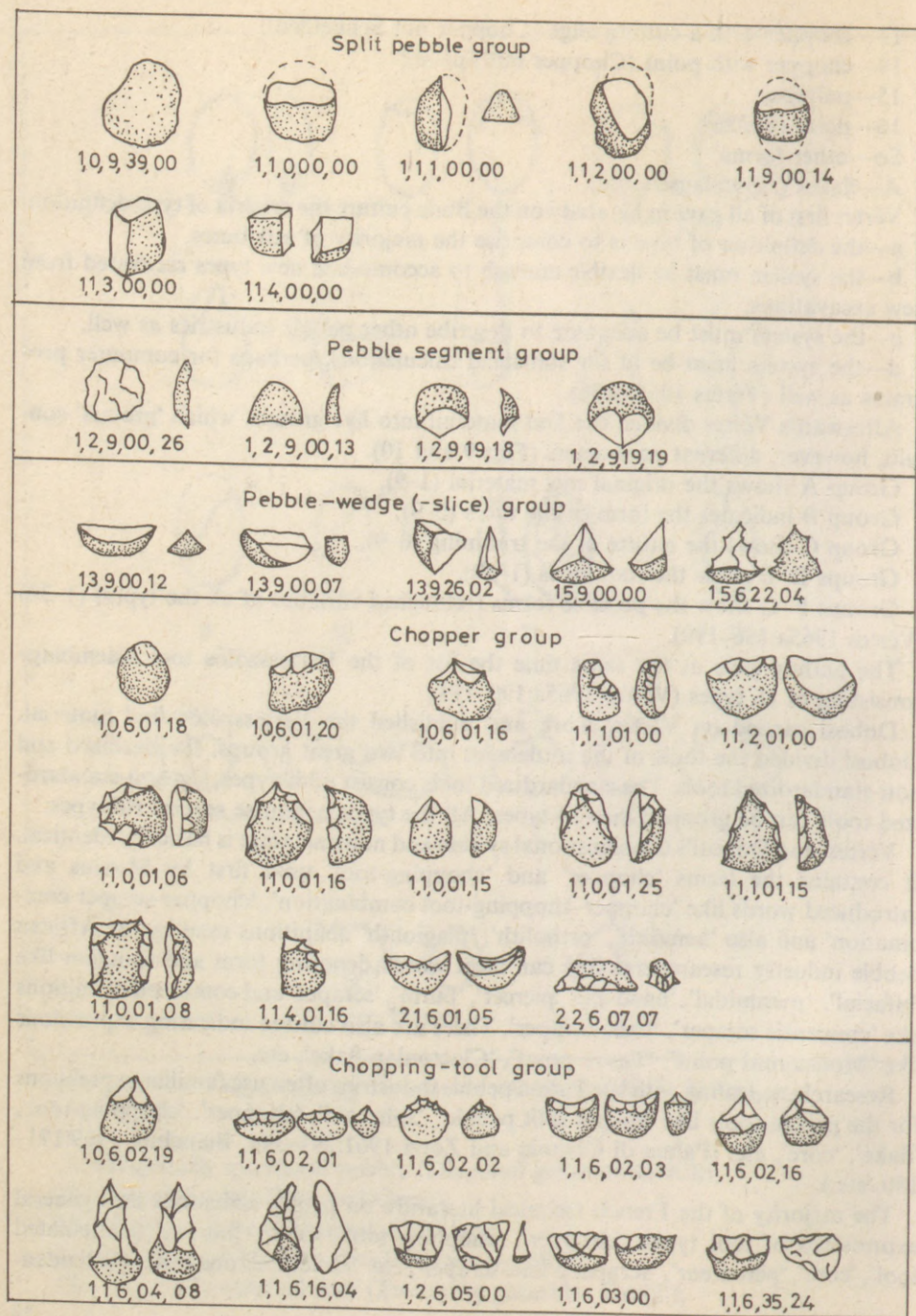


Fig. 9 Pebble-tool types of the Buda culture (after L. Vértés, 1965a: 188)

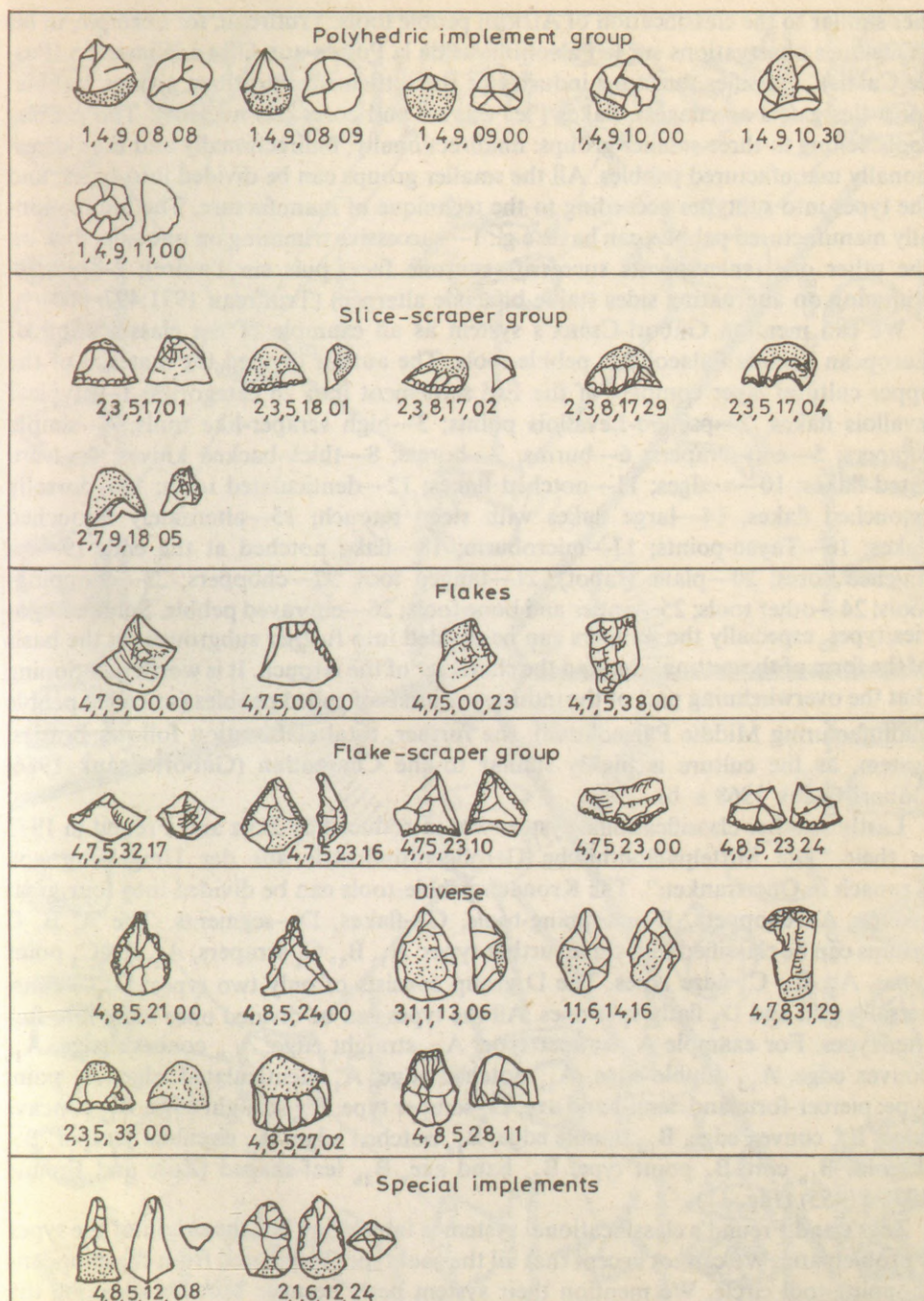


Fig. 10 continued from Fig. 9 The pebble-tool types of the Buda culture (after L. Vértés, 1965a: 191)

cies similar to the classification of African pebble tools. Truffreau, for example, in his "Quelques observations sur le Paléolithique de la Pointe-aux-Oise à Wimereux (Pas-de-Calais)" classifies the stone industry of the settlement into three groups: pebble-tools (les galets aménagés), flakes ('les éclats') and cores (les nucléus). The pebble-tools belong to three smaller groups: unidirectionally, bidirectionally and multidirectionally manufactured pebbles. All the smaller groups can be divided into types, and the types into subtypes according to the technique of manufacture. The bidirectionally manufactured pebbles can have, e.g.: 1—successive trimming on one side, then on the other one (enlevements successifs sur une face, puis sur l'autre); 2—bifacial trimming on alternating sides (taille bifaciale alternée) (Truffreau 1971:497–500).

We can mention Gábori-Csánk's system as an example of the classification of European Middle Palaeolithic pebble-tools. The author divided the material of the upper cultural layer complex of the Érd settlement into 26 categories: 1—atypical levallois flakes; 2—pseudo-Levallois points; 3—high scraper-like tools; 4—simple scrapers; 5—end-scrapers; 6—burins; 7—borers; 8—thick-backed knives; 9—truncated flakes; 10—wedges; 11—notched flakes; 12—denticulated tools; 13—dorsally retouched flakes; 14—large flakes with steep retouch; 15—alternately retouched flakes; 16—Tayac-points; 17—microburin; 18—flake notched at the end; 19—retouched cores; 20—plane (rabot); 21—tanged tool; 22—choppers; 23—chopping-tools; 24—other tools; 25—antler and bone tools; 26—engraved pebble. Some categories/types, especially the scrapers can be divided into further subgroups on the basis of the form of the cutting edge and the character of the retouch. It is worth mentioning that the overwhelming part of the industry consists of rolled pebbles (so-called pebble manufacturing Middle Palaeolithic); the further, total elaboration follows Bordes' system, as the culture is highly similar to the Charentian (Gábori-Csánk 1966, Gábori-Csánk 1968 a–b).

Lastly another classificational system was introduced by Zotz and Freund in 1973 in their "Die Mittelpaläolithische Geröllgerätindustrie aus der Umgebung von Kronach in Oberfranken". The Kronach pebble-tools can be divided into four great groups: A—choppers, B—chopping-tools, C—flakes, D—segments. The A, B, C groups can be classified into three further types: A₁, B₁, C₁ scrapers, A₂, B₂, C₂ point types, A₃, B₃, C₃ adze types. The D group consists of only two types: D₁—transversally split and D₂ flatly split ones. All the types can be divided once more into further types. For example A₁ scraper type: A_{1a} straight edge, A_{1b} concave edge, A_{1c} convex edge, A_{1d} double edge, A_{1e} notched edge, A_{1f} denticulated edge. A₂ point type: piercer-form and demi-hand axe; D₁ scraper type: B_{1a} straight edge, B_{1b} concave edge, B_{1c} convex edge, B_{1d} double edge, B_{1e} notched edge, B_{1f} circulate scraper, B_{1g} discoid, B_{1h} core B₂ point type: B_{2a} hand axe, B_{2b} leaf-shaped (Zotz and Freund 1973:51–55) (Fig. 11).

Zotz's and Freund's classificational system is interesting but the origin of the types is problematic. We cannot accept that all the tool types originated from the chopper–chopping-tool circle. We mention their system here, because broadly speaking the

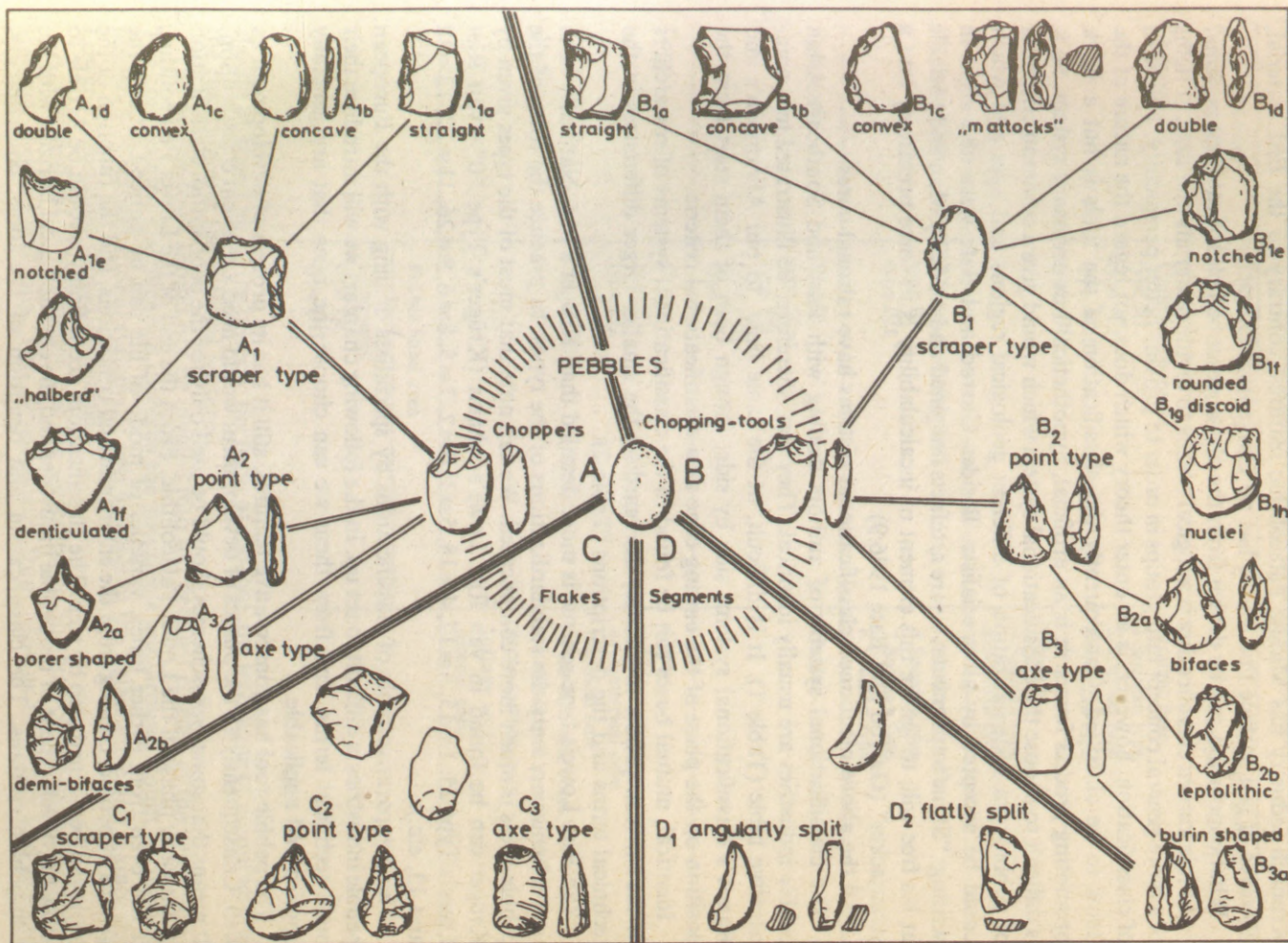


Fig. 11 Typology of the Kronach pebble industry (after E. F. Zotz and G. Freund, 1973)

Kronach industry has Middle Palaeolithic features; contrary to the Érd material, however, it is a surface find and it has no Charentoid character.

What conclusion can be drawn from the above described classificational systems?

As it is known classification is a logical means to divide materials and data or items of a more general concept into groups in order to provide better perspicuity. The basis of classification, however, is an outer theory which does not regard the nature of the items to be classified. Consequently the classification of the tools is but a work promoting process for us. It is an artificial, hypothetical but necessary system. So it is difficult to choose the classificational system which would give a common criterium of pebble-tool systematization of different geological regions and ages and which could be accepted by all specialists. Besides Garrod and Bate were also right in writing: "Stone implements: . . . are artefacts imagined and made by Man and variable at his free will; to ignore this element of incalculability is to force prehistory into a straitjacket" (Garrod and Bate 1946:9).

All the above-mentioned classificational systems have rational cores.

The classificational systems of authors dealing with East and Southeast Asian pebble industries are usually identical. They can, therefore, be illustrated in a comparative table (Table 1). It is difficult, at the same time, to put Abramova's and Ranov's classificational systems side by side, though both of them start from the position on the place of the cutting edge as a classificational criteria.

Identical, mutual bases can be found in the classificational systems of researchers of the African pebble industries, disregarding the smaller larger differences in the technical terms and the descriptions (Table 2).

Van Riet Lowe's type-scheme is more detailed than Krüger's one. Naturally both type-schemes are only the standardizations of the types. In practice the form of the pebble-tools is much more complicated. We can note that most of the types given by Krüger can be found in van Riet Lowe's scheme (Krüger's Type "0" = van Riet Lowe's Type 25; 1 = 15, 3 = 17, 4 = 18, 5 = 1, 6 = 2, 7 = 5, 8 = 6, 9 = 26, 11 = 22, 12 = 12 and 13, etc.).

The comparative table of classifications by specialists dealing with the European pebble industries is difficult to set up. In the following chapters we will introduce their main technical terms, and from them we can choose the ones that are generally applied and applicable.

The pebble-tool has conservative features, still it has its process of development as well. Consequently all the phases of development would need a relevant classification. It means that some type-schemes should be used only for the pebble-tool classification of the early phase of the Lower Palaeolithic. From the end of the Lower Palaeolithic, if not even from earlier times, varieties of mode of life can be noticed among the groups of people, coming from the environmental conditions, and the function of the tools can be defined step by step. The classification, accordingly, should be flexible to show the development of the pebble industries and the chronological horizon with the non-pebble cultures. The classification and denotation of the tools, consequently,

Table 1 Comparative table of different classificational systems

Movius (1948)	Lal (1956)	Paterson and Drummond (1962)
Choppers	Unifacial choppers: type AI type AII type AIII type AIV	Straight base: 1 Soanian type 2 Soanian type 3 Soanian type
		Oblates: 4 Soanian type 5 Soanian type
Chopping-tools	Bifacial chopping-tool: type BI type BII	Core-shaped tools: 6 Soanian type 7 Soanian type 8 Soanian type
Flake-tools	Flakes: type FI type FII type FIII type FIV	Flakes
Cores	Cores: type EI type EII	Cores: pebble-core asymmetrical core biconical core proto-biconical cores spindle-shaped core proto-tortoise core tortoise core discoid core
	Pebble hand axes	
	Hand axes: type DI type DII	

should be based on all the criteria: the form of the tool, the technique of manufacture, the function and the cultural features.

The pebble-tools should not be divided into too detailed classes, at the same time. The complicated classification disturbs the specialists and arouses doubt. A mutual tendency of classificational systems of pebble-tools of the Palaeolithic and mainly the Lower Palaeolithic should be simple.

A well-defined development can be observed in the list of the classificational systems, methodologically. This development, from Movius to Vértés and Dobosi

Table 2 Comparative table of different classificational systems

Hugot (1955)	Biberson (1961)	Alimen and Chavaillon (1962)	Ramendo (1963)
	Simply fractured pebble hemilith plagiolith ortholith	Type A: simply split pebbles	series 0: split pebble series 01 series 02 series 03 series 04
Type 1 1a 1b 1c 1d	Unidirectionally manufac- tured pebbles	Type B: Unidirectionally trimmed pebbles	First decimal series: unidirectionally manufac- tured pebbles (11-14)
Type 2 2a 2b	Bidirectionally manufac- tured pebbles	Type C: split pebbles posteriorly manufactured on the sur- face of elevation	Second decimal series: bidirectionally manufac- tured pebbles (21-26b)
Type 3 3a 3b 3c 3d 3e		Type D: alternately trimmed pebbles	
	Multidirectionally manu- factured pebbles	Type E: pebbles retouched by trim- ming, posteriorly split	Third decimal series: multidirectionally manu- factured pebbles (31-34)
Other Types	pebble-hand axe tridirectionally manufac- tured tools pebble-adzes		Fourth decimal series: different types rostricaréné tridirectionally manufac- tured tool

shifts from the simpler to the more complicated. Pursuit of truth results in the 'division' of types, of course not a real one, and it is not by chance that it happened in the case of the pebble-tools.

II Main distribution area of pebble-tools in Europe

Finds evidencing the existence of the earliest man can be found nearly everywhere in Europe, except for Scandinavia and the northern part of the Soviet Union. Pebble-tools, the most characteristic types of which are the choppers and the chopping-tools were found in Portugal, Spain, France, Italy, Austria, Germany, Czechoslovakia, Hungary, Yugoslavia, Romania.

In the following we shall give a short geographical review of the main occurrences of the pebble-tools. Of course not all the finds to be mentioned belong culturally to the pebble industries, though in many cases the pebble-tools are among the constituents of the different cultures.

Portugal

The theory of some researchers on the existence of a 'Pebble Culture' older than the rest of the Palaeolithic industries in Portugal is so far only a hypothesis. All the pebble industries found on this territory are younger than the 'Pebble Culture' of Villafranchian age.

The Portuguese pebble-tools appear first with the Abbevillian. Most of the Abbevillian pebble-tools were collected on the surface, or from the seaside deposits and from the Mindelian sediments of the base of the 30 m high alluvial terraces (Zbyszewski 1976:7).

Choppers and chopping-tools were found near Lisbon and on the Estramadura coast at Caldas da Rainha and Foz do Arelho. The pebble-tools of Abbevillian age are known on the territory of Peniche, found in sediments of Thyrrhénian age. The pebble-tools at Ribamar, Ericeira, Açafora, Magoito and between Praia da Aguda and Areias (Cascais) were lying in coastal sediments of 'Sicilian' age. Hand axes, pebble-tools and flakes are known from the coastland of South Tage.

Pebble-tools belonging to the Abbevillian were found in the Thyrrhénian levels of the coast. Further settlements are lying on the left bank of the Tage on territories of Alpiarça and Muge, where the pebble-tools and the hand axes were found on the 50-60 m high terrace of the Casalinho. Similar tools occur in the base layer of the terrace of Quinta do Outeiro on the 30-40 m high Thyrrhénian terraces of Vale do Forno, Tojal da Caqueira, Alto do Freixo and Vale da Atela, in the sediments of the 30 m high base terrace of Marinhais, Gloria, Corte dos Dois Irñaos and in Magos

area. Also pebble cores and some other tool types were found in the valleys of Guadiana and Caia on the territory of Elvas.

According to Zbyszewski there were three local centres of raw materials in Portugal during the Abbevillian: silex raw material at Lisbon, small-sized pebble raw material on the Estramadura coastland and large-sized pebble raw material on the terraces of the southern territories (Zbyszewski 1976:101).

The above prove that the pebble industries were widespread on the territory of Portugal, but they are not pure, and their age is various and questionable.

Spain

Two kinds of pebble industries are known in Spain: find assemblages belonging to cultures found on open-air settlements, and those found in caves.

Pebble-tools were noticed on this territory first of all in old, marine sediments, found in circumstances which did not help their exact dating. Later Breuil described two settlements from the territory of Cádiz county: Taivilla and Tapatanilla. Their find materials consist of two different raw material groups: sandstone and silex. The tools made of sandstone comprise unifacially manufactured pebbles, bifacially manufactured pebbles, retouched and not retouched flakes. According to Breuil the two settlements date from the Chellean (Abbevillian).

Several Mousterian age levels have been distinguished among the older layers of the Castillo Cave in Cantabria. The tools of the first layer belong to the Mousterian of Quina type, and just like the ones of the Pontiniano industry, they were made of small-sized pebbles (Bordes 1968:120).

Viguié collected pebble tools on the 175 and 135 m terrace levels of the Guadalquivir river between Brenes and Lora del Rio in North Carmona. The first tool series were found on the 170–180 m high terrace between Brenes and Lora del Rio. The finds were lying on the surface. The find assemblage consists of 20 quartzite tools and two flakes. The ones made of quartzite consist of 13 chopping-tools, 4 choppers, 1 inverse chopper, 1 core and 1 flake. The industry is classified, on the basis of technological and typological observations, to the advanced 'pebble culture' known on the territory of the Moroccan Casablanca and Rabat (Bordes and Viguié 1969:1946).

The other site was found on the 130–140 m high terrace in Lora del Rio. The industry consists of only 8 pieces: bidirectionally manufactured pebbles, rough scrapers, trimmed pebble fractures.

Pebble-tools were found in fossil soil west of Guadalete near Puerto de Santa Maria. The industry consists of 16 pieces: 5 chopping-tools, 4 choppers, flakes. According to Bordes and Viguié the material can be dated to Mindel and belongs probably to the Upper Villafranchian (Bordes and Viguié 1969:1948).

We mention Cau del Duc de Torroella de Montgrí, Pau and Reclau-Viver caves from among the cave sites of the Spanish pebble industry.

The Cau del Duc cave is situated near Ulla in the Montgrí mountains, and it was first visited by Rossell Vilá and Pericot in 1917. Excavations were carried out by Pallarés and Pericot in 1922. The fauna of the site is composed mainly of *Equus caballus*, *Capra* sp. and *Cervus* sp. remains. The majority of the tools were made of quartzite, the minority of silex. Tools made of flakes are much rarer than those made of pebbles (25%–75%). Scrapers, points, knives, chopping-tools, choppers, picks, adze-shaped tools, denticulated tools, flakes, Levallois flakes, blades and cores can be found in the industry. Ripoll-Perello and de Lumley classified the find material to the classical Mousterian and dated it to the first phase of the Würm (Ripoll-Perello and de Lumley 1965:31). The find material will be described in detail in the next chapter.

Mollet cave, discovered in 1943, excavated in 1947 and 1958 lies near the Cau del Duc de Toroella de Montgrí. A Mousterian industry of non-Levallois technique was unearthed in the Würm 1–2 layer of the site, the tools of which were made from quartz (64.25%), quartzite (26.38%), silex (9.36%). This industry cannot be grouped among the pebble industries, it is worth noting, however, that a part of the tool assemblage of the cave was made of pebbles (14.5%).

Some pebble-tools were unearthed as well in the Pau cave on river Serinyadell, some hundred metres from the Mollet cave in 1943. They are a double convex scraper, two transversal convex scrapers, a transversal straight chopper and a chopping-tool (Ripoll-Perello and de Lumley 1965:16).

Lastly we mention the Reclau-Viver cave, which is another entrance of the Pau cave, and where two Middle Palaeolithic pebble-tools, a pick and a transversal convex chopper were uncovered (Ripoll-Perello and de Lumley 1965:16).

We must mention that the list of the Spanish pebble-tool sites is far from complete, probably much more of them are known, but the technical literature is inaccessible.

France

Bordes wrote in his "Typologie du Paléolithique ancien et moyen" in 1961 that the choppers and the chopping-tools, which according to the author are tools made of pebble or silex inclusions, "...ne manquent nullement dans tout le Paléolithique inférieur et moyen français, plus ou moins rares, persistent dans le Paléolithique supérieur français, et nous ne serions pas étonné si l'on en signalait dans le Néolithique" (Bordes 1961:47).

Pebble-tools can be found nearly everywhere in France, and a remarkable quantity of them has been gathered. The French technical literature gives only the review of the discovery of pebble industry on a given territory or of a given site and its research. There does not exist a complex summary and analysis as yet.

Pebble industries can be found on the following territories of France: Provence, Rhône Alps, Tarnbasin, Garonne basin, Loire-Valley, the northwestern territory, Lorraine-Alsace and especially in Languedoc and Rousillon.

Vallonnet cave at Menton is one of the most important sites of the French pebble industries. Its importance lies first of all not in the quantity of the tools but rather in its stratigraphy, fauna and dating. The site was first investigated by Pascal in 1958, then it was excavated by Barral and Iaworsky in 1959, and it has been excavated by de Lumley since 1962.

The layer series of the cave is not thick, it is only 1.5 m. The remains of the marine transgressional level has been preserved at the bottom of the layer series. After the retreat of the sea level, the terrestrial deposits of the Upper Calabrian filled the cave nearly totally. Its lowermost levels can be dated from the Villafranchian (de Lumley, Gagnière, Barral and Pascal 1963:8). The fauna of the Vallonnet cave belongs, according to the publication, to the Upper Villafranchian.

Flakes, choppers, chopping-tools and 'rostracarénés' were found in the lowermost Pleistocene layer of the cave. The tools were made of pebble, their manufacture is beyond doubt. Besides, trimmed bones have also been discovered. Some authors hold that the industry of the Vallonnet cave is contemporary with phase III of the pebble culture known on the Atlantic coast of Morocco (de Lumley, Gagnière, Barral and Pascal 1963:18). Its absolute dating is 900–950 000 years (de Lumley 1976a:768). The site will be described in detail in the next chapter.

Another important site, also in southeast France near Nice is Terra Amata. The site was discovered and first excavated by Iaworsky. Later excavations were carried out by de Lumley in 1966.

The open-air Terra Amata site contains three marine gravel layers, separated by downsand and covered with terrestrial layer series. 21 layers could be counted during the excavations in 1966, several of which yielded traces of human settlement. The sandy beach yielded an industry containing choppers, chopping-tools, proto-hand axes, pebble hand axes, cleavers ('hachereaux'), scrapers, Tayac-points, picks. The industry of the downsand layers is somewhat different from the previous ones. There are more chopping-tools in it, and flake tools can be found as well.

The fauna of Terra Amata is very rich. De Lumley dated the layers of the settlement from the very end of Mindel (de Lumley 1966:38), while others place the layers between the end of the Mindel–Riss and the Riss II (Bonifay 1975:205). The detailed description of the site will be given in the next chapter.

Lazaret cave is known from the works by Octobon and de Lumley (Octobon 1955:33–124, 1956:3–78, 1958:3–84, 1961:9–91, de Lumley 1969). It cannot be stated that the find material of the Lazaret should belong to the pebble industries. Our attention, however, was attracted by the high ratio of the pebble-tools (13–26%). The cave is in Nice in the side of the Boron hill. The first excavations were carried out by Rivière, Octobon, then de Lumley worked here for years.

The Levallois technique is weak—the index of the scrapers is high, the number of tools of Upper Palaeolithic type is small, there are relatively more hand axes: 5.3%. According to de Lumley the development of the Acheulean tool assemblage of the Lazaret cave can be characterized by the decrease of the percentage of hand axes

(almond-shaped, smooth 'flake'-shaped) and the quantitative increase of the typologically more developed hand axes (cordiform, spear-shaped) (de Lumley 1976c:834). According to Bonifay the age of the site is unilateral: the marine sediments of the basic layer of the site can be dated either to the very end of the Mindel or the first interstadial of the Riss (Bonifay 1975:204).

Pebble-tools were found on the surface of the terrace of Entressen dated from the Günz (Ferme du Vallon site), on the surface of Brays or Crau de Saint-Pierre-de-Vence dated from the Mindel (Coustières de Malacercis site), and also on sites Castel (Salon-de-Provence), Samatane (Saint-Martin de Grau) and Term-Est (Salon-de-Provence). According to de Lumley most of the collected finds are inapt for age determination, though striking similarity can be discovered between them and the tools from Costière du Gard and the Mindel ones of Rousillon (de Lumley 1976a:775).

Eight levels of the Quaternary terraces can be defined between Mees and Oraison in the valley of the Durance. The sites of the pebble industries were found on the highest levels, the Ruffe and the Brigadel terraces, and also on the Bois-Saint-Martin terrace. Two tool series can be found here: the older series (Ruffe and Brigadel terraces) contains choppers, polyhedrons and some flakes, and it belongs to the Lower Pleistocene (Dubar 1975). The younger series, Ruffe, Brigadel and Bois-Saint-Martin, can be dated to the beginning of the Würm (de Lumley 1976a:770).

Pebble-tools were found on several spots of the Riez-Valensole plateau. They can be grouped into two series of different age: the Lower Pleistocene and the Riss (de Lumley 1976a:771).

A rich pebble industry was discovered on the Fouillouse terrace as well. There are more choppers here than chopping-tools (e.g. the ratio of the choppers is 76%, that of the chopping-tools is 14% on site Chapouiller). Some of the well elaborated hand axes are covered with thick cortex. An important characteristic of the Acheulean site is that the hand axes and cleavers ('hachereaux') made of flakes can also be found beside the pebble-tools (Brochier 1976:876-877).

According to Bourdier most of the Palaeolithic industries in Bas-Dauphiné used quartzite and limestone pebbles (Bourdier 1962:368). Geyffier found quartzite cutting-tools on the southern edge of Bièvre near the medieval castle of Bressieux. Later Bourdier, Bourgon and Barbier collected pebble-tools at the mouth of Bièvre-Valloire (near Saint-Vallier). A 'couperet' made of quartzite pebble was found in northwest Agnin in 1961 on the occasion of which Bourdier wrote his opinion on pebble manufacturing industries and the 'Pré-Abbevillian' (Bourdier 1962:367-370).

Let us now turn to the right bank of the lower Rhône. Several sites of the pebble industries have lately been found on the surface of Costière du Gard. Such are Garrigue in Générac, Mas Goulin-Mejanelles and Château-Barnier in Caissargues, the northern Cadenette, Pin de Candiac and Saint-Véran I and II in Vestric Candiac, Rompude in Beauvoisin, Mas d'Arnaud in Vergèze, Bois des Orgnes in Montfrin.

Split pebbles, choppers, picks, chopping-tools, proto-hand axes, polyhedrons, flakes and cores characterize the great quantity of tools of the sites.

The tools of the territory are usually made of the quartzite pebbles of the Alpine region. The sites lie on different levels. According to some researchers the ratio of the choppers is higher in all the levels than that of the chopping-tools. These levels belong to the Günz and the Mindel (de Lumley, Collina-Girard, Abelanet, Bazile and Meignen, 1976:779).

Valat des Marchands is a small tributary in the Valliougues valley. Several archaeological sites of different ages are situated on this territory, among others site Jean Thomas where stone tools were found in 1971. Several layer horizons have been unearthed on the site (A_p , Bt, Bca_1 , Bca_2 , Bca_3), the industry was found in horizons Bca_1 and Bca_2 . The flakes are small, short, thick, often preserving the original cortex of the pebble. Cores can often be found. The ratio of the scrapers is not high ($I_{Ress} = 26.4$); there is no Mousterian point. On the other hand, there are many denticulated tools. The tools of Upper Palaeolithic type, especially those made of pebbles, are frequent. According to Bazile the industry of Jean Thomas is close to Mousterian with denticulated tools and can be dated to the Pre-Würm (Bazile 1972:276).

Mas des Caves cave is situated 1 km northwest of Lunel-Viel near Montpellier. The first tools were found here in 1925, systematic excavations were carried out in 1966–67. 13 different layers could be observed in the 4.5 m thick layer series of the cave. The fossil fauna is very rich and perfectly preserved. It contains first of all *Equus*, *Cervus*, *Rhinoceros*, etc. The industry is not too rich. Pebble-tools dominate the material beside the finely manufactured tools. Some of them are made of silex, the rest of quartzite. The find material can be placed in the Mindel–Riss interglacial on the basis of stratigraphy, fauna and the features of the industry (Escalon de Fonton 1968:472, Bonifay 1968:46).

Excavations were carried out in the Aldène cave from 1971. Two different industries can be found in the cave: a relatively advanced industry consisting of Levallois type silex flakes—the other tool assemblage is composed of pebble-tools, characterized by ‘micro-quartzite’ or quartz pebbles. According to Barral and Simone the industry of the upper layer of the Aldène cave is closely related to the Tayacian or the Proto-Charentian industries of Caune de l’Arago, while the industry of the lower layer belongs to the older Tayacian (Barral and Simone 1972:65). The site will be introduced in detail in the next chapter.

Several pebble industries and sites are known on the southernmost territories of France, especially on the terraces of Roussillon.

Caune de l’Arago can be found near Perpignan, north of the Roussillon Plain, in the Eastern Pyrénées. The several metres thick Quaternary deposits of the cave consist of rough-grained sand. The excavations were started in 1964. The fauna is rich and well preserved. The stone industry, recovered from different levels of the site is very rich, belonging to the older Tayacian. The tools made of pebble, choppers, chopping-tools, some polyhedrons are the majority of the more than 100,000 objects unearthed

so far. The Tayacian type tools are made mostly of quartz, very rarely from silex and quartzite. The tools of the Middle Acheulean are usually made of schist with levallois technique. According to de Lumley and M. A. de Lumley there are some micro-choppers and micro-chopping-tools which they related to the industry of the Hungarian Vértesszőlős (de Lumley, M. A. de Lumley 1971:1470-1471, de Lumley 1976d:853-854).

The Roussillon Plain is bordered by the following territories: the Corbières mountains on the north, the Pyrénées on the west and the south, the Mediterranean on the east. The area is the watershed territory of three small rivers, the Agly, the Têt and the Tech, the banks of which are covered by Quaternary sediments yielding Palaeolithic sites. Pebble industries, grouped in three ages, were found on terraces of the lower and the Middle Pleistocene (de Lumley et al. 1976:785; Collina-Girard 1978:175). They are the following:

The first one is dated from the end of the Günz. Industry series linked to the end of the Günz can be found on the Lower Pleistocene terraces, and contain the following tool types: choppers (38%), chopping-tools (30%), atypical 'épannelés' (10%), discoids (8%), polyhedrons (10%). The sites are Mas Ferrer, Mas Saint-Thérèse near Cabestany, Mas Mester at Canohès, Mas Galtes, Mas Auriol at Perpignan, Gourg and Oums at Baixas.

The second one is from the beginning of the Mindel. The industry series are lying in the Middle Pleistocene terraces (Butte du Four) and contain the following tool types: choppers (25%), chopping-tools (29.5%), 'épannelés' (9%), discoids (2%), polyhedrons (14%). The sites can be found in the valley of the Têt (Butte du Four, Corneilla-la-Rivière) and of the Tech (Valmagne Boulou).

The third one is dated from the end of the Mindel. The industry series are situated in the second and third terraces of the Middle Pleistocene. The percentage of the choppers in this series is very high (46%), the ratio of the chopping-tools decreases (19%), that of the 'épannelés' grows to 19%, the percentage of the polyhedrons is 10%, and some hand axes can also be found. The sites of the series are Mas Romeu (at Saint-Estève), Coll de la Guille, Llabanère.

Collina-Girard groups the pebble-tools of the Têt terraces into six basic types in her last publication: choppers, chopping-tools, 'épannelés', discoids, bifacial pieces (hand axes and bifacoid tools) and polyhedrons. The most important type groups are the choppers, the chopping-tools and the 'épannelés'. The author writes that the choppers are represented in higher percentage in the industries of the terraces of the Llabanère (Coll de la Guille, Llabanère and Mas de Romeu sites) dated to the end of the Mindel than the chopping-tools. The ratio is the opposite in the case of the Butte du Four terrace (Butte du Four, Rodès and Ternère) and on the sites near Cabestany dated to the end of the Günz and the beginning of the Mindel (Collina-Girard 1978:172-175).

River Fresquel, the tributary of Aude, runs between Castelnaudary and Carcassonne. On its terraces the finds of the 'Pebble Culture' (Günz), the advanced Abbevil-

lian (end of the Mindel), the Tayacian and the Premousterian (Riss) have been collected. Choppers and chopping-tools were found on the Rivoire terrace on sites Grazaillies (Carcassonne) and Rivoire (Pennautier). Also choppers and rostro-carénés were found on the Saint-André terraces on sites Bois des Castelles (Villepinte), Saint-André (Lasbordes) (Tavoso 1968-1969:112). An industry consisting of 40 choppers, 8 chopping-tools, 3 picks, 15 polyhedrons, 4 flakes and 4 cores dated from Mindel II, was found on site Labastide d'Anjou. The tools were made of the quartzite pebbles of the Noire mountain.

Some sites containing pebble-tools can be found on the territory of the upper Garonne as well. The Mauran site is situated 60 km from Toulouse in the valley of the Garonne. Eight cultural levels can be detected on the site, yielding the finds of a hunters' camp. The pebble-tools represent the majority of the implements (Tavoso 1976c:1040).

Pebble-tools, choppers, chopping-tools and other types have been unearthed in some caves of the Montmaurin mountains.

Finds dated to the end of the Lower Pleistocene or the beginning of the Middle Pleistocene were found in the highest gravel level of the terrace of the Garonne in Lomagne. Choppers and chopping-tools made of quartz and quartzite pebbles compose the greater part of the material collected in the oldest terraces of the territory (Thibault 1976:800). Another important area of the French pebble industries is the immense territory between Dordogne and Agout.

Tools made of pebble play a significant role in the Acheulean sites of the terraces of the Tarn and the Agout. The oldest industries of the Tarn Valley are represented by the Older and the Middle Acheulean materials of the highest (Günz) and middle (Mindel) terraces of the Agout. Typologically the hand axes are dominating with 30%, many of which are covered by cortex. The ratio of the choppers, chopping-tools and polyhedrons is 56-63%. The flakes are usually large and the talons are nearly always covered by cortex (Tavoso 1976a:797).

Tavoso groups the sites into two stages of development:

Older Acheulean: approximately 10 very rich sites in Lavour and Saint-Paul-Cap-de-Joux. The sites can be dated to the end of the Mindel until the beginning of the Riss, except for some sites in the deposits of the Mindel terrace. The ratio of the pebble-tools is 56-62.7%. The percentage of the hand axes is 27.5-32.7%, 95.1% of which are covered by cortex. There are only a few, though typical cleavers ('hache-reaux'). Nearly all the flakes bear the traces of cortex. The ratio of the flakes without cortex is 2.5-7.9%.

Advanced Acheulean: the four most important sites are Giroussens, Lavour, Mas-sac and Damiatte. The ratio of the pebble-tools is 64.2%, 20.8% of them are chopping-tools, i.e. it is larger than in the first series. The ratio of the flakes covered by cortex grows (6.1%), the number of the hand axes is small (12.7%) (Tavoso 1976:899-901).

Several Acheulean series can be found in Mousterian find assemblages on the

middle and high terraces near Gaillac from Giroussen to Lagrave. The ratio of the hand axes is high in these series (23% in Cadalen, 24% in Ducrose), and there are many pebble-tools as well (56.3% in Cadalen). The find assemblages are rich in choppers (51.7% in Cadalen, 52.6% in Ducrose). The ratio of the chopping-tools varies between 4.6–12% (Tavoso 1976b:903).

Site Técou can be found near Técou, south of Gaillac, on the middle, Mindel terrace of the Tarn. The finds spread on a territory of several acres, 80 m higher than the present terrace of the Tarn. 184 of the 400 objects are tools. 51 of them are pebble-tools, 4 hand axes, 129 flake-tools, a 'protolimace' an elongated point, a Tayac point, a Quinson-point, denticulated tool, a core and flakes. Different points and scrapers can be found in the tool series of the Mousterian type group (32.3%). The Upper Palaeolithic type group comprises end-scrapers, burins, piercers, knives, knives with natural back, truncated flakes, notched flakes, denticulated tools, cleavers. According to Tavoso the industry of Técou belongs to two stages: the advanced Acheulean, i.e. Late Riss, and the Mousterian of Acheulean tradition (Tavoso 1972:142).

Camp sites can be found some kilometres from Montauban on a plateau of the tributary of the Tarn (Rieu-Tort and Fabas streamlets). Hand axes, pebble-tools (choppers: 19.3%, chopping-tools: 9.8%, polyhedrons: 3.8%), cores, picks, cleavers made of flakes, sometimes flake-tools and 1675debitage have been found here. Flakes with talons covered by cortex are dominating in the whole material (96.9%).

In South Montau, between Fabas and Fronton, the middle terrace yields the richest sites. Similar materials were collected from about 10 sites, containing 2510 large tools and half as many flakes. Approx. 70–78% of the tools were made of quartzite. The majority of the material consists of hand axes, semi-hand axes (hand axe + semi-hand axe + hachereaux = 55.3%), pebble-tools (32.3%), cores (12.3%), and flakes. The ratio of the flakes with talons covered by cortex is more than 80% (Tavoso 1976b:901, 903).

Site Chaubard can be found 5 km north of the valley of the Tarn on a hill formed during the Tertiary. Hand axes, pebble-tools were found in the upper layers. The pebble raw material was used first of all in case of hand axes. The site is dated to the end of the Mindel and the Early Riss (Tavoso 1973:104, 107).

The sites of the Lower and the Middle Palaeolithic can be found in the area between the Dordogne and the two valleys of the Lot as well as along the Lémance and its tributaries (Ménaurie and Nauze, on the plateaus of the Las Pélénos, Pronquière, Baillard, and Cabrol. The raw material of the tools is usually quartz, quartzite. The tool assemblages are rich in choppers and flake tools (Turg 1978:136).

An industry with pebble-tools and without hand axes was unearthed in the Early Riss layer of the Pech de l'Azé II cave, also in Dordogne (Bordes 1968:92).

Cave Fontéchevade plays an important role among the Palaeolithic sites of Charente from several aspects. The cave opens 2 km from Montbron above the small streamlet of the valley. The detailed stratigraphical analysis was carried out by

Henri-Martin in 1957. The large tools were made of blocks and of pebbles. The significant tools are the choppers, chopping-tools, rough scrapers and points (Alimen 1965:101-102). According to Debenath technologically the Levallois technique is overwhelming, while typologically the Tayacian industry of Fontéchevade can be characterized by the high ratio of the choppers and chopping-tools, the low ratio of the scrapers, the loss of hand axes and the great quantity of tools made of pebble (Debenath 1976:930). The age of the Tayacian layers of Fontéchevade (E_1 and E_2) is the Riss-Würm interglacial (Henri-Martin 1957, 1965).

Some sites of pebble industry can be found on the territory of Upper Loire, between Loire and Allier, as well. Guth presents some stone tools in a new publication, found in Chilhac in the Villafranchian layer of the Auvergne (Guth 1974). They are trimmed gneiss and quartzite pebbles found together with the remains of *Mastodon*, *Equus stenonis*. According to Delporte they may be the oldest tools in Europe, dated from approx. 1.8 million years (Delporte 1976:803). The find material will be described in detail in the next chapter.

Pié du Roi was unearthed near Chilhac. Legall and Carré collected series of trimmed pebble-tools belonging probably to the oldest phase of the Palaeolithic (Delporte 1976:803).

Pebble-tools were found in some other parts of the Loire Valley as well, such as 'Les Grouais' near Pezou (Loir-et-Cher), half a kilometre north of Chêne-Carré. Industries of Lower and Middle Palaeolithic were found on three sites between 1967 and 1971. The tools of the first two sites are rather atypical, while the third provided a relatively good series of pebble-tools. The industries can be dated with the help of alluvial deposits. The lower series were collected from the soil, the second from the upper level of the gravel layer, the third from the lower level of the alluvial gravel. The last find material contained pebble-tools, cores, well manufactured hand axes, scrapers, flakes, transversally split pebbles (Despriée and Lorain 1972:19).

The Lower Palaeolithic of Lorain is represented first of all by surface finds. The pebble industries were collected from the slopes of old alluvial deposits, like the terraces and plateaus of the Meuse, Moselle, Meurthe, Seille and Saône. This territory differs from the previous ones in the absence of the good quality silex and the abundance of quartzite raw material (Guillaume 1974:279). The western border of the diffusion of the industries is the Meuse basin; the eastern border is Achenheim site on the Alsac Plain, and the industries uncovered in the valley of the Rhine and the Moselle in Germany, especially those around Trèves. The southern boundary of the diffusion area is the Saône basin towards Franché-Comté.

The most significant pebble industry site of the Alsace territory is Achenheim. The layers were investigated by Wernert, and the levels became stratigraphical norms, phases. The raw material of the tools is schist, granite, rhyolite, sandstone, quartzite; silex is very rare. According to Wernert the oldest tool assemblage appeared in the Acheulean in the lower layer of the older sandy loess. The benched layers meet in a stepped way. There are trimmed pebbles, pebble fragments, scrapers, end-scrapers,

burins, choppers, points, unifacially manufactured tools, discoid cores to be found, characterized by Levallois technique. The Levallois technique renders the industry to the contemporary phase of the Acheulean, while the presence of the choppers groups the industry in the Clactonian (Wernert 1957:199). The older middle loess consists of 6 layers. The find material of the basic layer shows both typologically and technologically Tayacian and the beginning of Mousterian. The archaic pebble-tools and the Tayacian technique can be found in the industry (Mousterian) of the next five layers too, and the Levallois flakes also appear. The young loess yielded proto-Solutrean tools of Font Robert type. The age of the last loess formation can be placed on the end of the 'reindeer' age or in the Epipalaeolithic (Wernert 1955:245-246). The site will be discussed in detail in the next chapter.

Pebble industries are known southwest of Achenheim, in the Saône Valley. The industries of the Upper Acheulean are frequent along the Upper Saône and on the plateau between the Saône and the Ognon. Thévenin and Arnault published industries from this territory containing pebble-tools at least in 25% (Thévenin 1965). An important pebble industry site has been unearthed lately southwest of Bleurville village in district Monthureux-sur-Saône. The raw material of the tools is quartzite. The industry contains pebble-tools, hand axes, cores, flakes, Levallois points, Mousterian points, knives and scrapers. According to Huguenin the importance of the industry lies in the great quantity and typological variability of the tools (Huguenin 1978:456). The site will be discussed in the next chapter.

The surface finds of county Vosges can be found mainly on the terraces of the Moselle. Surface sites, published by Claude between 1966-1970, are situated on the right side of the Moselle, on the Al-Vosges plain between Epinal and Charmes. Such sites were discovered at villages, Haillainville, Girmont, Moriville, Rehaincourt and Zincoirt on the Quaternary terraces of the Moselle, 35-40 m higher than the present level. The main raw material is the quartzite pebble—over 90%. According to Claude and Guillaume all the cores were made of quartzite pebbles, the most frequent type was the discoid core. Technologically it is non-Levallois. There is no blade and Levallois point in the materials. The non-Levallois flakes are thick, often covered by cortex. There are some bifacially manufactured flakes and many debris. The choppers and chopping-tools are present in large quantity. Some Micoquian type almond-shaped, pressed cordiform hand axes, with cortex on the base, were found on sites Zincoirt Champ-de-Loup, Zincoirt La Sorrière, Girmont-Haut de Chèse, Moriville La Tuilerie. The Mousterian point is rare and atypical. The simple, convex and transversal convex scrapers are frequent, the straight and 'déjeté' scrapers are rare. Knives with natural back made of pebbles can also be found. End-scrapers are rare. The Upper Acheulean industry is poor in hand axes, rich in scrapers, developed until the Würm and turned into a slight Mousterian of Acheulean tradition (Claude and Guillaume 1971:70-74).

Tools made of pebbles have also been found on sites 'Au Champ-Masson' (Saint-

Baslemont), 'La Perrière' (Provençères), 'Bâtreau' (Thuilières), 'Liévau' (Lignéville) (Huguenin and Meunier 1972:167-170).

Janot, during the field survey of Art-sur-Meurthe-Lenoncourt highland, discovered surface sites containing 80% pebble-tools. The collected materials consist of choppers, chopping-tools and some proto-hand axes.

Site Lenoncourt (Meurthe-et-Moselle) is situated on the Mindel II terrace of the Meurthe. The pebble-tools were lying on the surface and they can be dated from the Mindel-Riss interglacial (Guillaume 1976:979, 982). Flavigny sur Moselle (Meurthe-et-Moselle) lies on the Premindel terrace of the Moselle, while Tonnoy (Meurthe-et-Moselle) can be found on the lowest Riss terrace of the Moselle valley. The industries consist of flakes, some scrapers and pebble-tools (Guillaume 1976:979, 982).

Pebble-tools appear also on territories near Metz. An almond-shaped Acheulean hand axe made of a quartzite pebble was found southwest of Metz as early as 1882 (Armbruster and Antoine 1955:467-477). The recent excavation of site Poirier d'Armenstein, in the same territory is even more important. The site was found on the 55-60 m high Quaternary terrace on the right side of the Seille, southeast of Metz, in the area of Grigy and Magny. The raw material of the tools is quartzite and quartz pebbles that can be collected from the banks of the Seille and the old alluvial deposits.

The collected find material consists exclusively of pebble-tools. Flake-tools are very rare (approx. 2%), they are made usually of quartzite and the talon can hardly be observed. Only 7 of the 120 flake-tools are of Levallois-technique.

Morin and Jacquemot grouped the Armenstein pebble-tools into the following types: choppers (with 25 subtypes), chopping-tools (with 5 subtypes), picks (with 2 subtypes), 'pebble-tools'* (with 5 subtypes), burins (with 2 subtypes), denticulated tools and notched tools (with 5 subtypes), cores, hammerstones, scrapers (with 4 subtypes), knives (with 2 subtypes) and points.

According to the authors the Levallois index is zero ($IL=0$), the hand axes are missing, the scrapers are rare, the notched tools are only slightly developed, while the ratio of the choppers, chopping-tools and chopper-cores is overwhelming.

The dating of the typologically highly characteristic material is uncertain; considering, however, the height of the terrace and the age of the terraces around Metz, the industry can be dated to the Mindel-Riss interglacial or more probably to the Inter-Mindel (Morin and Jacquemot 1976:139).

Also a Mindel I-II pebble industry was found on the same area on site Saint-Mihiel on the terrace of the Moselle-Meuse (Guillaume 1976:982).

Tools of the Montsaugéon (Upper Marn) were also made of pebbles. 6 types can be defined: choppers, chopping-tools, 'épannelés', polyhedrons and discoids (Amiot 1979:132).

Pebble industries were unearthed on the northernmost territories of France, too.

* The author indicates with the expression all those pebble-tools which cannot be fitted into the previous type groups.

Site Pointe-aux-Oies is known from publications by Briquet, Hure, Dutertre, Sauvage and others. The tools made of silex pebbles, collected from the sandy beach, have been collected and described since 1934. The site can be found near Wimereux, 6 km north of Boulogne-sur-Mer. The find material, collected by Truffreau in Pointe-aux-Oies contains mostly pebble-tools (more than 85%), 9% of them are manufactured unidirectionally, 65.3% bidirectionally, 10.8% multidirectionally (Truffreau 1971:497-500). Bourdier (1976:807) mentions in his publication obscure hand axes and some large 'polyhedrons' as well.

The flakes are rare in Pointe-aux-Oies, they are usually covered, partly, by cortex. Most of the cores are simple ones, though definitely trimmed or used. Besides cylindrical and irregular globular cores can also be found (Agache 1968:286), their total quantity in the find material is approx. 9.8%.

The dating of site Pointe-aux-Oies is problematic, neither is the opinion of the authors clear. The stratigraphical position of the site is uncertain. According to Bourdier the primitive character of the tools in Pointe-aux-Oies would render the industry before the Abbevillian, but it is a false appearance' (Bourdier 1976:808). According to Truffreau the industry of Pointe-aux-Oies is similar to Clacton-on-Sea in England and can be compared to the materials of the most advanced phase of the 'Pebble Culture' (Truffreau 1976:965).

An industry containing small-sized pebble-tools was found at Coquelles, southwest of Calais. The find material can be dated to between the interglacial following the Cromerian and the Würm 1-2 interstadial (Lefebvre 1972:162).

Lastly the industry found on site Montfarville in Normandy, 6 km south of Cherbourg, stands close, according to Bourdier (1976:808), to the finds of Pointe-aux-Oies.

It is to be mentioned that the French Charentian culture, which, of course, does not belong to the pebble industries often used pebble and quartzite as raw material. This problem will be discussed in the following chapters.

Italy

Italy is also rich in pebble industries. Not only Lower Palaeolithic pebble industries can be found here but also Middle Palaeolithic ones and as the notion defined by raw material and technology is used in a chronologically broad sense, Mesolithic ones as well.

The diffusion of the pebble industries can be observed in Italy in two geographical regions: on the Apennine Peninsula and in Sicily, connected with the former one during a long period of the Pleistocene.

Pebble-tools have been known from Italy for a long time. It seems, however, that it was Battaglia, who was the first to discover the connection between the pebble-tools found in the deposits of the Correntino River and the tools of the 'Pebble Culture' in the strict sense, stepping over the strict notion often used by the researchers.

Northern Italy is a white spot in the respect of pebble industries. On the other hand, several choppers, chopping-tools were collected by Galiberti in the 60s on the terraces near Billona in Toscana, between northern and southern Italy.

Field surveys were carried out earlier by Blanc and Cardini from 1955, then by Cardini until 1968 in the bone breccia layer of Monte Peglia (near Oviato). They found some old tools which can be dated to the end of the Günz-Mindel interglacial. It means only four tools, the first was found by Blanc in 1955 in the bone breccia layer, the second and the third ones came to light near the deposit in 1966-1967, the fourth one was unearthed by Cardini in 1968 in the upper level of the mentioned layer. One of the tools is a simple convex scraper, one is a chopper (Blanc described it as a hand axe shaped flaked stone), the other two are large flakes covered by cortex and another one with narrow striking platform (Piperno 1972:54-59).

Latium, near Rome, is one of the most important centres of the Italian pebble industries. Here the Pontiniano industries are to be mentioned first of all, which form a facies of the Mousterian in broad sense, and which got its name from Agro Pontino in 1939 by Blanc. The sites of the industries are Grotta del Circeo, sites of Agro Pontini, Bassa versilia, Grotta della Costa di Salerno, Grotta Guattari, etc. The tools are usually small-sized, therefore one of the groups is called 'micro-Pontiniano'. We have to point out that not all the sites of the Pontiniano contain pebble-tools and belong to the pebble industries—the expression/notion Pontiniano is not the synonym of the pebble industries of the Italian Mousterian.

The region of Rome has long been studied from palaeontological, palaeoethnological and partly archaeological respects.

The first data concerning the research of the territory was from Indes in 1869. Indes carried out excavations in the Monte Gioie Cave, unearthing Pleistocene fauna and stone industry. The next research was lead by Clerici in 1888. The territory was once more surveyed much later in 1935-1938 by Blanc excavating, among others, in Sedia del Diavolo and Monte delle Gioie (Blanc 1938). The archaeological results of the two caves are known from the publication in 1948 (Blanc 1948).

Cardini and Cassoli examined the fauna of Sedia del Diavolo for the first time, which is exceedingly important for us. The stone industry of the cave unearthed by Blanc is known unfortunately only in part. It can be stated, anyhow, that the raw material is always some small-sized pebble. The tool assemblage is dominated by scrapers.

Monte delle Gioie lies on the right bank of the River Aniene. The lowermost layer is a thick, yellow loam layer, sedimented prior to the stone industry and the attached fauna. The stone industry is rich, the ratio of the scrapers is high (75%).

The industry of Sedia del Diavolo and Monte delle Gioie, together with the mentioned pachyderm fauna and birds originates from the time of the last but one terrace of the Aniene, corresponding to the period preceding the local 'Nomentana', i.e. it is identical with the Riss. The tools are always made of small-sized pebbles, dominated by well retouched scrapers. Typologically and technologically these materials are close to the Würm facies of the Pontiniano, its Würm phase of development,

considering, however, their geochronological position Taschini (1967:313) denoted them 'Protopontiniano'. According to the author the Protopontiniano industry is similar to the Riss age industries beyond the Alps, e.g. the material of Rigabe (France), and it was also she, who immediately noted the resemblance between the Mindel pebble industry of Vértesszőlős and the early Würm one of Tata (Taschini 1907:314–315). This is the point where Dobosi's observation on the technologically highly developed stage of the Vértesszőlős industry or Gábori-Csánk's remarks concerning the broader relevations of the 'pebble manufacturing Mousterian' gain significance.

The next territory is Monte Circeo 110 km south of Rome. The caves of Monte Circeo open directly on the sea, only 1–2 metres above sea level. The caves got under water during the last interglacial when the level of the sea rose. Accordingly the bottom of the caves is covered by deposits characterized by the fauna of the Tyrrhenian Sea (*Strombus*, *Conus*, *Tritonidea*, etc.). Following the last glaciation the level of the sea sank and the coastal caves emerged from the water. They were populated, and in general the usual cave deposits filled them. Afterwards the caves were closed by landslide, and they were reopened only during postglacial times by the sea or by quarrying of our days.

Due to the above reasons the glacial deposits have remained only in the better preserved caves, yielding important palaeoethnological, palaeonthological and archaeological finds. The first results of palaeoethnological, palaeonthological and archaeological examinations were published by Blanc (1937:88–93), followed by a series of works on the finds of Monte Circeo in the following years (Blanc 1938:201–209; 1939:215–221, 1942).

Pleistocene filling was found in twenty caves of Monte Circeo, ten of them contained layers with Mousterian and Aurignacian type industries and fossil fauna. On these sites an upper, highly rocky horizon can be observed, which contained, in the Fossellone cave, middle Aurignacian culture together with the bones of *Capra ibex*, *Equus hydruntinus*, *Hyaena*, etc. The lower horizon is rather sandy, consists of a fossil soil containing Mousterian industry with the remains of *Hippopotamus*, *Rhinoceros*, *Elephas*, *Equus caballus*, *Hyaena*, etc. Its underlying layer is the fossil coastal layer or bank of the Tyrrhenian sea.

The most significant of the sites of Monte Circeo is Grotta Guattari, where the tool assemblage of the Micropontiniano and the skull of *Palaeoanthropus* in cultic position, with broken base were unearthed. The geohistory of Grotta Guattari is identical with that of the other caves. It contained a layer with Pontiniano and Micropontiniano industries, and its age is characterized by 'warm' fauna, strengthened by the occurrence of *Hippopotamus*. Guattari consists of a series of halls; the central one contained the skull. The dating was carried out on the basis of the thickness of the layer series which, according to Blanc (1942:16) is identical with the continental cold climate phase of the Würm II.

Another important site of Monte Circeo is Grotta Breuil, where Blanc and his

colleagues unearthed a tool assemblage of Pontiniano type during the research of the Pontino coast in 1936–1938. Most of the tools were made of pebbles; Mousterian points, different scrapers, end-scrapers, burins, raclettes, truncated flakes, denticulated tools, chopping-tools, cores can be found among others. The finds of the cave played an important role in the research of the Pontiniano industry as a definite development can be observed towards the Upper Palaeolithic.

It is to be mentioned here that Mesolithic industries preserving the tradition of the Pontiniano culture are known in some caves of the Monte Circeo. Blanc Cave can be grouped here. The small site lies on the western slope of Circeo at 20 m altitude, and it was excavated by Cardini and his colleagues between 1960–1963. The upper part of the filling is a Holocene layer from the Mesolithic, while the lower part was formed during the Pleistocene. Some small knives with natural back and flakes were found in the lower deposit layers of the Blanc Cave, which have similar features to the ones of the upper layers of the Fossellone. The upper part of the deposit is separated from the rest by an intermediate layer. The thickness of the Mesolithic layer is 40 cm in average, and it contained shells, some mammal remains and an industry of pebbles.

The industry of the Blanc Cave is very characteristic. The tools were made of small pebbles, their raw material is of low quality. The small blades are rather rare; the types are denticulated tools, notched tools, piercers, 'bec', scrapers, end-scrapers, retouched blade, truncated flake, point, burin. Besides there are 104 flakes with traces of wear, 44 cores, 2100debitage. The absolute age of the Mesolithic finds of the Blanc Cave is 8565 ± 80 years (= 6615 B.C.) (Taschini 1968:137, 144–150) (Pl. XXXVII).

The results of research between Frosinone and Cassino are known from the work by Biddittu. On this territory, especially between Arce and Fontana Liri only series of tools made of pebbles were discovered.

The find material of Arce was lying in a deposit of terrace gravel, sedimented on an alluvial-lacustral sand deposit that developed during the travertine formation in the Cromerian (Mindel). The mentioned sand is lying on a Villafranchian conglomerate. The find material is dominated by choppers, besides some scrapers, 'trihedrons' and hammerstones were found. Discoids and polyhedrons are rare. The Arce industry can be dated, based on stratography, from the last phase of the Mindel (Biddittu 1972:51).

There are two sites known near Fontana Liri, Pozzo Camillo, the material of which stands close to that of Arce. Here, however, later types can also be found. Chopper of simple trimming is relatively rare, while the number of the bifacial tools, scrapers and flakes grew. The multidirectionally manufactured tools are more frequent, just like the polyhedrons, than in Arce (Biddittu 1972:51).

Finds proving the existence of pebble culture have been discovered in the deposits of the Campano river on Carpino Plain and in the deposits of Romandato in east Italy. According to Radmilli (1976:37) these stone tools represent the oldest traces of the Palaeolithic in Puglia.

Romandato can be found 3 km west of Rodi Garganico on a 800 m high territory

rising steeply above the plain. The open-air site was discovered by Pasa in 1949, and it was excavated by Pasa, Brena and Palma di Cesnola in 1954. The site contains 5 layers. The first, upper layer is rich in Campignian industry, while the next four layers belong to the Palaeolithic. The latter ones can be grouped into 4 series: first series—smoothed surfaces, highly worn edges; second series—smoothed surfaces, less worn edges; third series—slightly glaring surfaces, sharp or only slightly smoothed edges; fourth series—intact surfaces, sharp edges. The tool assemblage of Romandato consists typologically of primitive 'pebble-tools', almond-shaped tools, wedges, discoids, 'zitrons', so-called spheroids, flake-tools, cores. Regarding the stratigraphy and the comparison with the Asian, African and European pebble industries, the find material of Romandato can be grouped in the Upper Acheulean, or in 'Venosa Micoquian' (Palma di Cesnola and Zorzi 1961:377), and it can be dated to before the Riss-Würm interglacial, perhaps to the end of the Riss (Palma di Cesnola 1967:7).

A 'Pebble Culture' type industry with proto-Levallois and Clactonian flakes was discovered in the reddish-brown clay deposits of the middle stream of Correntino, by Battaglia. The layers of the Correntino yielded almond-shaped tools, while in the lower deposits of the Campane, which according to Mancini are to be dated to the Würm, an industry belonging partly to the Clactonian and the 'Pebble Culture', partly to the Protolevalloisian was discovered (Palma di Cesnola 1967:8, 10).

Examining the Lower Palaeolithic of Gargano region Palma di Cesnola thinks that industries of 'Pebble Culture' type made of pebbles can be found together with Clactonian flakes in North Gargano, in Calinelle on the southern and eastern side of Lago di Varano, and the main sites are Calinelle, the middle stream of Correntino, Ponte della Statale sul Correntino, Ponte sul Campane, Capriozzi, Ponte della Statale sul Romandato, Foce del Romandato (Palma di Cesnola 1967:19).

The next territory we must mention is the coastal line of Marina di Camerota, the survey of which was begun by Palma di Cesnola and his colleagues in 1964, and which yielded significant results concerning the distribution of the pebble industries. Acheulean type tools made of pebbles were found in Marina di Camerota in 1967. In the next years, 1969–1970, the basic research was carried out in Cala Bianca, Capo Grosso and Cala di Arconte. Cala Bianca is approx. 3.5 km east of Marina di Camerota. Acheulean type pebble tools, together with almond-shaped tools and chopping-tools were unearthed here in original position (layer 2) during the excavations in 1969. The 2nd and 3rd layers of Cala di Arconte, approx. 1.5 km west of Marina di Camerota, also contained pebble-tools, among others almond-shaped tools, side scrapers, denticulated scrapers, flakes and cores. Flake-points, denticulated scrapers and simple flakes were found in the red, sandy layer of Capo Grosso. The finds of Marina di Camerota can be classified into two groups: an older level (2nd layer of Cala Bianca) and a younger level (3rd level of Cala di Arconte, 2nd level of Cala di Arconte and Capo Grosso, 3rd level of Cala Bianca) (Gambassini and Palma di Cesnola 1972:157–174). It is interesting to note that many of the almond-shaped hand axes in Marina di Camerota were made of pebble.

A lately discovered and very early site of the pebble industries is 'La Pineta' in the vicinity of Isernia, in South Italy. The settlement was unearthed by D'Agostino, Piretto and Sala in 1979. During the construction of the Naples-Vasto highway, settlement remains, the cultural layer of a hunters' camp were uncovered in an old Pleistocene layer in the side of the road.

The territory is rich in archaeological and palaeontological finds, it lies behind the Isernia-Campobasso railroad. A surface of 62 m² was excavated south of the railway embankment. The approx. 15 cm thick archaeological level was cut by pedogenesis.

On another excavational territory of 53 m² north of the railway line, animal bones and teeth were found in the depth of 4 metres, covered by freshwater limestone blocks, several choppers and silex tools.

The fauna is composed of remains of *Bison* sp., *Rhinoceros*, *Ursus*, *Elephas* etc. The tools found here are choppers, more rarely flakes and denticulated Clactonian flake tools.

The material of the settlement found in a sand layer is dated to before the Mindel-Riss interglacial. (The site is known from a preliminary circular, the new data are gained from a letter by Peretto in March 1980.)

In Sicily the pebble industries occur mostly in district Agrigento. Pebble-tool finds were reported from Faro Rossello, Casa Bioni, Pergole, Punta Grande, Punta Bianca and Mandrascava sites.

Examination of the pebble industry found on the Quaternary terrace of Capo Rossello (Realmonte, district Agrigento) was carried out by Bianchini in 1968. The very old industry is made of silex and of pebbles. The tool assemblage contains choppers, many chopping-tools, some multidirectionally manufactured tools like proto-hand axes, wedges and also Clactonian type tools. Bianchini (1969:177-178; 1971:102-103) grouped the finds typologically into 5 categories: 1—simply trimmed pebbles, 2—choppers, 3—chopping-tools, 4—pointed pebbles (trihedrons, primitive hand axes, polyhedrons), 5—flakes. The industry of Capo Rossello is identical with the advanced phase of the 'Pebble Culture' of Maghreb region and stands especially close to the developed tool assemblage of Sidi Abderrahman (Morocco) (Bianchini 1969:178, 180).

The 'Pebble Culture' industries on the Quaternary terraces of southwest Sicily can be separated into two facies: macrolithic and microlithic ones. The largest size of the tools of the first facies is 22 cm, the smallest is 6 cm. Three main type groups can be observed: 1st series—choppers, chopping-tools, 2nd series—cleavers (nachoir), wedges made of pebble, trihedrons, 3rd series—small-sized spheroid tools (so-called shouldered spheroids, truncated pyramidal tools, spheroids of curved edge). The largest size of the tools of the microlithic facies ('small pebble culture') is 6 cm, the smallest is 2.5 cm. Its types are: simply trimmed pebbles, choppers, chopping-tools, polyhedrons, Tayac-points, trihedrons, flake-tools and cores.

Concerning the age, Bianchini (1970:143) holds that the industry of the macrolithic facies appeared together with the African 'Pebble Culture', first of all that of Magh-

reb, while the microlithic facies spread in Sicily during the Mindel interstadial and can be correlated both typologically and chronologically with Vértesszőlös in Hungary dated to the Upper Biharian (Mindel, Inter-Mindel). The trend of development of these pebble industries in Sicily can also be traced, based on the stratigraphy of Punta Bianca, from the macrolithic industries towards the microlithic facies. Stratigraphically Punta Bianca consists of 5 layers (layers A–E). In layer B from upwards down some atypical flakes were found, a small-sized pebble industry and a Tayacian flake industry is known from layer C, while the pebble industry of macrolithic facies together with Clactonian flakes was uncovered from the underlying layer D.

Further two pebble industries are known from between Sciacca and Menfi on the southwestern coast of Sicily. One is Bertolino di Mare (Agrigento) discovered in 1971. Its tools were made of limestone and quartzite pebbles. The types are so-called frontal choppers, lateral choppers, polyhedrons, flakes, simple pebble fractures and trimmed pebbles. The find assemblage contains only 22 tools. On the other site, in Menfi (Cavarretto) 63 tools were unearthed. The types here are also the so-called frontal choppers, lateral choppers, bilateral choppers, s.c. frontal scrapers, pebble-cortex scrapers, side scrapers, polyhedrons, points, flakes, cores, pebble debitage, trimmed pebbles and others (Biddittu and Piperno 1972:67–70).

Summing up, strikingly many pebble industries and sites congregate on the relatively small territory of Sicily. They are neither typologically nor technologically as old as they could be expected. If the microlithic facies can be put in the Mindel interstadial, the macrolithic pebble industries date to the Günz–Mindel interglacial—if not even to the beginning of the Mindel, so they are not older altogether than the ones from the inner territories of Europe.

Germany

A human jaw found by the workers during quarrying was given to Schoetensack in 1907 from the sand mine of Mauer. Unluckily there were no accompanying finds beside the jaw. Decades later Rust searched through the mine until he gathered a great many worn pebbles which he described as tools belonging to the culture of *Homo heidelbergensis*. It is totally uncertain whether these objects are in fact tools, better to say the question of the 'Heidelberg culture' is problematic to such an extent that the technical literature did not even start a debate on it.

Beside the pseudo-tools that were called for years by researchers 'rustolites', two important centres of pebble industries are known in Germany: Oberhessen and Kronach regions.

Well elaborated pebble tools were found on surface in the Oberhessen region, but neither faunistical nor any other find material accompanied them. Krüger described in his publications (1959:196; 1973) between 1959 and 1962 400 items from 30 settlements, though the total sum of the finds is no less than 2000, according to this

last publication. These tools were collected mainly on the terraces near Münzenberg, where not only pebble-tools, but also Middle Palaeolithic hand axes were found on several sites.

The tool assemblage of Oberhessen contains pebbles notched with trimming, horizontally halved pebbles, rectangularly quartered pebbles, diagonally halved pebbles, diagonally quartered pebbles, diagonal tools, diagonal flakes, 'zitron' pebbles, choppers, pointed choppers, polygons, points, flake debitage and individual forms.

The 30 so far discovered sites in Oberhessen are Münzenberg-Eilo, Am Steinberg, Steinberg-Ost, Steinbeck-Süd, Buchberg, Hofland, Galgen-Ost, Galgen-West, Metz, Dühnberg, Markwald, Streubel, Mühlberg, Kreuzberg, Kettermühle, Burglehn, Steinfeld, Junkermühle, Burgberg, Goldberg, Eisengrund, Würtzberg, Geiersberg, Heerstrasse, Römerstrasse, Heiliger Stein, Wasserbehälter, Tennegrund, Feldheimer Wald, 'Platte'; the richest of them (64 items) is the collection of Münzenberg-Eilo.

Krüger lists site groups from around Münzenberg of various types of occurrences. He groups according to the latter feature, but it does not help the dating.

The age definition of the finds is naturally difficult. According to Lotz the geological dating of the Oberhessen industries is practically impossible, considering their different typological characters two chronological groups can be supposed. The younger group can be characterized by Middle Palaeolithic tool types belonging probably to the Riss-Würm interglacial, and surviving until the Würm I. The tools of the other group are usually large, primitive hand axes and pebble-tools, which may be much older than the previous ones (Zotz 1968:522).

One more significant data can be added to the uncertain grouping. The young, so-called 'Jungacheuléen' dated to the beginning of the Riss-Würm interglacial, and appearing only much later, during the early Würm only sporadically in the Upper Danube region, can really be found in Oberhessen and on the North German Plain. (Bosinski 1967). The young industry with hand axes is characterized by large Levallois flakes and blades, thus the age of the pebble-tools is still unknown.

Krüger (1959:167) also agrees. According to him the age of the Oberhessen pebble industries is uncertain, and he deduces that the tools cannot be attached to a given age, they may have appeared in different periods. He puts, however, the Münzenberg type pebble industries found in Oberhessen before the Riss glaciation, more exactly dates them to the Mindel-Riss interglacial, relying on typological and stratigraphical reasoning (Krüger 1973:49).

The other centre of pebble industries is Kronach district (Ober-Franken).

The group of the Kronach pebble industry can be found on three sites. The first is Hummendorf settlement, on the surface of the 25 m high terrace of the Rodach river, the other two are Wachtersmühle and Kreuzberg on the 40 m high terrace of the same river.

The characteristic feature of the Kronach industries is that they were made mostly of schistified pebble (lydite). The types are the followings: simple choppers, chopping-tools, concave scrapers, convex scrapers, convex and straight scrapers, etc. Beside the

discoïd scrapers and the discoïd cores are frequent. Hand axes and a 'zitron' can be found in the material as well (Zotz 1968:522).

All the above items are surface finds. The finds of the three sites can be considered uniform from the respect of typology and preservice. Typologically the scrapers represent 50% of the material. There are only a few choppers and chopping-tools.

Zotz dealt with the problems of the three sites in detail and arrived at the conclusion that the material is basically uniform. We would like to add that the above type list denotes, broadly speaking, a Middle Palaeolithic industry which is nothing more really than a highly possible typological hypothesis. Pebble industries of different ages may have appeared in Kronach, and it seems probable that they should be younger than the last interglacial. Zotz (1968:524) renders similar possibilities concerning the culture. According to him it is possible that the Kronach industry was the forerunner of the Presolutrean I of Kösten, 40 km farther, which contains several Premousterian and Mousterian forms. Two tools have been found in a clay mine of Kreuzberg. One originates from the end of the Riss-Würm or the early Würm, the other must be older, as the altitude difference between the two objects was 2.7 m. These stratigraphically defined objects, however, do not help the dating of the surface finds.

The next territory with similar industries is the district of Trèves-Luxemburg along Moselle and Sûre, represented by approx. a hundred Palaeolithic surface sites. The tools are all made of quartzite. All the sites are situated in great density on plateaus and limestone hills. Similar find material was discovered in the neighbouring territory in the valley of the Rhine and the Sarre, where the most important site is 'Grossenbüsch'.

The Grossenbüsch plateau lies between the Moselle, the Leuk and the Sarre, south of Oberbillig, on the bank of the Moselle. The plateau is 800 m long and 300 m wide. The Palaeolithic tools form dense 'settlement patches' on some places. The tools made of pebbles were classified into two groups. The first group can be characterized by quartzite tools, while there are less quartzite tools in the second group, and typologically it is dominated by scrapers (Boecking and Guillaume 1979:144).

The above authors report 382 objects, 93 of which are tools, 91 are cores. The raw material is mostly quartzite pebble (97%), the technique is non-Levallois. Concerning typological features, the ratio of the Mousterian tool group is high (II = 72.34%), consisting mainly of simple convex scrapers, convex transversal scrapers and transversal wavy edged scrapers. The ratio of the Levallois, Upper Palaeolithic and denticulated tool group is low (I = 10.63%, III = 4.25%, IV = 2.12%). The ratio of the hand axes is 7.84%.

The tool types of the Grossenbüsch material are: typical Levallois flake, atypical Levallois flake, atypical Levallois blade, truncated blade, pseudo-Levallois point, Mousterian point, Levallois point, 'limace', simple straight scraper, simple convex scraper, simple concave scraper, double convex scraper, simple pointed scraper, convex pointed scraper, concave pointed scraper, scraper with wavy edge, alternate straight scraper, dorsally retouched scraper, steeply retouched scraper, scraper with

thinned back, end-scraper, 'raclette', denticulate tool, chopper, chopping-tool, hand axe. As it can be seen the typological constitution tends, even disregarding the percentage ratio, towards the Middle Palaeolithic: actually it is a pebble manufacturing Middle Palaeolithic.

The age of Grossenbüsch is uncertain. According to Boecking and Guillaume (1979:152) the technique of manufacture is non-Levallois, the material is poor in hand axes, the Mousterian types are dominating over the Acheulean ones, and lastly the industry is rich in charentoid scrapers of Quina type. It fits into the picture expected of a pebble manufacturing industry. The real Charentian itself also likes pebble raw material, quartzite, even on territories where much finer raw material could have been gained at the same time in abundant quantity.

Going on eastwards in Europe we have to mention the finds of Markleeberg, though only flake tools have been collected on the site investigated for a long time. Similar small assemblages can be found around Regensburg. Besides there are some younger sites like Kösten, where also tools made of pebbles were unearthed.

Pebble-tools survive in Germany until the Magdalenian. Thus several choppers and chopping-tools were found on the Münzingen settlement.

Stratigraphically defined pebble-tools were found at Sächlingen in the Lower Palaeolithic of Murg in the southwesternmost part of Germany, though their dating is uncertain. Its age, according to some authors can be Riss II or early Würm.

A typical pebble-tool was found in the lowest layer of Dunkle Kammer cave. The accompanying finds are only atypical flakes. The cultural layer belongs to the last interglacial.

Pebble-tools are known from several Middle Palaeolithic cave sites of Bavaria, like from the Obeneder cave (Altmühl Valley) and the neighbouring Schulerloch.

The German pebble industries are generally young. Their new types play an important role in the Middle Palaeolithic research of Central Europe.

Czechoslovakia

Czechoslovakia is one of the territories where a great many pebble-tools have been collected. Their dating is problematic, however, as only few finds were found in original position (in layers).

Lower Palaeolithic pebble industries were found in great quantity, mainly in Bohemia (Žebera 1952, 1965). The Quaternary terraces of Bohemia were first surveyed in 1941, when several trimmed and retouched pebble-tools were collected from around Kladno and Kralupy.

Žebera discovered Mlázice, one of the most important pebble industry sites in Bohemia in 1948 (Žebera 1952:35, 1965:47). Mlázice settlement can be found on the northern part of Prague, at the junction of the Elbe and the Vltava on the territory of Mělník. The finds were discovered on the surface near the Elbe terraces. They

contain beside the choppers and the chopping-tools several flakes with cortex on the striking platform. The flakes are usually large, rough, though sometimes there are some thin ones, too.

The tools of the site were made mostly of quartz and quartzite pebbles, and the following types can be found: cores (pebble core, discoid core etc.), tools made of pebbles (trimmed pebble, transversally fractured pebble, obliquely fractured pebble, unilaterally manufactured pebble, bidirectionally manufactured pebble, pointed pebble, pebble manufactured on one end, pebble manufactured on both ends), tools made of the upper part of a pebble, pebble-tools of hand axe shape, flakes, flake tools (point, scraper, piercer, burin, etc.), 'trihedrons', hammerstones, basalt pebbles worn by wind, amorphous quartz fragments, small, burnt pebbles, and also Upper Palaeolithic and Mesolithic tools (Žebera 1952:46-64).

Žebera (1952:65) considered first of all the discoid cores as leading types, and called the industry, accordingly, a 'protolithic' one. Žebera (1965:56) thinks, relying on typological and stratigraphical observation that the Mlazice tools were made during the Mindel-Riss interglacial.

Pebble-tools were found not only around Mlazice and Vehlovice but also on the neighbouring territories.

Later Klen found tools made of quartzite and quartz near Dobruška in northeast Bohemia, then Prošek collected similar objects near village Chaby. Žebera (1952:69) found an industry identical with the Mlazice and Vehlovice ones in Roudnice nad Labem in 1949 and it was also he, who discovered pebble tools in Kácov (near Kutná Hora) and in Dubec (Říčany).

Another important pebble industry to be mentioned was found in Sedlec. According to Žebera (1965:47) the Sedlec settlement can be correlated with the Mlazice site. The pebble-tools were found in the upper part of the Mindel II terrace or in the lower part of the Riss age loess of the Vltava. Consequently it is held that the pebble industry can geologically and stratigraphically be put in the Mindel-Riss interglacial. Globular, oval discoid objects have been found in Sedlec, which can be considered as 'index fossils'. According to Žebera the Sedlec industry is of Clactonian type.

Pebble-tools were also found on Palaeolithic sites in Bohemia like Předletice, Bečov I, Bečov II, etc., which actually do not belong to the circle of pebble industries (Friedrich 1976:14-21). According to Valoch (1976:178) these find materials show another technique of tool making beside pebble manufacturing.

The other centre, outside Bohemia is the surroundings of Brno, where several pebble industries were found. Sporadic pebble-tools have been collected for a long time in the loess and the terraces of Moravia (Valoch 1961:163-184). Effenberger found many pebble-tools near Příbice (Břeclav district), approx. 30 km south of Brno. Příbice I settlement can be found south of Příbice on a terrace 20 metres above the present plain. According to Smolíková the terrace is not older than the Cromerian, thus the industry is dated to the Cromerian (Valoch 1977:485).

Rough pebble-tools were collected in Bystrice (near river Svratka), in Popovice (at

the confluence of Svratka and Bohrava), in Brno-Bohunice, Moravsky Krumlov (on river Rokytá) (Valoch 1961:163-184). It is worth mentioning that the well-known Upper Palaeolithic settlement of Dolní Vestonice yielded some tools made of whole or fractured pebbles, or from the flakes split off from them (Valoch 1965:40).

Austria

Some of the million pebbles of the high terraces of the Danube could also be attributed to man, if the circumstances would allow. These 'Lower Palaeolithic' pieces were described by Mottl and Mohr, arousing nearly no comment at all.

Drachenhöhle at Mixnitz (Mixnitz in the following) is one of the sites where pebble-tools were collected. Drachenhöhle can be found at Mixnitz, near Graz in the valley of the Mura. The stratigraphy, botanical and faunistical data of the cave are well known. Two cultural layers can be found on the site separated by an only 10 cm thick intermediary level. Black pine, spruce and *pinus* sp. were defined in the flora, the fauna contained cave lion, mountain goat, cave bear, wolf, etc.

The industry of the two layers is identical. The tools were made of the pebbles of the Mura. The raw material is large sized quartzite pebble. Kyrle classified the find material into 'zitron' scrapers, high scrapers, convex scrapers, rhomboid scrapers and small scrapers, completed by end-scrapers and flakes. Kyrle described 93 tools. Gábori-Csánk reduced them to 69. According to the latter the scrapers are dominating (58 pieces): 32 simple scrapers, 17 of which are convex, 7 are rectangle scrapers, 6 are convergent scrapers, 9 are transversal scrapers, and 3 scrapers are manufactured bilaterally. The Mixnitz tools are larger and more roughly elaborated than the Érd material.

The quantity and the technical processing of the find material suggest that prehistoric man inhabited the cave only provisiorically, The cultural layer is dominated by the cave bear. The occupants of the site must have specialized in the hunting of this species.

The Middle Palaeolithic cultural layer can be dated to the Riss-Würm interglacial or the Brørup interstadial (Gábori-Csánk 1968a:264).

Hungary

Barely more than a hundred Palaeolithic sites are known in Hungary, considering also the sporadic finds and the uncertain data. Some of them, especially the Transdanubian Middle Palaeolithic contain some pebble-tools in the find materials not belonging to the pebble industry complex, like the Szelim cave, the Kiskevély cave, the Csákvár rock shelter, Tokod or the cultural layers of the Subalyuk and Szeleta caves. They are, however, subordinate items in the tool assemblages of civilizations

of quite different features. According to Vértes (1969:37) one of the millions of pebbles from the Middle Pleistocene layer in Pestlőrinc was picked up and since it resembled a chopper, it was published as a tool.

The relatively small number of pebble-tools in Hungary does not reduce the role it plays in the research of the European pebble industry. Their great merit is that on most sites the vertebrate palaeontological material is well preserved, their changes in the successive layers are true evidences of the climatic changes of the geological ages and their chronological grouping seems to be reliable.

Following the history of research the Tata settlement is the first to be mentioned.

The thin loess layer, sedimented between freshwater limestone layers, from which faunistical and archaeological material was collected, was unearthed by Kormos in the Tata 'Porhanyó mine' in 1909. Thus Tata is the first known Mousterian site in Hungary (Kormos 1912). A striking characteristic of the archaeological find material is that most of the tools (approx. 59%) were made of pebbles.

The cultural and chronological grouping of the finds was changed several times. Kadič defined it as Mousterian, Hillebrand as proto-Solutrean. Prošek placed the site in the Würm 1-2 interstadial, which was also accepted by Vértes. Later, following the new excavations and the monographical elaboration, the dating also changed: the Tata settlement was used from the Brørup interstadial until the Göttweig interstadial, i.e. from 50,000 until 40,000 years B.P. Lastly and finally Kretzoi put the settlement to just before the peak of Würm 1 (Kretzoi 1968:101).

The next site in the row is the Castle Hill in Buda. Special air-raid shelters were being built in the 30s in the so-called Castle Caves. Kadič after the discovery of fossil mammal fauna in gravel and in the above lying travertine in the cellar of 72 Űri street, started excavations immediately. Beside the animal bones some fractured pebbles were also found and Kadič regarded their surface as manufactured by man. According to Vértes, however, these fractured pebbles and amorphous flakes, made of quartzite and chert, are natural products and there is no trace of manufacturing or flaking on them. Vértes did not accept them as work of man merely because of their raw material (Vértes 1965b:104). Probably the uncertainty forced Kadič to describe his finds as 'Mousterian tools' in 1939, while in 1942 he wrote that they were the oldest tools in Hungary (Kadič 1942:49-75). According to Vértes the Castle Caves lie above the fourth gravel terrace of the Danube. The pebble finds collected by Kadič in the cellar of Űri street are identical with the gravel underlayer of the Vértesszőlös lime-tuff (Vértes 1969:40).

The most important find material of Hungary, which was named Buda (now Vértesszőlös) culture by Vértes, was unearthed in Vértesszőlös.

Pécsi observed animal remains and fractured pebbles, flakes between the freshwater limestone layers in Vértesszőlös during the survey of the Pleistocene terraces of the Átalér. Following his report the Hungarian National Museum organized excavations in the lime-tuff quarry lead by Vértes in 1963, which was followed by large-scale

excavations in the following years. Finds were uncovered from four different levels (settlement levels).

Vértesszőlős is the only Lower Palaeolithic site in Hungary. The first finds came to light from adjacent settlement levels, not in gravel terraces or sporadically. This is one of the most significant features of the well-known site. The two main characteristics of the industry are that all the tools were made of pebbles and the types are all small-sized. The age of the site was put into the interstadial phase of the Mindel glaciation, faunistically Kretzoi placed it into the Biharian stage (Kretzoi and Vértess 1965:77).

Another important site, near Vértesszőlős, is the Palaeolithic settlement in Érd. The prehistoric settlement can be found, as distinguished from the ones in caves and in travertine, in open-air, in valley-heads cut into a low plateau. The new site was discovered in 1962, and it was totally unearthed in the following years. The area of the excavation was 214 m², its ultimate depth was 3–4 metres. A great many animal bones, debris and several hearths were unearthed in the settlement. Its importance lies first of all in the palaeoecological analysis and in the stone industry, appearing for the first time in Hungary.

The Érd stone industry did not use block raw material, but exceedingly the worn, rolled alluvial pebbles. 75% of the tools were made of quartzite. Two cultural layers were unearthed in the settlement. The tools of the lower cultural layer are identical with those of the upper complex. The stone industry of Érd is defined by two factors: the pebble trimming technique similar to Pontiniano and the typological setting similar to the Charentian (Gábori-Csánk 1966:331). The layers of the Érd valley-head group, containing Middle Palaeolithic culture, date to the end of the Riss–Würm interglacial until the end of the early Würm (Gábori-Csánk 1968:105, Kretzoi 1968:101). The detailed discussion of the site will be given in the next chapter.

Yugoslavia

Krapina cave, the well-known site of Yugoslavia has been known for a long time. The site can be found on the westernmost part of the Ivanscica mountains, near Zagreb. It was unearthed in the last century. Gorjanovič-Kramberger worked here for years, though published mainly only the anthropological finds. The last monograph was published by Malez but the archaeological material is not wholly described in it either. The site has two layer complexes, the upper one of which was divided into 9 layers by Malez. The lower complex and layers 1–3 of the upper one are archaic, similar, more or less, to the Tayacian, though they are rather uncertain. The layers 4–5 contain the South East European Charentian made of fine-grained quartzite pebbles. The industry is dominated by 'zitron' scrapers, cortex-scrapers, Quina elements and 'zitron' tools can also be found. The cortex can usually be found on the tools. The tools, due to the fine raw material, are generally finely retouched. The

pebble raw material disappears in the upper layers 5-9, and the characteristic Central European typical Mousterian occupies the site.

The fauna of the lower layer is homogeneous. *Dicerorchinus kirchbergensis* has significant chronological role. The fauna of the upper layers contains *Ursus spelaeus*, *Ursus arctos*, *Equus* sp., *Cervus elaphus*, *Bos primigenius* etc. The rhinoceros and the cave bear are dominating among the hunted species, while the aurochs occupies only the second or third place.

The age of the cultural layers goes from the end of the Riss-Würm interglacial (Varbó warm phase) till the end of the early Würm (Kretzoi 1968:100-101).

Another site in Yugoslavia, where pebble-tools were collected is the Veternica cave. 10 layers can be distinguished on the site, the lower three of which, the "h-i-j" layers contained the Middle Palaeolithic, the 'Mousterian industry in broad sense. Species characteristic of the lower phase of the Upper Pleistocene can be found in the lower "j" and "i" layers of the cave. The layer "j" contained *Dicerorchinus kirchbergensis*, *Dama*, *Capreolus* etc., while in layer "i" *Hystrix* could also be found. The fauna of layer "h" refers to colder climate.

The industry of Veternica is identical with that of Krapina. Most of the tools of the lower "j+i" layers were made of extremely fine milk-quartz. The technique corresponds to the well-known pebble-trimming technology. The quartzite tools always preserve the remains of cortex, most of them are 'zitron' or cortex scrapers. There is no Mousterian point or tools of Levallois technique, IR and IC are high. The ratio of the quartzite pebble-tools is quite low in the upper cultural layer. The industry preserves its typological character, though Mousterian forms are frequent.

The age of Veternica can be placed at the end of Riss-Würm or the beginning of the early Würm. The radiocarbon dating of the cultural layers is 52,000 and 45,000 years.

According to the so far gained data, Šandalja I is the oldest site in Yugoslavia with pebble-tools. Šandalja I site can be found approx. 4 km northeast of Pula. Different Pleistocene layers were detected in carstic hollows in the western rock wall of the local quarry during yielding in 1961. The profile of the carstic hollow shows 9 layers (a-i layers). Layer i-f belong to the Lower Pleistocene, they were deposited probably during the Middle and Upper Villafranchian (Malez 1976:109).

The majority of the finds in the bone breccia of the Šandalja I site belonged to the wild horse, rhinoceros, boar, different cervidae and roe. It shows the predominance of mammals. According to Kurten they display the characteristics of the Upper Villafranchian. The layer contained a chopping-tool or chopper, which, according to Malez (1976:112), was the earliest man-made tool in Europe. The chopper described by him was followed by another pebble with engravings on the worn cortex from the bone breccia layer.

The importance of the Šandalja I finds lies in the fact that a human upper first left incisor was also found in the mentioned layer. The tooth lay in the Villafranchian deposit, and belonged, most probably to a representative of developed Australopithe-

cus group (Malez 1976:116). According to Valoch (1976:182) the age of the Șandalja I tool can be estimated to be 1.5 millions years, while according to Malez it is contemporary with the finds of cave Vallonnet, i.e. approx. 900,000–950,000 years.

Romania

The Romanian 'pebble industries' are problematic as none of them were found in unambiguous Quaternary deposit, and no pleistocene fauna can reliably be correlated with the 'pebble-tools'. The technical literature, however, shows the efforts made to prove the existence of such Lower Palaeolithic industries on the territory. Moroșan searched the ravines of the Oltenian terraces in 1954, and in 1958 he found tool series in the Dîrjov, Valea Muierii Oltenian valleys, which he grouped, typologically to the 'pebble culture'.

According to Nicolăescu-Plopșor and Moroșan (1959:23) the tools of the Dîrjov valley may belong, geologically, to the first interglacial (Günz–Mindel). These finds were followed by similar discoveries in the valleys of the Olt, Argeș, Teslui, Mozacu, Dîmbounic, Coteana rivers. Several stones were chosen from the valleys of the above mentioned rivers, which have no observable stratigraphical position, no fauna; typologically, however, some of them do resemble 'pebble-tools'.

Nicolăescu-Plopșor unearthed typical Upper Villafranchian fauna from original layer in Graunceanu, near Bugiulești village in 1963. There is fauna in Bugiulești but there are no stone-tools, so Nicolăescu-Plopșor reasoned that the Dîrjov stone material can be attached to the Bugiulești fauna.

Later Paul published a unifacially manufactured chopper from the surface without fauna and layers in village Racovita, which he grouped, based on the patination the traces of rolling and the type into the 'pebble culture' in 1973. Its analogies he found in Oltenia.

We may mention that Boroneant found pebble-tools in original Villafranchian layers in village Ciuperceni in county Teleorman in 1977. They are typologically rather uncertain ones. Is the layer really Villafranchian? Some stone fractures show traces of rolling. As the layer of the finds is Villafranchian and the pebble-tools are accepted to originate from it, their age is 1.5 million years (Toca 1978:58–63).

III Most important sites of pebble industries in Europe

The last chapter gave a review of diffusion of pebble industries according to geographical regions, countries. Now we will describe the most important sites of the pebble industries in chronological order. Here we will not deal with surface finds, sporadic or uncertain ones, only with sites which have reliable stratigraphy and dating (except for some special cases).

Chilhac

(FRANCE)

The Villafranchian site of Chilhac used to be known for its palaeontological finds, collected by Count Morteuil as early as 1870. The site is called now Chilhac I, 1 km north of Chilhac village. The finds are lying in the second Villafranchian deposit of the Allier river.

The other palaeontological site, Chilhac II is closer to the village, on the western slope of the small tributaries of River Allier, on the eastern edge of a small basalt massive. According to Bout the finds are also in the upper part of the second deposit layer of Villafranchian age. The excavations were carried out by Phillis, while the palaeontological site was once more examined in 1966. Chilhac II is a more or less mixed layer-system with the dominance of loam-gravel, containing also gneiss pebbles and volcanic debris. The layer series change towards the level of the finds into an approx. 1.5 m thick clay layer, from the basis of which an intact skeleton of *Cervus* was unearthed.

Chilhac III, the newest site was discovered in 1969. The site can be found opposite Chilhac II on the eastern slope of the river, where Guth led excavations. Chilhac III is a slope-deposit containing the remains of fossil mammals and stone tool assemblage. The first piece of the small find assemblage consisted of a fine tool, a chopper made of a quartz block. The second was a greyish white quartz fragment, the largest width of which was 3 cm. Deep and relatively regular flaking can be seen on its oblique edge. The third tool is a longitudinal triangular quartz half-pebble, the largest width of which is also 3 cm. The clear traces of flaking can be seen along the edge of the pebble. The last piece was a primitive hand axe made of gneiss. The edge shows traces of wear and retouch (Guth 1974:1071–1072). The four photos published in the article are not clear enough to be reproduced.

The collected fauna of the three sites was published by Boule and Schaub. It is composed of the following species: *Ananacus arvernensis* Croizet et Jobert, *Elephas meridionalis* Nesti, *Rhinoceros leptorhinus* seu *Rh. etruscus* Falconer, *Equus stenorhinus* cf. *vireti* F. Prat, *Cervus philisi schaubi* Heintz, *Hystrix* sp., *Ursus etruscus* Falconer, etc. According to Beden and Guth (1970:2967) the fauna of the three sites is actually contemporary, and if there is a slight difference in them it can be detected between Chilhac I and II, rather than between II and III.

Guth (1974:1072) dated the Chilhac finds based on the rich fauna from the middle phase of the Villafranchian and estimated the absolute age with the help of Potassium-Argon method to be 1.8 million years. Delporte (1976:803) considers the stratigraphy uncertain, he still holds that the fauna gives evidence for the oldest tools of Europe.

Šandalja I

(YUGOSLAVIA)

Šandalja I site can be found in South Istria, approx. 4 km southeast of the town of Pula, on the eastern slope of the 'St. Daniel' hill, from which it got its name (St. Daniel means Šandalja). A carstic cavity filled with different Pleistocene deposits was found during yielding of rocks in the western part of the quarry in 1961. This was Šandalja I. Next year another cavity, Šandalja II was opened during yielding. Upper Pleistocene animal bones, human remains and the tools of the Aurignacian and Gravettian cultures were found in the second cave.

The stratigraphy of Šandalja I consists of 9 layers (layers a-i from top to bottom). The lowermost "i" layer is a Cretaceous formation of yellowish-greenish compact clay. The next layer "h" is a greyish-yellow one covered by yellow, recrystallized thick, laminar stalagmite layer ("g"). Afterwards comes a reddish-brown bone breccia layer ("f"), covered by reddish-brownish clay ("e"). The upper complex of the sediments contains fine mica schist ("d"), then brownish clay ("c"), light brown clay ("b") and lastly dark grey humus ("a").

Layers "i" to "f" belong to the Lower Pleistocene and were accumulated probably during the Villafranchian (Malez 1976:109). Some layers are missing due to an erosional phase during the Middle Pleistocene and partly at the beginning of the Upper Pleistocene (Pl. II.1)

The fauna of Šandalja I is very rich containing the following species: *Macaca florentina*, *Hypolagus brachygnathus*, *Oryctolagus* cf. *lacosti*, *Allocrietus bursae*, *Minomys* sp., *Canis etruscus*, *Ursus etruscus*, *Ursus mediterraneus*, *Euryboas lunensis*, *Crocota perrieri*, *Equus stenorhinus*, *Dicerorhinus etruscus*, *Sus strozzi*, *Euctenoceros senezensis*, *Anoglochis ramosus*, *Cervus acoronatus*, *Cervus philisi*, *Dama nestii*, *Lepitobos stenometopon*, *Francolinus* sp., *Columba* sp., *Turdus* sp., *Testudo* sp., etc.

The remains of the horse, the rhinoceros, the boar and the different deers and roes are dominating in the bone breccia of the site, i.e. the majority of the fauna is

composed of mammals. All the many species of the fauna can be attached to a steppean warm climatic period.

A single chopping-tool or rather a chopper-shaped tool of finely manufactured quartzite was uncovered in the bone breccia layer of Šandalja I. Its length is 64 mm, the width 53 mm, the thickness 34 mm, its weight is 135 gr. Another pebble was also found in this layer, the length of which is 98 mm, the width 99 mm, the thickness 66 mm, its weight is 711 gr. Some engravings can be seen on the cortex of the latter, it may have been an aid for making chopper-shaped tools. Beside the two objects, charred, burnt bones, pieces of charcoal, artificially broken animal bones and lower jaws were also found, which, according to Malez (1976:113) are the remains of the 'osteodontokeratic' culture.

One of the most important finds of the breccia layer is a human upper first left incisor (I¹ sin). The tooth is well preserved. Malez (1976:116) holds, referring to the anatomical structure and morphometrical features of the tooth that it belongs to the Homo order, the definition of the facies is however problematic and "this tooth probably belongs to a representative of the group of the advanced Australopithecines".

Layers i to f of Šandalja I where the human tooth, the above fauna and the two stone tools (Pl. II.2) were found originates probably from the Middle and Upper Villafranchian, underlined first of all by the presence of *Ursus etruscus*, *Euryboas lunensis*, *Macaca florentina*, *Canis etruscus*, *Crocota perrieri*, *Sus strozzi*, *Dama nestii*, *Equus stenonis*, *Cervus philisi*, *Leptobos stenometopon*, etc.

Cave Vallonnet

(FRANCE)

Cave Vallonnet was first excavated by Pascal in 1958. Further excavations were carried out by Barral and Iaworsky in 1959 and de Lumley from 1962 on and also several articles were published (de Lumley, Gagnière Barral and Pascal 1963). Cave Vallonnet can be found on the right bank of the 'Vallonnet' or 'Vallon du Pontet' streamlet, on 108 m absolute height, at Menton near Roquebrune-Cap-Martin on the territory of Alpes Maritimes.

The stratigraphy of the cave consists of four layer complexes: 1—Lower Palaeolithic layer series, 2—Calabrian transgression layer formation, 3—oldest layers of Lower Palaeolithic, 4—post-Villafranchian layers. The traces of the marine layer level have been preserved at the base of the layer series, at ± 108 m height, containing coastal fauna (*Gryphaea virleti*, *Gryphaea cucullata*, *Patella ferruginea*) which, according to Mars is adequate to date the layer to the Middle Calabrian. After the regression of the sea during the Upper Calabrian the terrestrial layer series almost totally filled the cave. These terrestrial deposits cannot be older, according to Bonifay than the end of the Günz-Mindel interglacial, they can be placed, probably, at the

beginning of the Mindel, while other attach them to the Villafranchian (Bonifay 1975:206, de Lumley, Gagnière, Barral and Pascal 1963:8). Three layers can be found directly on the rock bottom of the cave (C, B_{II} and B_I) followed by three soil horizons corresponding to the upper Villafranchian or the three different phases of post-Villafranchian (Pl. III.1).

The fauna of the Vallonnet Cave belongs to the Villafranchian, it is richly represented and well preserved in the last levels of the Günz. The most frequent species are the *Leptobos* sp. and the *Ursus* cf. *arctos* L. According to de Lumley (1976a:766) the presence of *Elephas meridionalis* and the lack of *Mastodon* means that the fauna can be placed to the end of the Villafranchian, while a great *Canida* and a great *Felida* and a *Bovida* hint at the Middle Pleistocene.

The industry of the late Lower Pleistocene layer contains tools made of pebbles (choppers, chopping-tools, 'rostro-carénés' and other pebble-tools) and trimmed, manufactured bones (de Lumley, Gagnière, Barral and Pascal 1963:11-14) (Pl. III.2, Pl. IV).

The above-mentioned authors state that the industry of the cave is contemporary to phase III of 'civilisation du galets aménagés' of the Atlantic coast of Morocco, which is a relatively advanced pebble culture (de Lumley, Gagnière, Barral and Pascal 1963:18), while according to Bordes the sediment of the cave with the Palaeolithic finds and the characteristic Upper Villafranchian fauna is contemporary with the basic level of Olduvai I and II (Bordes 1968:50). More exactly the layer of the finds of Cave Vallonnet can be dated from the Jaramillo episode, i.e. 0.9-0.95 million years (Lumley 1976a:768).

Vértesszőlős

(HUNGARY)

Animal bone remains and trimmed pebbles were found by Pécsi, geographer, and his colleagues in the freshwater limestone layers of Vértesszőlős during the survey of the Pleistocene terraces of the Átalér in 1962. Following his report, the Hungarian National Museum organized excavations in 1963, followed by large-scale excavations from 1964 on. The excavator of the site, Vértés, died in 1968, and since then Dobosi (1990a, b) has been carrying out the complex analysis of the site. Several publications have appeared on the well-known site in the 60s (Vértés 1965a, 1968, Kretzoi and Vértés 1965).

Vértesszőlős site is situated near the Tata site on the southern part of the Gerecse mountains, 15 km south of the Danube, 50 km west of Budapest.

Four cultural layers could be observed on several parts of the site. The two lower layers were discovered in the lime-tuff characterized by warm fauna, while the two upper ones were unearthed in the loess with cold fauna. According to Kretzoi *Trogontherium*, *Rhinoceros* cf. *etruscus*, *Pitymys hintoni*, *arvaloides*, *ratticepoides* are

characteristic of the cultural layer, while the loess above it contains the same species mixed already with 'cool' elements like *Microtus gregaloides*, *Ochotona* and *Machairodus* (Kretzoi and Vértess 1965:75–79). The analysis shows that the oldest layer is the 1st cultural layer of Site III, followed by the total layer complex of Site I, the youngest ones are the 4th and 5th cultural layers (dealt with together) of Site III. According to the first, preliminary analyses the tools of the four levels are identical or at least highly similar (Pl. V.1).

The main characteristics of the Vértesszőlös industry are that all the tools were made of pebbles and nearly all the types are small-sized. The largest tools are 4 cm long, the average length is only 2.4 cm. The tools preserved in most cases the original form of the pebble.

8890 tools of the industry can be classified. 5819 of them are standardized, 3071 are non-standardized. Vértess defined more than 80 types, including the unretouched pebbles and the fractured ones. The choppers and the chopping-tools are dominating among the types. Besides several finely retouched scrapers, convex scrapers and even so-called 'Tata scrapers' are known. Pyramidal tools, halved or quartered pebbles, hemiliths, ortholiths, plagioliths etc., also occur. So-called proto-hand axes can be found as well (Vértess 1965a:186–193, Kretzoi and Vértess 1965:80–83).

In the last, total analysis, the Vértesszőlös pebble-tools are classified into two large groups, following Vértess' method: standardized and non-standardized tools. 49 types compose the typical tools: chopper (1354 = 23.27%, with 33 subtypes), inverse chopper (121 = 2.08% with 24 subtypes), inverse chopper-simple chopper combination (22 = 0.4% with 10 subtypes), chopper-chopping-tool combination (97 = 1.66% with 21 subtypes), chopper-scraper combination (33 = 0.57%, with 16 subtypes), chopping-tool (326 = 5.6% with 27 subtypes), elongated chopping-tool (5 = 0.1%, with 2 subtypes), flat chopping-tool (170 = 2.94% with 22 subtypes), trifacial (57 = 1% with 11 subtypes), pyramidal (213 = 3.66% with 7 subtypes), blunt pyramidal (81 = 1.4% with 10 subtypes), 'bolas' (202 = 3.48% with 11 subtypes), 'half-bolas' (33 = 0.6%, with 5 subtypes), proto-rostro-carinata (27 = 0.46%, with 7 subtypes), rostro-carinata (50 = 0.86% with 9 subtypes), proto-hand axe I (12 = 0.2% with 4 subtypes), proto-hand axe II (43 = 0.70% with 10 subtypes), hand axe (3 = 0.06% with 3 subtypes), beaker (13 = 0.22% with 7 subtypes), retouched mousteroid point (19 = 0.33% with 9 subtypes), Tayac point (12 = 0.2%), central 'zitron' scraper (271 = 4.60% with 29 subtypes), lateral 'zitron' scraper (276 = 4.74% with 25 subtypes), crescentic scraper (207 = 3.56% with 12 subtypes), double crescentic scraper (3 = 0.06% with 2 subtypes), flake scraper (971 = 16.69% with 30 subtypes), scraper retouched on the base (70 = 1.2% with 15 subtypes), double scraper (137 = 2.35% with 23 subtypes), raclette (5 = 0.1% with 5 subtypes), S-edged flake scraper (90 = 1.55% with 14 subtypes), Clactonian notched flake (144 = 2.47% with 19 subtypes), piercer (104 = 1.8% with 16 subtypes), burin (102 = 1.75% with 19 subtypes), burin on steep flake (37 = 0.63% with 11 subtypes), burin on pebble flake (56 = 0.93% with 12 subtypes), burin-chopper combination (25 = 0.43% with 13 subtypes), burin-scraper combination

(6=0.10% with 5 subtypes), proto-steep scraper (67=1.15% with 13 subtypes), steep scraper (43=0.74% with 11 subtypes), knife with natural back (23=0.4% with 4 subtypes), lamellar blade (30=0.51% with 9 subtypes), hook (24=0.41% with 5 subtypes), flake with scaled retouch on the surface (30=0.51% with 5 subtypes), triple-edged tool (47=0.80% with 11 subtypes), combined tool (63=1.07% with 20 subtypes), extreme tool (32=0.55% with 12 subtypes), hammerstone with traces of use (62=1.07% with 7 subtypes), anvil (1=0.02%).

The non-standardized tools contain the following types: hemilith (126 with 5 subtypes), ortholith (100 with 3 subtypes), plagiolith (101 with 4 subtypes), quartered pebble (391 with 6 subtypes), pebble smaller than a quarter (328 with 8 subtypes), split pebble (23 with 7 subtypes), pebble-flake (299 with 14 subtypes), pebble 'zitron' (485 with 17 subtypes), pebble polygon (26 with 6 subtypes), pebble point (207 with 11 subtypes), core (108 with 7 subtypes), Clactonian flake (607 with 22 subtypes), non-clactonian flake (258 with 25 subtypes), and transversal flake (11 with 2 subtypes), (Pls V.2, VI, VII).

According to Dobosi the quartzite raw material is replaced by better manufacturable silex parallel with the development of the types in Vértesszőlös industry. Most of the Upper Palaeolithic types were already made of silex. The use of limestone follows the decline of the quartzite. The Lower Palaeolithic type group is in close contact with the quartzite raw material. The use of the silex raw material grows in the Middle Palaeolithic type group, while it reaches its top in the case of Upper Palaeolithic types. It seems that the more specialized tools are highly dependant on the raw material.

There are 105 bone objects on the site, which beside trimming, show also other traces of human activity, 93 of them can be classified.

The fractured animal bones heaped up densely in the basin, sometimes forming a 20–25 cm thick layer. This debris lay in original position. Strongly burnt hearth spots could also frequently be observed in the settlement.

The anthropological finds were published in detail by Thoma. 3 milkteeth were found during sieving of the settlement level, while an occipital was unearthed in the travertine. The milk teeth stand closer to the *Sinanthropus* than the *Atlantropus*. The definition of the occipital is *Homo sapiens palaeohungaricus seu erectus*, its brain capacity is no smaller than 1400 cm³.

There were many animal footprints found in the lower limemud of Site III. Also the footprint of man seemed to have been discovered, though later it proved to be a misinterpretation.

The age of the site is defined by the stratigraphical position and the rich fauna. The site can be found on the 4th terrace of the small streamlet Átalér, which deposited during the second glaciation of the Pleistocene, the Mindel glaciation. The Vértesszőlös fauna corresponds to the short warm period between the two cold phases of the Biharian stage, i.e. it can be dated to the Inter-Mindel (Kretzoi and Vértes 1965:79). The absolute age of the settlement was defined first as 460–450 000 years, the latest dating suggests 350 000 years.

Terra Amata

(FRANCE)

Terra Amata lies near the commercial harbour of Nice on the western slope of Boron hill, in southeast France. The pleistocene layers of the open-air settlement were investigated by Boucart in 1958, accompanied by Siffre, by Iaworsky in 1959, Miszkowski and de Lumley in 1963 and it was totally excavated in 1966 (de Lumley 1966, 1969, 1976, Bonifay 1975).

The Pleistocene deposits of the site are 10 m thick, the stratigraphy uncovered by de Lumley (1966:31–38) in the publication of the first results of the excavations were the following:

- (1) Mindel age deposits (consisting of three sandy coastal borders: older, second and younger ones);
- (2) Mindel–Riss age soils;
- (3) Riss-age sediments;
- (4) Riss–Würm sediment;
- (5) Würm sediments;
- (6) post-glacial sediments. (Pl. VIII.1).

The deposits of the Middle Pleistocene (Mindel) can be divided into four layer complexes or cycles. The first three (A, B and C) start with a transgressional marine coastal border. Three marine gravel levels can be found above them at the same altitude (+ 26 m), separated by downsand. They are covered by a 10 m thick terrestrial layer complex. 21 levels of the prehistoric settlement could be observed during the excavations in 1966.

A rich fauna was unearthed in the layer complex C_{1a} and C_{1b} with species *Ursus* sp., *Sus scrofa*, *Capra* sp., *Bos primigenius*, *Cervus coronatus*, *Dicerorhinus hemitoechus*, *Palaeoloxodon antiquus* (de Lumley 1976c:821).

About 25,000 objects were uncovered during the excavations. The stone industry is made mostly of silex, quartzite and limestone pebbles. The tools of the sandy coast consist mostly of choppers with some chopping-tools, proto hand axes, pebble hand axes with talons covered by cortex, cleavers (hachereaux), scrapers, Tayac-point and pick (Pls VIII.2, IX, X, XI). On higher levels in the downsand there was a highly developed industry with choppers, some chopping-tools, pebble hand axes with talon covered by cortex, flake tools, among others scrapers, end-scrapers, denticulated tools, Clactonian notched tools, becs, points, proto-limaces, Tayac points, Quinson points and picks (de Lumley 1966:48, 50).

De Lumley considers, based on detailed analyses that the industries of the different settlement levels are very similar to each other and they can be characterized as follows:

There is no Levallois technique ($IL = 0.1$). The blade-shaped tools are rare ($IL_{am} = 3.3$). Flakes with smooth talons are frequent, while flakes with narrow talon are rare ($IF = 2.6$ and $IF_s = 0.9$). There are many flakes with talon covered by cortex

($IT_c = 62.2$). The microindustry is either made of flakes (92.2% in the downsand, 70.6% in the sandy coast) or of pebbles (7.8% in the downsand, 29.4% in the sandy coast). The scrapers can be found in great abundance (IR_{ess} in micro-industry is 54.9% on the downsand and 46% in the sandy coast). The tools with retouched edge are rare on the sandy coast ($IR_c = 2\%$), somewhat more frequent in the downsand ($IR_c = 4\%$). There are relatively many notched (35.3 and 40.9%) and denticulated tools (61.5 and 64.7%). Great many pebble-tools can be found on the Terra Amata site (17.5% in the downsand, 62.5% in the sandy beach). They consist of different types of choppers. The chopping-tools are represented with smaller number in the sandy coast (5.9%), while they are exceedingly rare in the downsand. The pointed choppers and the unilateral picks are characteristic. The hand axes are very rare (1%), their talons are covered by cortex. The small tools are nearly always made of trimmed pebble, sometimes of flakes. There are many pebbles without edge (more than 30%); they must have functioned as hammers (de Lumley 1976c:824). There are only a few bone tools. Ochre pieces can also be found on the site.

Beside the above listed find material also huts, traces of wind-shelters and hearths were unearthed in Terra Amata, as it is well-known. The form of the huts was oval, their length was 7–15 m, their width 4–6 m.

De Lumley (1966:38, 50, 1969:45) dates the prehistoric settlement of Terra Amata to the very end of Mindel, and attaches it, culturally, to the Abbevillian or the lower Acheulean, while the Potassium-Argon dating of C_{1a} layer complex is 450,000–380,000 years. Contrary to it Bonifay (1975:205), considering the stratigraphy of the archaeological material and the fauna attaches the industry of Terra Amata to the Middle Acheulean, which spanned the very end of the Mindel–Riss and the beginning of the Riss.

Aldène Cave/layers H–I–K

(FRANCE)

Aldène cave can be found on the right side of the Cesse river, a tributary of river Aude and it has been excavated since 1971. Studies by Baissas (1972), Barral and Simone (1972), Chaline (1974) and de Lumley (1976d) deal with the site. The age of the industry found here can be defined by the layer series of T_1 complex (A–M layers: pre-Würmian sediments) and T_2 complex (1–4 layers: Würmian sediments).

Baissas divides the layer series of the cave as follows:

Upper layers (1a, 1b, 1c, 2a, 2b, 3, 4 layers);

Middle layers (A_1 , A_2 , B_1 , B_2 , C, D_1 , D_2 , E, F, G and H layers). They contain Middle Pleistocene macrofauna, Riss age small mammal fauna, Upper Acheulean industry (B, D and G layers) and Tayacian industry (layer H).

Lower layer (I, J, K, L, M layers) characterized also by Middle Pleistocene macrofauna and Tayacian industry (layers I and K) (Baissas 1972:72–80) (Pl. XII.I).

Two different industries can be observed in the Aldène cave: a relatively advanced tool assemblage, represented by silex flakes manufactured by Levallois technique (layers A–G) and another one consisting of pebble-tools and made of small-sized quartz or quartzite pebbles (layers H–I–K).

The industry of layers A–G is technologically of Levallois character. It is called Micoquian type Upper Acheulean (Barral and Simone 1972:58).

The tools in layers H–I–K were made of quartz or quartzite pebbles and flakes. Those made of flakes may have wide and smooth striking platform, or may preserve the cortex on the talon. There are scrapers with steep retouch among them, this is the most frequent type. Sometimes thin, flat scrapers, large notched tools can also be met, there are moreover a denticulated scraper, a Tayac-point made of silex, and scraper-flakes made of quartz.

The tools made of pebbles are usually large consisting of the following types; chopper (70%), laterally trimmed pebble-tool (20%), chopping-tools (10%). Beside these main types there are some unidirectionally and bidirectionally manufactured pebble-tools, some fractured or trimmed pebbles, a high, laterally trimmed tool type (type d'outil aménagé par enlèvements disto-latéraux abrupts à surelevés). Two hand axes found in layers I and K are also important. The minority of the find material is represented by a series of microtools made of 2–3 cm large quartz pebbles: they are choppers and pseudo-becks (Barral and Simone 1972:62) (Pls XII.2, XIII).

According to Barral and Simone the industry of the lower layers of the Aldène cave are in strong connection with the Tayacian of Caune de l'Arago or its Proto-Charentian, and the find material of layers H–I–K belongs to an old Tayacian. The authors define the age of the layers in the following way: the age of layers M and L is Mindel–Riss, that of layers K and I is the end of the Mindel–Riss, that of layer H is the Riss, the age of layer G is Middle or rather Lower Riss, that of layers E–D are Riss III, of C–B₂ the end of the Riss, that of layers B₁ and A₂ is the very end of the Riss or the beginning of the Riss–Würm, while the age of layer A1 is the Riss–Würm (Barral and Simone 1972:65–66).

Baissas thinks that the Upper Acheulean of layers B, D, G and the Tayacian of layer H can be dated from the end of the Riss and the Riss–Würm, while the Tayacian of layers I and K originate to the Mindel–Riss (Baissas 1972:72, 78, 85).

De Lumley groups the find material of the cave into two industries: Upper Acheulean and Tayacian. The age of the Upper Acheulean is Riss and he put the Tayacian complex in the Mindel–Riss (de Lumley 1976d:863).

Achenheim

(FRANCE)

Achenheim can be found 12 km west of Strasbourg, in the Rhine area. The site is known from the publications by Schmidt, Wernert, Millot, von Eller, Hatt and Thevenin (Wernert 1937, Wernert, Millot and von Eller 1962, Hatt 1968).

Wernert (1957) dealt with the stratigraphy of Achenheim for a long time and defined the main phases. These levels became one of the classical grouping systems of the Quaternary. The pebbles appear in Achenheim in the basic layer of the sandy old loess—though at that time they are still rare and sporadic. They are more characteristic of the layers of the lower and middle old loess. The industries of the lower old loess were found in four levels: (1) sandy-clayey-loessy level; (2) blackish level, (3) yellowish loessy level and (4) black clay. The find material contains large fractures, trimmed pebbles with flat base, cube-shaped blocks, pebbles with biconvex edges, unilaterally edged tool, scrapers, end-scrapers, flakes and a discoid core. The industries can be put in the Acheulean culture (Wernert 1957:199).

The middle old loess consists of 6 levels: (1) blackish level; (2) atypical yellow loessy level with large concretions and the large shell of *Helix arbustorum*; (3) atypical loessy level with the great shells of *Helix arbustorum*; (4) limy brownish soil; (5) atypical loess with great shells; (6) red clay. This complex contained the majority of the stone industry, consisting of the following types: burins, points, pointed scrapers, simple scrapers, end-scrapers, 'limaces' clevers, oblong-shaped tools, chance tools (*outils de fortune*), trimmed pebbles, amorphous cores, biconvex discoid cores, hammer stones, debris and flakes.

According to Wernert the tools of the lower layers of the middle old loess, i.e. of the black clay are worn off, poorly represented and of archaic features, though the Mousterian technique can already be observed. The next layer shows the features of the 'Pebble Culture' and the growth of the ratio of the well-definable tools. Typologically and technologically the material of the first layer displays a restricted picture of the pebble industries, the beginning of the Tayacian and the Mousterian technique, while the industries of the following five layers belong to the Mousterian (Wernert 1957:201, 205, 245).

Stone tools are rare, and they are still made of pebbles in the upper old loess. Beside the hammer stones, cores, debris and flakes, trimmed pebbles, one can find an almond shaped unilaterally manufactured tool, hand axes and Levallois flakes. Pebble-tools are very rare in the younger loess (Pls XIV, XV.2, XVI, XVII).

New investigations were carried out in the loesses of Achenheim since 1965 lead by Soulié, yielding palaeontological finds and also trimmed stone pieces in all the Pleistocene deposits, in the lower old loess and even in the young loess. The layers of the wall of Achenheim streamlet were clarified during the new analyses. A₀ layer is contemporary with the fluvatile, clayey yellow level of the lower old loess. Two trimmed pebbles and a larger, broken pebble were found together with the vertebrae

of a Bovida in this layer. Layers B, C, D are practically identical with layer A. Layer E is identical with the first black level of the lower old loess, observed by Wernert. Layer F contains many remains of *Equus robustus*. Layer G₁ is level with red sand lenses. G₂ is also level with large limestone fragments. Layer H is homogeneous yellow level. Layer I is the lower layer of the middle old loess, layers J, K and M contained the bones of *Equus robustus* and *Elephas trogontherii*, and also pebble-tools of Tayacian characteristics. Layer I contained *Elephas trogontherii* and *Equus* remains, in layer N the bones of *Elephas trogontherii*, *Elephas primigenius*, *Rhinoceros tichorhinus*, *Equus hemionus* were found. The latter one is the first layer of the upper old loess. Layer O is a grey loessy level. Layer P is a clayey, sandy level. Layer Q is the dark clay of the upper old loess where the bones of *Equus germanicus*, *Bison priscus*, *Hyaena*, *Elephas primigenius*, *Rhinoceros tichorhinus* could be found. A characteristic Mousterian flake was lying on the surface of the clay. Lastly layer R is a young loess with many bones of *Mammoth* and *Bison*, layer S is a young typical loess (Hatt 1968:353, 356) (Pl. XV.1).

Some bones, among them the trunk of an *Elephas trogontherii* and its jaw were found some metres from the top of Rhénan sediments in 1972–73. Also a tooth of *Cervus*, the bone of a carnivorous animal and the fragment of a long bone were collected.

More than 200 m² were unearthed on this spot in 1974. The bones of *Rhinoceros* and *Equus*, butchered here were found in the northern part of the territory. Only one tool was found together with the bones. Contrary to it, scrapers, choppers, chopping-tools were concentrated in a very small area on the southern part of the territory, where only one bone fragment was found. According to Guérin the *Rhinoceros* remains date from the Würm, while according to Prat the remains of the *Equus* come from Würm I or Würm II (Thévenin 1976b:1139).

According to Wernert Achenheim man used the pebbles of the nearby sediments. The raw material was schist, granite, rhyolite, sandstone, quartzite. No silex can be found. Considering typology, some authors mention the existence of Chellean forms in Achenheim. The Acheulean and Tayacian tool types are manufactured with Levallois technique. Stratigraphically the Achenheim terrace is a vaste deposit of loess fractured by three large ravines, sedimenting since the Mindel–Riss, during the whole duration of Riss and the Riss–Würm until the last glacial and even in the postglacial time (Wernert 1957:254).

The large layer complex contains Tayacian industry in the lower and middle old loess. In the upper old loess an old Levallois industry can be found, while the base of the sandy young loess contains typical Mousterian. A 'transitional' industry between the late Aurignacian and Solutrean can be found in the upper levels of the sandy young loess, while its uppermost levels contained late Magdalenian industry (Wernert 1937:373).

Wernert stated in his publication written in 1957, that there was a Middle or even a Lower Acheulean in the lower middle loess. The middle old loess layer is charac-

terized by the 'degeneration' of the pebble-tools and by Mousterian technique. The next five layers contain Mousterian. The tools of the upper old loess are still made of pebbles with Tayacian technique, while 'classical' Mousterian appears on the bottom of the sandy younger loess. The further upper layers can be characterized by the 'Protosolutrean' of Font Robert type, and the last loess by the late Magdalenian (Wernert 1957:245)

The Achenheim pebble industries seem to originate from the lower layers of the old loess in the Mindel-Riss, they can be found later in the four phases of the lower old loess, in the Riss, then in the 6 layers of the next old loess, still belonging to the Riss, and lastly in the upper old loess, dated to the Würm. Pebble industries can be attached basically, however, to the lower and middle old loess in Achenheim, consequently they can be dated to the Riss.

Sedia del Diavolo

(ITALY)

Blanc carried out palaeontological investigations, excavations around Rome in 1935-38. Sedia del Diavolo, on the left bank of river Aniene is one of the sites investigated by him.

Meli's studies, concerning the features of volcanic origin around Rome seems to be important from the respect of the site, as it gives the layer series of Sedia del Diavolo, as well.

The first summary of Blanc's investigations appeared in 1948, discussing first of all the state of Saccopastore site. Pl. XVIII.1 shows the stratigraphy of Sedia del Diavolo as reconstructed by Taschini, based on observations by Blanc, Pannuti and Rossi and data published by Meli. The lower part of the layer series consists of a gravel deposit, lacking volcanic rocks, unearthed beside a tuff bench. This layer is more than 25 m thick, containing the bones of *Elephas*, *Cervus*. Above it there is a light yellowish tuff. We have to mention as regards the development of the upper layers, that more or less sandy, stratified loam among others the so-called 'black pumiceous tuff' can be seen especially well on Monte delle Gioie. The new period of sediment formation of Aniene created later the considerably thick gravel and sand deposits (Meli's IVth and Vth layers), which contain the mentioned black pumice concretions, the fossil fauna and the stone industry. Also human remains were unearthed in this layer of Sedia del Diavolo. The next period of erosion resulted in the partial mutilation of the oldest deposits. This layer complex was covered by grey volcanic tuff, mixed with white pumice. The stone industry was preserved by this cover layer.

Cardini and Cassoli dealt with the fauna of the site for the first time. The rich fauna consists of the following types: *Elephas antiquus*, *Hippopotamus amphibius*, *Rhinoceros* sp. cfr. *R Mercki*, *Bos primigenius*, *Dama dama*, *Cervus elaphus*, *Equus caballus*, *Sus scrofa*, *Canis* sp. cfr. *Lupus*, *Lepus* sp., *Oryctolagus cuniculus*, *Felis* sp. cfr. *Pardus*, *Aves*.

The stone industry, unearthed by Blanc is not large. The raw material is small-sized pebble. Flakes, alternate scrapers, dieders, points, simple scrapers, denticulated tools, and mainly scrapers constitute the tool assemblage. Besides there are two chopping-tool-shaped pebbles or cores to be found in the find material (Pl. XVIII.2).

The fact that the existence of a sediment formation period older than the Riss-Würm interglacial was observed on the territory, enabled Blanc to compare the upper gravel deposits of Sedia del Diavolo and Monte delle Gioie with the upper-middle formation of Torre in Pietra, dating from the same age. According to Taschini the industry was lying in the gravel level of the last but one terrace of Aniene dating from the Riss. Typologically and technologically the industry is close to the Würm facies of Pontiniano; from geological, geochronological respects, however, it can be defined as 'Protopontiniano' (Taschini 1967:301-319).

Monte delle Gioie

(ITALY)

The hill called Monte delle Gioie can be found on the right bank of the Aniene, near the Tevere junction, at the Salario bridge. The results of investigations on the site were first published by Indes in 1869, when he unearthed Pleistocene fauna and Palaeolithic stone industry in the sediments of Grotta del Monte delle Gioie. Later Clerici carried out excavations in 1888, while the total uncovering took place in 1936 (Blanc 1938), and the archaeological material of the site was published in 1948 by Blanc, together with the finds of Sedia del Diavolo.

The species of the fauna of Monte delle Gioie are the following: *Cygnus bewicki*, *Branta leucopsis*, *Anas* sp., *Anser albifrons* Scop., *Cygnus olor* Gmel., *Ciconia ciconia* L., *Phalacrocorax carbo* L.

The stone industry is very rich, according to Blanc and it can be divided into 18 types: simple straight scraper (13 items), simple convex-scraper (19 items), simple concave-scraper (5 items), double-scraper (2 items), pointed-scraper (3 items), 'déjeté' (1 item), transversal convex-scraper (1 item), alternate scraper (1 item), bifacially retouched scraper (1 item), alternately retouched scraper (1 item), end-scraper (1 item), knife with natural back (1 item), raclette (1 item), truncated flake (2 items), denticulated tool (7 items), chopping-tool (3 items), core (8 items) and flakes (Pls XIX., XX).

The ratio of the scrapers among the tools is approx. 75%, and 40% of the scrapers are convex ones. According to Taschini the find material is highly standardized, the tools were made of small pebbles. Both typologically and technologically the industry can be attached to the Mousterian in broad sense, most probably to the 'Mousterian' of La Quina type (i.e. the Charentian), and it stands close to the Würm facies of the Central Italian Pontiniano. The find material was lying in the gravel layer of the last

but one terrace of the Aniene, belonging chronologically to the late phase of the local Nomentana glaciation. Considering this latter data the site is called Protopontiniano, dated to the Riss (Taschini 1967:312–313).

Bleurville

(FRANCE)

Bleurville is one of the pebble industry sites in France published in the most recent times. The site can be found southwest of the village Bleurville in district Monthreux-sur-Saône, 2 km south of Saône river. The excavations were carried out by Barrard and the find material was grouped by Huguenin. The tools (mostly quartzite pebbles, quartz is very rare) can be classified into 7 larger groups:

—The pebble-tools (16 items) contain two types: unidirectionally and bidirectionally manufactured tools.

—Among the hand axes (19 items) one can find lance-shaped, Micoquian, triangular, subtriangular, cordiform and almond-shaped ones.

—Among the cores (66 items) discoid, Levallois globular, etc. ones were found.

—The fourth group contains the flakes and the Levallois points, among other 8 atypical Levallois flakes, 2 levallois points and 1 atypical Levallois point.

—The next group contains 3 Mousterian points.

—The sixth group consists 5 knives.

—The last larger group contains the scrapers (40 items). 17 of them are simple convex, 2 are concave, 3 are double convex and pointed, 3 are oblique scrapers, 7 are transversal scrapers, 1 has steep retouch, 3 are thinned, 4 are bifacial scrapers of La Quina type (Huguenin 1978:447–456) (Pls XXI, XXII, XXIII).

The find material can be characterized by the large quantity of hand axes and also by the high ratio of the scrapers (53.33%). The industry is rich in discoid and Levallois cores and Levallois flakes are also frequently met. Knives with natural back are rare, and there are no denticulated and notched tools. The tool types generally made of rolled raw material, of quartzite pebble.

The dating of the site is uncertain due to the lack of stratigraphy and fauna. Huguenin (1978:459) considers the industry to be upper Acheulean following the Quina–Ferrassie development trend. Correlating the cultural-typological definition, the age of the find material is probably the beginning of the Riss–Würm.

Cau del Duc de Torroella de Montgrí

(SPAIN)

Cau del Duc de Torroella de Montgrí cave can be found under the Santa Catalina castle on the right side of the Ter river near Gerona, 200 m above sea level. It consists of a 18 m long, 9 m wide hall. It was discovered by Rossell and Pericot in 1917, and it was excavated five years later by Pericot and Pallarés. The results of the excavations are known from several publications (Pallarés and Pericot 1921–1926, Pericot 1923, Ripoll-Perello and de Lumley 1965).

The layer series of the cave is rather simple, the fauna is poor, only *Equus caballus*, *Capra* sp., and *Cervus* sp. can be found. Most of the tools were made of quartzite pebble, only some of them were made of silex. The ratio of the flake-tools is 25%, that of the pebble-tools is 75%. The technological indices of the flake industry are: $IF = 37.5$, $IF_s = 20.8$, $ILam = 14.8$, which shows that 25.9% of the material is of Levallois technique. A Levallois blade, a pseudo-Levallois point, five knives, denticulated tools, a multidirectionally flaked tool and a core can be found beside the levallois flakes. There are only a few scrapers in the industry (8.11%), among them there is a simple convex, two flat lateral and a denticulated one.

2 chopping-tools (8.3%), 7 choppers (29.16%), 14 picks (58.33%) and a transversal adze (4.16%) can be found among the tools made of pebble. The relative percentage ratio illustrates that the chopping-tool is rare, the choppers are more frequent and there are even more picks—the latter ones comprise pick-choppers, 'Cresses-pick', so-called 'Montgrí-picks', alternate picks and atypical picks (Ripoll-Perello and de Lumley 1965:23–31) (Pls XXIV, XXV, XXVI).

The two authors compare the Montgrí industry to the materials of Mollet and Libron and find it to be a characteristic Mousterian, placed in the first phase of the Würm (Ripoll-Perello and de Lumley 1965:31).

Érd

(HUNGARY)

The open-air site can be found near Érd–Parkváros, on the Érd plateau, southwest of Budapest. The settlement of several layers was discovered at the end of 1962, the first excavations began in 1963 on a surface of 40 m², where many animal bones, stone tools and debris were unearthed. The whole settlement was uncovered in 1964 on a territory of 214 m² in maximal depth of 3–4 m. The results of the excavations were published in detail in the next years (Gábori-Csánk 1966, 1967, 1968 a–b, 1971), and the whole settlement was published in a complex monograph (Gábori-Csánk 1968a).

The site has a specific geological and morphological character. It is a hunters' camp of the Mousterian culture, situated in the open-air in a valley head divided into an

older, thinner, lower and an upper layer complex. The two cultural layers of the site contain find materials of identical features. The first settlement was of short duration or only seasonal. A 20 m thick cultural layer sedimented on the limestone bottom of the valley. The archaeological finds are few, the animal remains are numerous, and the remains of a hearth and the waste material of the tool manufacture give the evidence of the first phase of settlement. Above it there is a sterile separating layer. Making the stratigraphical circumstances of the site simpler we can say that this layer was covered by an 80–100 cm thick upper cultural layer, which became compact, nearly cemented by the find material. The Holocene layer, covering the surface of the site is a rendzina soil formed on limestone. The only exception is the red-brown forest soil formation at the bottom of the layer series, sedimented on the valley bottom which survived only in patches and which serves as the lower, oldest limit of the stratigraphical and chronological grouping, the beginning of the layer series. The cultural layer itself is dissected by a sedimentational limit area, then later by 9 small, weak tundra surfaces and 3 rendzina soil formations and their remains, and 2 loess layers (Pl. XXVII).

The industry of Érd does not use block raw material, only rolled, worn alluvial pebble. The source of the raw material was the gravel layer 500 metres from the site. This pebble formation contains first of all quartzite, sometimes flint and other rock sorts. The technology was defined by the pebble manufacturing itself, the size of the pebbles and the heaviness of the quartzite. The whole industry is characterized by the large quantity of tools covered by cortex.

According to Gábori-Csánk the Érd industry contains, beside the cores, hammer stones, retouchers etc., 808 tools: 75% of them were made of quartzite, of pebbles. 789 tools of the industry to be described in the following came from the thick upper cultural layer, which can be divided into 5 levels. The types are: atypical Levallois flake (0.65%), pseudo-Levallois point (0.383), high scraper-shaped tool (0.12%), simple scraper (34.09%) and its subtypes: simple straight scraper, simple convex scraper, simple concave scraper, double scraper, pointed scraper, 'déjeté', transversal convex scraper, transversal concave scraper, transversal straight scraper, dorsally retouched scraper, steeply retouched scraper, alternately retouched scraper, end-scraper (3.16%), burin (1.38%), piercer (0.88%), knife with thick back (2.78%), truncated flake (5.19%), wedge (0.25%), notched flake (2.91%), denticulated tool (1.77%), dorsally retouched flake (1.01%), thick, steeply retouched flake (0.50%), alternately retouched thin flake (0.25%), point of Tayac type (0.38%), micro-burin (0.12%), end-notched flake (0.12%), retouched core (0.12%), rabot (0.12%), pendunculate tool (0.12%), chopper (1.89%), chopping-tool (3.04%), other tools (3.54%). Besides there were some antler tools, engraved pebbles, etc. found on the site.

The number of the tools in the lower cultural level is low, and they are identical with the ones of the upper cultural layers. The following tool types can be found among them: simple convex, cornered, transversal convex, dorsally retouched scrapers, atypical piercer, knife with thick back, chopping-tool, other tools.

The technological indices of the Érd industry are: $IL=1.06$; $IF=0.00$; $IF_s=0.00$; $ILam=0.00$; the typological indices are: $ILty=0.63$; $IR=65.52$; $IC=28.40$; $IAt=2.78$; $IB=0.00$; $IQ=5.8$; the characteristic type groups are: $I=1.01$; $II=65.64$; $III=8.23$; $IV=2.91$ (Pls XXVIII, XXIX, XXX).

About 50,000 animal bones were unearthed in the cultural layers of the settlement, most of which were lying in midden heaps, and can be considered as prey animals, kitchen waste. *Ursus spelaeus* is dominating among the species, showing hunting specialization, a unique case on an open plateau far from caves, while the other significantly represented species are the *Equus* sp., *Coelodonta antiquitatis*; *Leo spelaeus*, *Panthera* sp., *Crocotta spelaea*, *Mammuthus primigenius*, *Cervus* etc. can be found in smaller quantity.

According to the detailed lithostratigraphical, palaeonthological, palaeobotanical analyses the layer series of the settlement was formed from the end of the Riss-Würm interglacial until the Würm 1 and the radiocarbon dating gave the following results concerning the different cultural layers and levels: lower cultural layer is older than 50,000 years (not measurable), the lower 'e' level of the upper cultural layer is 44,300, the 'd' level the upper cultural layer is 38,100 and 35,300 years old.

The industry of Érd is a specific form of the Middle Palaeolithic, characterized by the technique of tool manufacture, the pebble manufacturing ('Moustérien sur galets'), which is similar to some sites using different technique. The high number of tools covered by cortex is characteristic of the whole industry. The characteristic pebble-grain forms, flakes with cortex on the talon are due to the pebble manufacturing technique. Often there is no striking platform, there are only some tools with real talon. There are basically two features to define the industry: the technology, similar to Pontiniano and the typological constitution, similar to, or even identical with the Charentian (Gábori-Csánk 1966:63, 102, 226, 1968a:245).

It is worth mentioning that a certain development can be observed in the 5 subsequent levels. Statistical analyses show that the quantity of the tools, just like that of the tool types grows gradually upwards, there is a small growth in the ratio of the young tool types and in the raw material, other and better than the quartzite, the size of the tools lessens, and also a similar growth can be observed in case of ice age wild horse and rhinoceros besides the cave bear.

An important divergence between Érd and Tata, which will be described in the following, besides the cultural difference, is that the size of the tools is smaller, the Levallois technique is dominating and bifaciality is very strong on the latter site. The culture of Érd is totally different from the so far known Middle Palaeolithic sites in the Bükk mountains and in Transdanubia. The technological and typological correlations can be found in the southeastern Alps, in north-northwest Yugoslavia and on the North Italian sites: a modified Southeast European Charentian (Gábori-Csánk 1966:390-391, 1968a 248-267).

Tata (HUNGARY)

Tata site is often discussed both in the Hungarian and in the Central European research. The thin loess layer, deposited between freshwater limestone layers in the "Porhanyó mine" containing Pleistocene fauna and archaeological material was first unearthed by Kormos in 1909 (Kormos 1909:1-3, 1912, 1913:3-24). Decades later further finds were found and the Tata site was last excavated by Vértes in 1958-1959 (Vértes et al. 1964).

The site can be found on the western bank of the large lake of Tata, on the eastern slope of Kálvária hill, 10 km south of the Danube, 60 km from Budapest. Kormos estimated the mine exposure to be 10-13 m high. A 1-1.2 m thick limestone-fractured alluvium can be seen on the top, under it there is a 0.5-0.8 m thick sandy, shell containing limetuff detritus, covering a 9-11 m thick travertine. Hearth remains and around them, many stone tools and waste material were found in the loess under the steep northeastern wall of the quarry and under the upper part of the limetuff formation extending southeast of it (Kormos 1912:3, 11) (Pl. XXXI. 1).

2193 stone tools, 150 kg of flakes and 23 manufactured bones were collected during the excavations in 1958-59. The raw material of the tools in mostly variegated silex (91.3%), quartzite (approx. 7%) and other rocks (1.4%), which were collected by prehistoric man from the pebbles of the Tata valley (Átalér) or from the Kálvária hill. 58.6% of the tools were made of worn pebbles, the average length is 30.25 mm.

Vértes grouped the tool assemblage into 19 types in his study published in 1964: points (2.07%); Tayac points (0.25%); Levallois points, Levallois flakes (1.5%); scrapers (52%) (subtypes: simple scraper (1.63%), convex scraper (8.57%), concave scraper (1.63%), cornered scraper (3.36%), convergent scraper (1.55%), double scraper (1.94%), alternately retouched scraper (2.46%), bifacial scraper (3.24%), Tata scraper (5.85%), zitron scraper (9.96%), denticulated scraper (3.53%), scraper with thinned back (0.47%), transversal scraper (0.17%), other scraper (3.15%); scraper knife (6.21%); end-scraper (2.76%); denticulated tool (1.21%); notched tool (0.61%); piercer (2.50%); burin (4.7%); hand axe (0.22%); hand axe-like tool (0.1%); blade (2.84%); blade-form flake (0.94%); chopping-tool (1.98%); chopper (1.21%); retouched flake (4.87%); core (with 3 subtypes: Mousterian core (1.78%), Levallois core (0.90%), Upper Palaeolithic core); hammerstone and other tools (with 13 subtypes: knife with natural back, backed knife, flake with smooth striking platform, flake of Upper Palaeolithic feature and striking platform, end-retouched flake, flake for unknown use, combined tool, wide burin-shaped tool, 'tranchet', Levallois core residuary, discoid, raclette, pebble with polished surface) (Vértes et al. 1964:143-174).

As it can be seen the scrapers are dominating in the Tata industry. The most characteristic ones are the zitron scrapers made of pebble and the bifacial and roughly manufactured, cleaver-like Tata scrapers also made of pebble. One or two burin-

shaped peaks are often formed on the end of the scraper edges. There is no Mousterian point or better to say there are only a few of them, which are typical. Most of the collected material is waste material and fractured pebble. There are some pieces among the tools which remind already of the Aurignacian. Vértés' observation that technically the development of the industry reached the level of the Szeletian, though no Szeletian developed from it, is even more important. The majority of the tools were made of small-sized, rolled pebbles. The average length of the tools is only 20–30 mm. The Levallois technique is predominating in the tool assemblage, and bifaciality is also strong. The following technological and typological indices show the character of the industry:

Technological indices: IL = 1.84, IF = 25.3, ILam = 15.43.

Typological indices: ILty = 1.84, IR = 50.0, IC = 10.24, IAU = 0.5, IAt = 40.7.

Indices of the characteristic tool groups: III = 10.01, IV = 6.82. (Vértés et al. 1964:177) (Pls XXXI. 2, XXXII, XXXIII).

Beside the stone tools a 'churunga', a 'nummulite amulette', artificially engraved bones, bone anvils, mammoth bone plates, mammoth tooth lamellae were also found in Tata.

The analysis of the faunistical material of the Tata site is known from publications by Kormos and Kretzoi (Kormos 1912:16–33, Kretzoi 1964:105–124).

The cultural and chronological grouping of the Tata settlement has changed several times, though it is one of the longest known Mousterian sites of the country. Kormos stated that most of the bones were found mainly on the upper boundary of the sand layer, embedded in the limestone, and in the sand itself together with primitive 'Chellean' type tools, burnt bones and charcoal pieces (Kormos 1909:2). The industry was defined as Mousterian by Kadič and as Protosolutrean by Hillebrand, while Prošek placed it in the Würm 1–2 interstadial. This conception was accepted by Vértés (Vértés et al. 1964:107), according to whom the Tata industry is the final stage of an overspecialized Mousterian.

The palaeontological analysis suggested two possibilities for the age of Tata, just like the C-14 dating which gave two highly different data. According to the one the site is 50,000 years old (the sample was taken from boring and not from the settlement level, and it was also questioned by Vértés), belonging thus to the Brørup (?), the other analysis, carried out on samples collected from the cultural layer resulted in $33,600 \pm 1100$ years. Lastly Kretzoi paralleled the age of the settlement with the upper levels of the Érd site, put it just before the peak of Würm 1, which is in concord with other datings of the peak of Würm 1 (Tokod C-14 = 36,200 years) (Kretzoi 1968:101).

According to Kormos there used to be a permanent workshop of prehistoric man here where not only the ready-made tools, but also the imperfect pieces were thrown away and the unmanufactured, trimmed flakes were left over. The large quantity of small-sized flakes indicates that man used to make palaeoliths on the Tata site, i.e. it was first of all a workshop (Kormos 1912:14, 44).

Grotta Guattari

(ITALY)

An important site district of Italy is Monte Circeo on the extensive coastland 110 km south of Rome. Several important caves with Palaeolithic sites are opening in its side above the present sea level. One of them is Grotta Guattari, where the skull of a Neanderthal man was found in 1039, and the layers of which contained the tools of Micropontiniano (Blanc 1942:1-37) (Pls XXXIV, XXXV).

The geohistory of the Guattari cave is identical with the other caves of the Monte Circeo. The first, lowermost layers of the site are due to the one-time coast: they were deposited by the Pleistocene sea. They were covered by fossil soils, sometimes sandy layers, which yielded the tool assemblage of the Pontiniano and the Micropontiniano type Mousterian culture together with a 'warm' fauna characterized by hippopotamus.

The cave was nearly totally filled with sediment, when an earthquake blocked the narrow entrance of the cave with rocks and it was opened much later by the modern quarry. This hermetic sealing of the cave preserved the layer filling in a rare perfectness and intactness. The soil of the cave became hard at the bottom of the lime concretions and the surface was covered by stalagmite formations broken off from the walls, and by animal bones. The main species of the fauna are *Elephas*, *Hyaena*, *Rhinoceros*, *Felis spelaea*, *Felis pardus*, *Ursus spelaeus*, *Equus caballus*, *Capra ibex*, *Cervus elaphus*, *Bos primigenius*, etc. (Blanc 1942:11). Grotta Guattari consists of a series of halls, the middle one of which contained the Neanderthal type skull. Observations suggest that man used the cave alternately with the hyaena. Contrary to it the bones show only some traces of chewing by man.

Stone tools belonging to the local facies of the Mousterian culture were found on the walking surface together with 'warm' fauna. The cold species, characteristic of the following age are missing here, then lastly the Guattari cave got closed before the man of Upper Palaeolithic would appear on Monte Circeo.

A characteristic feature of the tool assemblage of the site is that it was made of small-sized pebbles. The dominating tools are the fine triangular points, small discoid cores, pebble zircon scrapers, Levallois flakes and blades, 'limace'-shaped high, double points, point-shaped retouched blades, in general tools, made by pebble trimming technique. The tool assemblage belongs to the Micropontiniano facies of Mousterian, which is known in Central Italy from other sites as well, namely from the caves of Monte Circeo.

The chronological grouping of the site and the find material is provided by the thickness of the layer filling, as the skull was found in the layers. According to Blanc the layer must have formed in a climatic phase, when the 'warm demanding' fauna still could survive on the relatively southern coastal area at the beginning of the glaciation. This period can be correlated with the continental, in other areas colder

climate period of the Würm II. This geological period is according to Milankovic's calculations approx. 70,000 years in case of Monte Circeo. The same calculations resulted in 130,000 years for the Saccopastore anthropological finds. The chronological difference between the two skulls is underlined by the divergence of brain capacity, which is 1200 cm³ in Saccopastore and 1550 cm³ in Monte Circeo (Blanc 1942:16-17).

Grotta del Fossellone

(ITALY)

The excavations of Grotta del Fossellone were started in frames of the research and excavational program of the coastal territory of Monte Circeo in 1936 (Blanc 1937). The investigations carried out in several trips in 1937-1938, furnished new elements enabling the reconstruction of the history of the caves and their sedimentation.

The layer series of Grotta del Fossellone consists of the following from bottom to top:

- Base layers, approx. 3 m thick, of unknown origin;
- Layer complex, observable thickness of approx. 1.5 m, consisting of blackish and purplish soil, with fossil fauna (*Rhinoceros*, *Bos*, *Equus*, etc.), charcoal pieces and atypical pieces of coastal Palaeolithic industry (in small quantity);
- An approx. 0.6 m thick layer of reddish rock detritus mixed with sand and pebble (probably taken into the cave by man), and with fossil fauna (*Bos*, *Cervus*, *Equus*, etc.), charcoal fragments and stone tools of Mousterian type (in large quantity);
- An approx. 0.20 m thick reddish clayey sterile layer;
- An approx. 0.40 m thick rock detritus layer with fossil fauna (*Bos*, *Equus hydruntinus*, *Capra ibex*, *Sus*, etc.), charcoal fragments and the products of the coastal Palaeolithic industry of Middle Aurignacian type (in large quantity);
- An approx. 5-6 m thick layer complex consisting nearly exclusively of rock detritus, a visibly sterile layer (it has not been thoroughly investigated as yet);
- An approx. 2 m thick upper layer with *Capra ibex* and *Arctomys marmota*.

According to the author, Blanc, a Mousterian and an Upper Palaeolithic layer has been unearthed, stratigraphically superposed, separated by a sterile layer, and accompanied by rich fauna. The Mousterian industry contains only a few types: discoid core, scrapers, points, flakes. The Upper Palaeolithic assemblage comprises some discoid cores and other objects proving that sometimes even the archaic technique of the Mousterian was applied (Pl. XXXVI). Blanc writes that the two industries of the Fossellone cave can be fitted in the development circle of the Palaeolithic of the Latium coastland, strengthened by the utilization of the silex pebbles. The Upper Palaeolithic cultural occupation is not in direct contact with the end of the Pontiniano layers. Here the Pontiniano and the Upper Palaeolithic features appear together in the layer at the end of the Circeo period, after a period when the cave was not inhabited following the departure of the Pontiniano people.

IV Development, conservatism, local features and connections of European pebble industries

(1) The pebble industries in Europe—in contrast with Asia, where they appeared at the beginning of the Lower Palaeolithic and survived throughout the whole Upper Palaeolithic and even in the Mesolithic and Early Neolithic—played an important role in the Lower and Middle Palaeolithic, in the appearance, formation and later development of the earliest civilization. The archaeological discoveries of the last decade enlarges significantly our knowledge of the oldest people in Europe. From cultural aspect it is noticeable that the pebble industries together with the other cultures played an organic part in the vivid and complicated picture of European Palaeolithic.

Pebble industries in the broad sense, as defined in the introduction, are the industries, civilizations and the tools which were made mainly of pebble raw material. In this sense the term 'Pebble Industry' used here is not totally synonymous with the expression 'Pebble Culture' used by the researchers of African pebble-tools. It means at the same time that pebble industries comprise not only the tools of the oldest civilizational level, but embrace also the pebble-tools and find assemblages of later ages.

It is a favourable circumstance that the industry is represented in Europe not only by sporadic surface finds or finds from terrace gravels, where age cannot be defined, but by finds from stratified settlement levels, easily datable layers, together with fauna (Fig. 12).

Three phases of development of European pebble industries can be observed with the help of such archaeological discoveries.

The first and oldest phase of pebble industries can be linked to the Lower Pleistocene, mainly to the Upper Villafranchian. The tool assemblage of these earliest industries is usually quantitatively poor, the tool types are simple, they are mostly unifacially trimmed though elements showing transition from the oldest pebble-tools towards the Abbevillian-Acheulean industries also appear. The material of three significant sites can be grouped in the earliest phase: Chilhac (France). Šandalja Cave (Yugoslavia) and Vallonnet Cave (France). The age of Šandalja and Vallonnet can be defined on the basis of layer series and the fauna.

The following Günz or Günz-Mindel age sites belong to this phase beside the above ones: La Garrigue, Mas Goulin, Château Barnier, Cadenette, Pin de Candiac (Cosièrre du Gard), Saint André, Bois des Castelles, Grazaillies (Fresquel), Oums, Gourg, Mas Auriol, Mas Galtes, Mas Mèster, Mas Sainte-Thérèse, Mas Ferrer (Cabestany), Ferme du Vallon (La Crau) in France, Brènes (Carmona), Puerto de Santa Maria

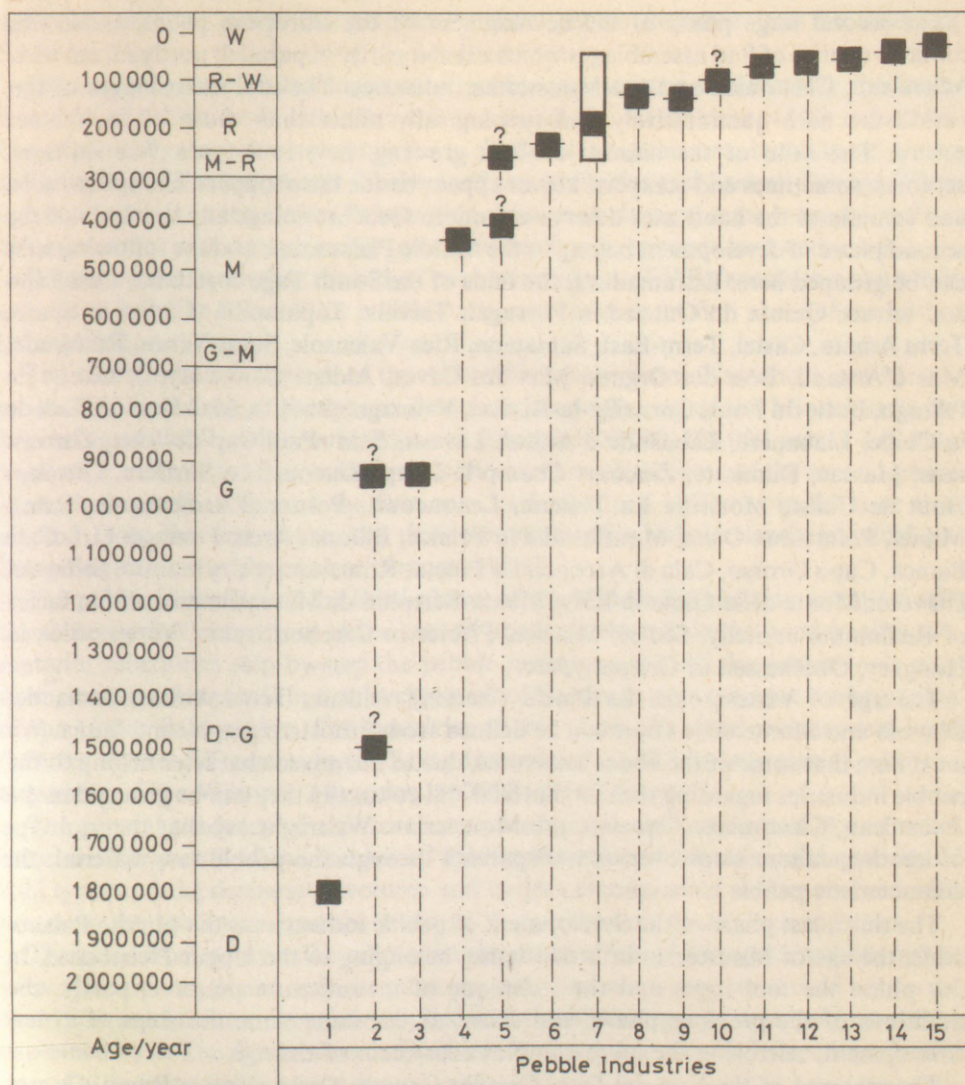


Fig. 12 Pebble industries: (1) Chilhac (2) Šandalja I (3) Cave Vallonnet (4) Vértesszőlös (5) Terra Amata (6) Aldène Cave (7) Achenheim (8) Sedia del Diavolo (9) Monte delle Gioie (10) Bleurville (11) Cau del Duc (12) Érd (13) Tata (14) Grotta Guattari (15) Grotta del Fossellone

(Guadalete) in Spain, Monte Peglia (Orvieto) in Italy, the macrolithic facies of Realmonte in Sicily and lastly Ciuperceni and Dîrjov in Romania, dubious to us but published as belonging to the same age.

The second large phase of the development of the European pebble industries contains a series of find assemblages which existed partly in parallel, partly mixed with Acheulean, Clactonian and pre-Mousterian industries. The tool assemblages of the period are both quantitatively and typologically richer than those of the former period. The ratio of the bifacial tools is growing, new tool types, like different scrapers, sometimes end-scrapers, knives appear beside the choppers, chopping-tools, and sometimes the hand axes deserve attention. Geochronologically the finds of the second phase of development belong to the Middle Pleistocene, and the following sites can be grouped here: Estramadura, the finds of the South Tage coastland, Casalinho and terrace Quinta do Outeiro in Portugal, Taivilla, Tapatanilla (Cádiz) in Spain, Terra Amata, Castel, Term-East, Samatane, Riez-Valensole, Saint-Véran, Rompude, Mas d'Arnaud, Bois des Orgnes, Mas des Caves, Aldène (lower layer), Caune de l'Arago, Butte du Four, Corneilla-la-Rivière, Valmagne Boulou, Mas Romeu, Coll de la Cuille, Llabanère, Labastide d'Anjou, Lavaur, Saint-Paul-Cap-de-Joux, Girus-sens, Massac, Damiatte, Zincoirt Champ le-Loup, Zincoirt La Sorrière, Girmont Haut de Chése, Moriville La Tuilerie, Lenoncourt, Poirier d'Armentstein, Saint-Mihiel, Pointe-aux-Oises, Montfarville in France, Billona, Arce, Fontana Liri, Cala Bianca, Capo Grosso, Cala di Arconte, La Pineta, Romandato, Correntino, Sedia del Diavolo, Monte delle Gioie in Italy, Menfi, Bertolini di Mare, the microlithic facies of Realmonte in Sicily, Sedlec, Mlazice, Přibice in Czechoslovakia, Vértesszőlös in Hungary, Oberhessen in Germany, etc.

The age of Vértesszőlös, La Pineta (Isernia), Aldène, Terra Amata, Sedia del Diavolo and Monte delle Gioie can be defined from lithostratigraphy and fauna. We must note that some of the above industries, due to the mixed character belong to the pebble industries regarding the raw material still culturally they can be grouped in the Acheulean, Clactonian, Tayacian, pre-Mousterian. We might say that the tool type of another culture steps over or transpires through the pebble raw material, the characteristic pebble technique.

The third, last phase of the development of pebble industries is the Middle Palaeolithic, the age of Mousterian in broad sense, belonging to the Upper Pleistocene. In this phase the tool types and the technique of manufacture preserve, partly, the traditions of the previous phase, and show, at the same time, the steps of a new development, mirroring the more complex ecosystem of the age.

The material of the Cau del Duc, Castillo Cave in Spain, Grotta Breuil, Grotta Guattari, Fossellone in Italy, Kronach in Germany, Érd and Tata in Hungary belong to this phase. The material of most of the sites was unearthed in quite coherent settlement levels.

As we have seen, the three development phases of the pebble industries are corresponding, basically to three geological ages, the Lower Pleistocene (Villafranchian), the Middle Pleistocene and the Upper Pleistocene. The clearest, truest phase is represented by the pebble industries of the first phase which existed between the Günz glaciation and the Günz-Mindel interglaciation, their absolute age being approx.

1,800,000–600,000 years. Geographically these pebble industries can be found in Southern Europe, mainly along the Mediterranean.

The second phase of development of pebble industries is substantially the intermingling of pebble-tools with other cultures beside the rather clear pebble industries. Geographically they were not restricted to the Mediterranean area, but diffused nearly to the whole of Europe, except for the northern territories and Eastern Europe. Their age corresponds to the Lower Palaeolithic cultures in classical sense, occupying their diffusion area, and even stepping over their territories towards east and south.

We state once more that the oldest pebble industries of Villafranchian age are not separated from the Palaeolithic but they are considered as the first phase of the Lower Palaeolithic.

The second phase is the age of the Abbevillian-Acheulean, Clactonian, pre-Mousterian. The industries of this phase lived from the beginning of the Mindel until the beginning of the Riss-Würm interglacial (approx. 600,000–100,000 years). Looking back to the above list it is striking that the number of the sites of the second phase is much larger than that of the first one. Its reason can be found in the time that elapsed from the first phase, the development itself which is clearly physical-anthropological and perhaps also 'demographical'.

The pebble industries of the third phase, of the Middle Palaeolithic, occupied still the same territories as those of the second phase. In this phase the good quality raw material substitutes step-by-step the pebble raw material until the pebble-tools play no more a significant role in the development of European cultures since the beginning of the Upper Palaeolithic. The industries of this phase show the varieties and local features of the different cultures living from the Riss-Würm interglacial until the beginning of the Würm 1–2 (approx. 100 000–30 000 years).

The general tendency of the development of pebble industries, just like of other ones, are the growth of the number of flaking, direction of trimming and quantity of tool types and the decrease of volume and weight, restriction of surface covered with cortex to the minimum, and the trend to choose the best quality raw material.

These tendencies cover the whole development series of European pebble industries. Here we mentioned only the most general phenomena, and we should not forget that this model cannot always be applied and not all the signs of development can be explained by it. The development of cultures is varied, complex and sometimes reality does not accept models set up by us.

It is true, however, that the gradual growth of chopping-tools and polyhedrons in time, as compared to the choppers, and also the growth of the direction of trimming and the quantity of flaking belong to the general tendencies of development.

It is to be mentioned that sometimes, in some cases, the way of development is different. Collina-Girard (1978:176) published an interesting comparative table and the excavated material of Têt Valley in her last publication. The table shows that choppers are more frequent in the young tool series than the chopping-tools.

The decrease of volume and weight is also a general tendency of tool development.

Examining the archaeological material we understand that in practice it is more complicated. The Mindel age tools of the Vértesszőlős site are very small, while the Middle Palaeolithic tools of Mixnitz, made of rolled pebbles are far too large and rough. All these and many other phenomena can be explained only with the variability of stone industries, perhaps with the given raw material, the way of utilization of tools, i.e. with their purpose.

The above development trends of pebble industries in Europe can be observed not only according to the subsequent ages but also on the concrete sites. According to Dobosi the quantity of quartzite raw material decreases in parallel with the development of tool types, for the sake of better workable silex. The Lower Palaeolithic type group can be attached mainly to the quartzite raw material. The Middle Palaeolithic type group shows the more frequent utilization of silex, while in case of the Upper Palaeolithic types the good quality raw materials are used in majority. Gábori-Csánk proved with the help of statistics that the quantity of tools grows gradually in the upper five settlement levels of the Érd Middle Palaeolithic site, just like the number of the tool types, while the size decreases and good quality raw material gains more importance (Gábori-Csánk 1968a:189-190, 192).

The question of how long pebble industries survived in Europe arises consequently.

It is difficult to draw a limit, it seems anyhow that the last period was the time of the Charentian, the real Pontiniano, and the Southeast European Charentian, which can be placed between 40,000 and 30,000 years. Later transitions, like the Pontiniano-Aurignacian, are rare and pebble-tools can be found sporadically in the Mesolithic (e.g. Asturian culture in North Spain).

(2) Conservatism is an important feature of pebble industries. This feature is not as strong, definitive in Europe as on other continents, e.g. in Southwest Asia, the archaism, however, can be detected in the tool assemblages.

As it has already been mentioned pebble industries lived, in general, until the Middle Palaeolithic. In some cases pebble-tools can be found in the Upper Palaeolithic, the Mesolithic and even after the Mesolithic. Choppers, chopping-tools, belonging to the Aurignacian are known from Abri Caminade Lišičić, Tuto de Camalhot or in the above-mentioned Pontiniano-Aurignacian (Sonneville-Bordes 1960, Clottes 1976). Cores, end-scrapers and other pebble types of the Szeletian culture are known from Rozdrojovice and Předmost sites. Gravettian pebble-tools were found in Dolní Věstonice, Riparo Blanc and other sites (Valoch 1964-65). Pebble-tools belonging to Magdalenian can be found in the Vth phase of the culture in Kvic, on site Hostim at Beroun (Sonneville-Bordes 1960, Vencel 1969). Choppers and chopping-tool-shaped tools can be found on the Polish Late Palaeolithic sites and similar ones occur also in the Mesolithic (Simonet 1976), like in the Blanc Cave (Taschini 1968) (Pl. XXXVII). The people of the Northern Spanish Asturian culture used pebble-tools at the end of Mesolithic: the shells were carved off the rocks with their help in the coastal settlements. Lastly pebble-tools can be found on some Neolithic and even Bronze Age sites.

Consequently there is 'a Europe' where the tool types of the Upper Palaeolithic are various, specialized and highly developed, not neglecting the advanced, naturalistic art, and beside it there is 'another Europe' where, though in restricted number and sporadically, rough pebble-tools can be found!

How can this phenomenon be explained? There are two possible reasons:

First—no matter what economic development civilization has reached, there are tasks, beside the functions fulfilled with elaborate and specialized tools which could easily be solved with choppers, chopping-tools. Analogies are to be found in our time, too. The role of the tools in the life of primeval man cannot be evaluated truly if we regard only their type, form and not their function. If a tool has a form which enables man to fulfil maximally the desired function, an idea, which for us, present-day researchers is a bit unusual, there is of course no need to change the form of the tool.

The above 'conservatism' means consequently the long survival of some techniques or tool types and not the stagnation of the industry, the civilization.

Second—in some cases the existence of the Upper Palaeolithic and Mesolithic pebble-tools is due to the strength of tradition, the manifestation of some traditions. This phenomenon is clearly displayed on the 'Languedocian' territory in France, where the so-called 'Néolithique de tradition languedocienne' can be found (Mérocs 1965:166), or in Central Italy, on the territory of the Pontiniano culture. As it has already been mentioned, there are many sites around Rome and on the territory of Monte Circeo where the pebble industry survives from the end of the Lower Palaeolithic till the Mesolithic both technologically and typologically and even in the utilized raw material. Such sites are Sedia del Diavolo, Monte delle Gioie (proto-Mousterian), Grotta Guattari (Mousterian), Fossellone (Mousterian and Aurignacian), the Blanc Cave (Upper Palaeolithic and Mesolithic). The tradition of pebble manufacture of Pontiniano culture played an important role in the survival of the old technique and the old types.

(3) Local feature is an interesting and difficult problem in archaeology which aroused and attracted the attention of researchers long ago. In some publications we have already expressed our opinion on the topic (Kinh and Tieu 1973; Tieu 1973; Kinh and Tieu 1976). Thus we shall not turn back to the whole circle of problems but try to discuss a small part of them: the local feature or some local characteristics of European pebble industries.

Except for some territories like, first of all, Southwest Asia, the pebble tradition (tradition 'galet') and block tradition (tradition 'bloc') rarely lived in parallel from the Lower Palaeolithic until the early Neolithic (Tan 1976:176, Kinh and Tieu 1976:87), and as we have already seen the survival and existence of pebble industries in Europe is restricted until the Middle Palaeolithic. The mentioned Upper Palaeolithic and Mesolithic pebble-tools are 'relics' produced to meet some definite aim, playing minor role in the whole of the ancient cultures.

The other feature of the European pebble industries appears clearly if the development phases are divided into shorter phases. Here one can find the oldest Villafran-

chian materials (Chilhac, Šandalja I, Vallonnet etc.), the Mindel age ones (Vértesszölös, Terra Amata, etc.), the Riss age ones (Aldène, Achenheim, Sedia del Diavolo, Monte delle Gioie, etc.) and the pebble industries of the early Würm (Cau del Duc, Érd, Tata, Guattari, Fossellone, etc.) No such detailed grouping can be found in Asia or even in Africa. Europe is lucky that the different phases of development, the most characteristic finds were found not scattered over the surface and not in terrace gravels, but in settlement levels together with fauna which allows classification into phases, supported also with positive chronology.

In Europe two pebble industries lived in parallel, sometimes mixed with other cultures, in other cases preserving their clear features. In Africa there is practically no Acheulean industry without hand axes and cleavers, i.e. industries with hand axes, cleavers, choppers and flake-tools dominate in the Acheulean. Contrary to it some parts of Asia show similar features as Europe: clear pebble industries and pebble industries mixed with other cultures are known.

Typologically the types of European pebble industries, especially the choppers and the chopping-tools are only slightly different from those of other continents. It is valid first of all for the Lower Palaeolithic, and it can easily be understood, regarding the level of development. It does not mean at the same time, that European pebble industries have no specific 'coloration', local feature of their own.

An interesting feature of these industries is that find assemblages consisting of small-sized tools were unearthed in Europe. Such are known from Vértesszölös, the sites of southwestern Sicily, in the Aldène cave and in Caune de l'Arago. It is the Vértesszölös material which deserves attention first of all. The main characteristic of the site is that all the tools were made of pebbles and the types are all small sized. The largest tools are 4 cm long, though the average length is only 2.4 cm. The too small measurements of the tools mean a problem for the specialists: for what work could those so-called 'microchoppers', 'micro-chopping-tools' be applied, could they serve as real choppers, chopping-tools? It is difficult to explain the real, exact function of these tools.

Anyhow, this phenomenon mirrors the variability of the oldest cultures. The same phenomenon is met once more during the Middle Palaeolithic in the so-called 'Micropontiniano culture', though of course with different tool forms and typological character.

The Pontiniano culture is known in the Italian and international palethnological literature as an industry characterized by the 'zitron' (i.e. sliced pebble) and 'su calotta' tool types or in general by small pebble-tools. A similar industry can be found far from Italy in the Castillo cave in Spain as well, and on other sites too (Bordes 1968:120). We must mention that only a part of the tools of the Pontiniano industries are made of rolled pebbles, while the same tool types were produced also of 'zitrons' and flakes.

There are other Middle Palaeolithic civilizations in Europe as well, which favour pebble manufacturing. One of them is the western real Charentian in western France,

the other is the southeastern Charentian in Southeast Europe (Gábori 1976:169). All the sites of these two cultures show identical typological character, colouring.

We consider the material of Érd and Tata really characteristic of the above Middle Palaeolithic industries, even if the Tata industry is not Charentoid. The tool assemblage from Érd is highly similar to the western Charentian in its typological constitution, and technologically it follows the Pontiniano technique (Gábori-Csánk 1966:331). The industry of Tata, with the small sized pebble-tools and the frequency of Levallois technique is a 'forme localement spécialisée du 'Mousterien' au sens large' (Gábori 1976:172). This industry is similar in many respects to the Micropontiniano.

Beside the elaboration of small pebbles another type of industry can also be found in Europe, which is the industry of Kronach as a local speciality. Local feature here means that most of the tools were made of lamellated pebbles (lydithe). It may be due only to the given raw material, though the so-called Languedocian culture displays the same characteristics.

Summing up, the following features can be found in the European pebble industries:

(a) European pebble industries can be found basically only in the Lower and Middle Palaeolithic. (We hold that Lower Palaeolithic contains Villafranchian, Abbevillian-Acheulean and pre-Mousterian industries.) This period lasts from the Günz until the early Würm. Pebble-tools survived on some places in the Upper Palaeolithic and in the next period. They are, however, only relics or tools reproduced without system for the sake of a certain task, and play minor role in these cultures and ages.

(b) The most characteristic find assemblages of the European pebble industries were found 'in situ' in layers with fauna. These industries can be grouped on the basis of their position, into several phases of development.

(c) The two pebble industries lived in parallel in Europe: sometimes they were absorbed by other cultures, in other cases they preserved their original basic forms.

(d) The pebble industries of Europe are various. This variability can be observed not only in the different phases of development, in groups of local colouring and in local tool types, but also in the form and size of the used pebbles.

What is the origin of the above features, variability of European pebble industries?

The characteristics of the pebble industries cannot be separated from the general variability and richness of the European Palaeolithic cultures, or from the average position and level of research. Variability as such cannot be explained by the dynamism of the surroundings, the different economic and cultural types, the raw material and by strength of tradition. It is also true that not all the phenomena can be explained by the enlisted motives and not all the motives are valid in all cases for all the industries. The question, why the European pebble industries lived only till the Middle Palaeolithic cannot be answered with the dynamism of the natural surroundings or the tradition, but rather with the economic and cultural forms, types and the raw material. The hunter-economy of the European Upper Palaeolithic was highly

developed, reached a high level and the long, thin weapons, bone spears, leaf shaped points and the attached elaborating tools appeared as early as the beginning of the age. Pebbles are not fit for such tool types. Besides the silex pebbles are rare, while the good quality block raw material is rather frequent in Europe. Consequently the mode of economy, the cultural type and the good quality raw material together acted in the isolation of pebble manufacturing in the Upper Palaeolithic. In some other concrete cases the survival of local traditions can be observed. The Mesolithic pebble-tool assemblage of the Blanc Cave is a good example of it.

(4) Starting from the opinion that the European pebble industries had one mutual cultural base (cultural substratum), which was the oldest pebble industry, it can be said that pebble tools appear more or less in every culture which developed following the oldest pebble industries of Europe.

As it has already been discussed the pebble industries lived partly in parallel, partly mixed with other cultures during the second great phase of development, chronologically from the Mindel glaciation on. Accordingly it is difficult to define or separate the pebble manufacturing and not pebble manufacturing groups especially in Western Europe.

Clactonian culture was considered by the researchers as a typical flake industry. Breuil stated in about 1930, that flake manufacturers lived in parallel with the hand axe makers from the Middle Pleistocene, approximately since the beginning of the Mindel-Riss interglacial, until the Würm glaciation. Warren reinterpreted the industry in 1951. He realized that the core, from which the flakes were removed were not really cores but rather choppers and chopping-tools and these two tool types were characteristic and dominant in the Clactonian culture. It means that the flake tools are chopper-flakes. Really the pebble tools are present in the Clactonian. A series of 'pebble-chopper-cores' were unearthed during a recent excavation in Clacton-on-Sea in 1969-70 (Singer, Wymer, Gladfelter and Wolf 1973:33).

Pebble-tools play an important role also in the Abbevillian-Acheulean cultures. It can be observed on the Lower Palaeolithic sites of Spain and Portugal that the pebble-tools always survive beside the other tool types like the 'Chellean hand axes' (Zbyszewski 1976:97-101). It is even more important that actually there is hardly any Lower or Middle Palaeolithic culture which would not make its tools like the different hand axes, of pebble, and the real choppers, chopping-tools could not be found (Gábori's kind oral information).

There is only a slight dividing line between the Acheulean industries and the pebble industries, in a broad sense, in France. It seems that the pebble industry of Vallonnet shows both typologically and technologically a trend towards the Acheulean development. Besides many French Acheulean sites belong to the pebble industries considering the raw material and technique or their finds, though typologically they are attached to the Acheulean (Terra Amata, Chapouiller, Mas des Caves, Lavaur, Saint-Paul-Cap-de-Joux, Giroussens, Massac, Damiatte, Zincoirt Champ-le-Loup, Zincoirt La Sorriere, Girmont Haut de Chèse, Moriville La Tuilerie, Lenoncourt, etc.).

There are some Acheulean sites, which cannot be grouped among the pebble industries, though they are close to them. We may mention the well-known Lazaret site as an example: the ratio of the pebble-tools in the cave is 25.09%, i.e. relatively high (de Lumley-Woodyear 1969:125).

The Tayacian find assemblages also contain pebble-tools of certain quantity. The most typical examples are the H-I-K layers Aldène, Caune de l'Arago, E₁-E₂ layers of Fontéchevade.

The tool assemblage of Romandato, which is dominated by tools made of pebbles, was defined as 'Venose Micoquian' (Palma di Cesnola and Zorzi 1961:377).

Pebble-tools can be found on some sites of Czechoslovakia like Předletice, Bečov I etc., where beside the pebble manufacture another technique of tool manufacturing is applied (Valoch 1976:178). Similar industries can be found in Germany, too.

There is, moreover, a civilization called 'Mousterian sur galet' in the Middle Palaeolithic of Europe which spread along the Mediterranean, and in which the pebble-tools are mixed with tool types of other industries. The Charentoid industries can be grouped here (Gábori-Csánk 1968a:125, Gábori 1976:169).

An interesting phenomenon can be found in the western French Charentian. This civilization preferred pebble raw material and quartzite, though very fine block raw material is at disposal. The ratio of the pebble-tools in the real Charentian industries is around 20-25% in general. It can be explained only with a certain population, which clung to this tradition and which repeatedly returned into the same cave. They alternate with different Mousterian groups, which use at the same place and nearly in the same time exclusively block material and different tool types.

When examining the contact of the pebble-tools with other cultures we cannot rely only on outer, formal signs. We cannot be sure if they were original, mutual connections or only chance similarities. Two different industries can be found in the Aldène cave: the first tool assemblage consists of silex flakes of Levallois technique (layers A-G), the other one contains pebble-tools, and the tools are made of small-sized quartz and quartzite pebbles (layers H-I-K). The second example is provided by the two layer complexes of the Krapina cave, the upper part of which was divided into 9 layers or levels. The lower layer complex and the 1-3 layers of the upper one contained a Tayacoid industry. In layers 4-5 the Southeast European Charentian can be found. In layers 5-9 the quartzite raw material totally disappears and a characteristic Central European Mousterian settles above the older industries.

How can the connections of the layers be explained? Was there an ethnic, genetical connection between them or are they separate, special cultures, the heritage of earlier and later inhabitants?

The clear or independent pebble industries belonged chronologically to subsequent, continuous phases (from the Günz until the early Würm), though culturally it is difficult to find kinship between them or to follow the inner development of the industries.

'Micro-choppers', 'micro-chopping-tools', similar typologically to the Hungarian

Vértesszőlős, were found on sites in southwest Sicily, in the H-I-K layers of the Aldène cave, in Caune de l'Arago. This outer resemblance, however, does not evidence the common ancestry. Similar industries are known also on smaller territories as well (pebble raw material, some technological features, types): Vértesszőlős—Érd—Tata. There is, however, no definite standpoint to state that they developed from each other. The industry of Érd is considered a very archaic Charentian. Even if it were older than the defined age, still there is a vast time sequence between it and the Mindel. Gábori writes carefully on this topic: "The possibility of a relationship between the pebble industries of the Lower and Middle Palaeolithic, suggested by the similarity between the Vértesszőlős pebble industry and the Middle Palaeolithic of Tata, is not to be excluded, but the hypothesis of introduction of a micro-chopper tradition from the south seems more appropriate in view of the fact that the temporal distance is still problematic" (Gábori 1968:372).

Concerning the origin and contacts of archaeological industries we think that an ethnic group cannot be attached simply to a certain raw material, and at the same time the origin of a pebble industry is to be searched not only among pebble industries. The pebble-tools could be ethnic, populational traditions as well. The possibility that a certain ethnic, human group could make tools, if needed, even pebble-tools under different circumstances and of different raw materials to fit a certain purpose cannot be excluded.

We cannot neglect this very simple possibility especially when the whole of the finds, the variation of the tool types and the cultural features are examined.

Let us now discuss an interesting contact: the problem of the relation of the hand axes and the pebble-tools.

As it is known it was Boucher de Perthes who realized, for the first time, the contemporaneity of the Lower Palaeolithic hand axes and the extinct 'antediluvial' animal bones in the gravel of the terraces of the Somme. His first book was published in 1847, and his observations were acknowledged only much later by the geologists. A century later, especially in the publication written in 1949, Movius defined another tool assemblage beside the Lower Palaeolithic hand axes, the group of choppers and chopping-tools. The very names were given to the tools by him, and he considered that two different, large cultural complexes could be found on two different vast territories:

The great hand axe complex, which was widespread throughout Africa, South, Central and Western Europe, in the Middle East and in South India.

The great chopper-chopping-tool complex, which was diffused in China, Northwest India and Southwest Asia.

Many researchers accept Movius' two great complexes, some contradict it (Zamiatin 1951, Okladnikov 1966, Boriskovsky 1971, Kinh and Tieu 1973, Tan 1973 and others.)

The opinions of researchers accepting or rejecting Movius' views start from different views. Some think that this division by Movius has no basis. According to others Movius' view is right, while others still deny the existence of the two complexes

on the two vast territories, though acknowledge the difference between the sites and the site groups and lastly some researchers are willing to substitute the notion of the 'western' and 'eastern' characteristic tool with the notion 'heavy'.

The way of development of culture, the culture of man is not simple. It is difficult to find a common model for all the cultures. It is possible that on a site or on a larger territory the ratio of the hand axes is higher than of the choppers and chopping-tools as compared to other sites, and vice versa. We have to stress that the so-called hand axe civilization was formed not always on the so-called West. In reality we see a complex picture: two industry types live side by side—sometimes mixed, sometimes preserving their clear features.

Tavoso provides interesting numerical data about the industries of rivers Tar and Agout. The ratio of the pebble-tools from 10 old Acheulean sites, in Lavaur and Saint-Paul-Cap-de-Jeux is 56–62.7%, that of hand axes is 27.5–32.7%. 95.1% of the latter are covered by cortex. The ratio of the pebble-tools on advanced Acheulean sites (Girousses, Lavaur, Massac, Damiette) is 64.2%, that the of the hand axes is 12.7% (Tavoso 1976b:899, 901).

The heritage of pebble-tool makers can be found nearly everywhere where the hand axe people lived, though the territory of the former is much larger than of the hand axe cultures.

Naturally we do not deny the fact that on some territories like Africa, Western Europe, Southwest Asia, South India, a large quantity of hand axes were uncovered, and in many cases the ratio of the hand axes is the highest among the tool types. It can be seen, however, that the mixing of the pebble industries with other cultures is a more common feature in the western territories than in the eastern ones, and the pebble industries are clearer in the eastern parts (Valoch 1968:354).

The question arising here is what the ratio of the hand axe industry can be in a given territory in comparison to the whole of the Palaeolithic industries.

In some geographical regions, like in France, a great many sites were discovered, it is no wonder that hand axes can be found in large quantity and in high proportion. Contrary to it there are only 6 Lower Palaeolithic industries unearthed in Southwest Asia, four of which contained hand axes. Though the number of the hand axes is not large in the tool assemblage, the ratio of 2:3, as the result of comparison to the whole of the industries, deserves attention.

The pebble industries and the hand axe industries are the representatives not only for horizontal but also of vertical evolutionary contacts.

The layer series of the well-known Olduvai site is known for a long time. The lower age group, layer formation, contains Bed I i.e. the sub-layers, levels of the 1st layer group. The upper great complex starts from the upper part of Bed II and contains the sediment series up to Bed V. The tools of a very old pebble industry were found in Bed I, and in the lower part of Bed II. They are gradually substituted by the tools of a more advanced pebble industry from the middle part of Bed II, which lie in the same layer, partly as the characteristic African industry of hand axes, also mixed with it,

while the hand axe industry is dominating from the top of Bed II up to the top of Bed IV, developing to higher and higher levels. Here the original relation of the pebble industry and the hand axes can be seen. Soundara Rajan (1961:81-84) shows the phases of development of the hand axes made of pebbles, of the Madras culture in his study written on the Indian pebble-tools.

The case is basically similar in Europe. Several fine hand axes made of pebbles are known from the Lower and Middle Palaeolithic. Alimen (1965:87) writes: "Le biface chelléen était le plus souvent dans nos régions, fait dans un galet de silex, ramassé dans les alluvions, mais le quartz, le grès ont aussi été employés". According to de Lumley (1976:872) many Acheulean sites were discovered on the Quaternary terraces, like Ruisseau de l'Aire, Saignasse, Compariés in the Libron valley, where the hand axes were usually made of flat, smooth, oblong pebbles.

Some authors give even more definite proofs of the chopping-tool-hand axe development. According to Bordes (1968:134) "Il semble établi que les bifaces se développèrent à partir des chopping-tools". According to Chavaillon (1961:777) "Le 'coups de poing' des premiers préhistoriens, qui semblent en étroite parenté avec les galets aménagés du type 'chopping-tool', présentent, pendant le Paléolithique inférieur de multiples formes obtenues par des techniques de plus en plus perfectionnées, pour un usage de plus en plus précis et déterminé".

In summary we may say that the relation of the European pebble industries to the other industries is really 'buissonnante', manyfold, ramifying, with crossing branches and gradually fading. From the Upper Palaeolithic pebble as raw material attracted primeval man no more.

V Origin of European pebble industries

More than 60 years ago Bayer (1929:7-8) investigator of Palaeolithic in Vienna was sure that man had had some kind of culture as early as the Pliocene, even if it had been very primitive. Thus hand axes were considered, at the beginning of the 20th century to be the oldest remains of human culture. The hand axes are from the view of technique of manufacture highly specialized prehistoric implements. The hand axes themselves demand, theoretically, some kind of antecedents in the earliest cultural phases, at an earlier level of human development. Nowadays it seems that these antecedents must have been the tools, characteristic of the oldest civilizations known in the whole world under the notion 'Pebble Culture'. The pebble-tools of course do not come from the Tertiary, as Bayer supposed. Vaufreys (1951:162) observed trimmed pebbles from the Villafranchian as early as in 1951, then the Preabbevillian industries, the 'galets aménagés' or 'couperet' were found in some European countries, especially on the territory of France (Bourdier 1962:367), while the results of excavations carried out in the last years added greatly to our knowledge of the earliest population of Europe.

Another question is from where the pebble-tool makers came to Europe, or if the culture, population making and using the oldest tools evolved locally in Europe.

As it is known the Pithecanthropus, living about half a million years ago, used to be called for a long time the oldest tool-making man. A very important event took place at the end of the 50s in archaeology. Significant archaeological and anthropological material was discovered in the Olduvai trench in 1959. The well-known stratigraphy of Olduvai consists of four main layers. In the oldest layer (layer I) Leakey unearthed a skull, some features of which resemble the Australopithecus, some others remind of man. Leakey called this find 'Zinjanthropus' and together with the 'Zinjanthropus' some pebble-tools were also found. The age of the layer of the 'Zinjanthropus' is, according to Potassium-Argon dating 1,750,000 years.

Leakey discovered another skull in 1960, which he defined as *Homo habilis*, and which was lying in the mentioned layer I, but 60 cm deeper than the Zinjanthropus. Most of the researchers consider accordingly that the oldest man was the *Homo habilis*.

After these discoveries Arambourg and Coppens, French researchers, found tools dated to about 2,200,000 years on an excavation at Omo river (Arambourg, Chavailon and Coppens 1968). In 1968-69 the researchers of the Kenya museum found choppers and flakes dated to 2,610,000 years (Leakey 1970). Other Australopithecus

finds have also been discovered in the meantime, among others the very old, supposedly 4 million years old Kanapo find, and the *Australopithecus* of Lothagam hill, which is dated 5.5 million years.

The oldest anthropological and archaeological finds discovered in Africa inspired many of the researchers to state that the oldest industries and even the makers of the lower Acheulean industries migrated to Europe from Africa. Sieveking (1962:125–126, 128) arrived to the following conclusion during the comparison of the Kota Tampan in Malaysia and the pebble industry of Olduvai: “The earliest southeast Asian industry must be considered as the evidence remaining from an initial very farflung diffusion of pebbles from Africa prior to the Second European Glaciation” . . . and “A picture thus emerges of a number of early protohominids migrating from Africa to both Europe and the Far East at some time prior to the development of the true hand ax, and the evidence from Olduvai Gorge suggest that the latest possible date for this is before the Second Interglacial, when Abbevillian types appear”.

There is an author, who drew the route of migration of pebble industry from Africa to Europe and from Africa to Asia. According to this analysis the pebble industries started from East Africa. One branch reached west across North Africa, the other branch turned north to the territory of the Transcaucasus, going on towards Central Asia, South and Southeast Asia and even to Northeast Asia. Vértés (1969:221) wrote the following: “If the pebble industries spread through the three continents really by way of migration, as is my hypothesis, I must suppose, considering the contemporaneity of Vértesszőlős and Chou-Kou-Tien that the groups bid friendly adieu to each other somewhere in the Near East, a group of them left for northeast, another one for northwest.”

Some investigators think that the makers of Acheulean also migrated to Europe from Africa. Friedrich (1976:20) writes the followings. “A certain similarity between the finds from Central Europe and Africa may suggest dispersion of the early Acheulean population from the tropical African area into the zone of the inner European subcontinent.” Fejfar’s (1976:343) sentences reveal a similar view: “The great similarity (i.e. of the Predletice tools) with finds from Olduvai Gorge suggests dispersion of the early Acheulean population from the tropical region of Africa not only to the temperate zone of the eastern (Ubeidiya) or northeastern (Vallonnet) Mediterranean, but also to the boreal zone of the inner European subcontinent. This event probably occurred at the Middle–Early Pleistocene boundary some 700,000 years ago, i.e. during the pre-Elsterian interglacial, but prior to the advance of the Elster glaciation in the north.”

Several other elements are to be considered, however, if we want to shed light on the origin of European pebble industries: the natural setting, climate, animal world, and also archaeological and anthropological data. As the problem is in relation with the oldest phase of human evolution and also with the appearance of the oldest tools, we have to deal with the oldest phase of the Lower Palaeolithic from the archaeologi-

cal point of view, i.e. the Olduvai phase anthropologically, the level of the Australopithecus, geologically the Lower Pleistocene, more exactly the Villafranchian.

First of all we have to examine the natural and geographical circumstances for the sake of a clearer picture of the event of the first phase of human history.

We are living in an age when climate became unfavorable on the parts of the Earth where the evolution of human species may have taken place. This was the reason why some specialists thought that the deterioration of circumstances helped or forced man to 'cross the Rubicon'.

Casting a glance at the natural surroundings of the Villafranchian we find a basically tropical fauna. It contains Mastodon and archaic elephant species, a zebra-like horse, rhinoceros, hippopotamus and macaco monkey, etc. (Arambourg 1962:99).

Without trying to give all the evidence we mention that similar fauna was unearthed in Spain on Villaroya site from the Lower Villafranchian. Upper Villafranchian fauna was found in Valverde de Calatrava (W-Mancha) which was unearthed by Hernandez-Pancheco already in 1921 in the Mestas de Cón (Cangas de Onís) and Llanera caves. Lower Villafranchian fauna was unearthed in France among others on site Perrier (Central Plateau) characterized by the lack of *Elephas* and the existence of *Mastodon borsoni*, *Anancus arvernensis*, *Tapirus* and a *Hipparion* species. Also Villafranchian fauna is known from Seneze site on Upper Loire. On the nearby Chilhac site, as it has already been mentioned, *Mastodon*, *Anancus arvernensis* and *Equus stenosis* remains were uncovered, dated from the Middle Villafranchian, together with stone tools. Upper Villafranchian fauna can be found in the Vallonnet cave and on sites Sinzelles (Upper Loire), Solilhac (Upper Loire), Saint Prest (near Charthres), Montières (at Amiens), St-Vallier and Chagny (at Lyon) and several other sites of the same age. Their fauna is characterized by "primitive Elephant", *Elephas meridionalis* Nesti, *Mastodon anancus arvernensis* Cr. and Tob., *Hippopotamus* (*H. major* Owen), *Equus zebra* (*E. stenon* Cocchi) and an archaic Bovidae (*Leptobos etruscus* Falc.) (Arambourg 1962:99).

Upper Villafranchian fauna can be found on Valdarno site in Italy near Florence and in the bone breccia of Šandalja I on Istria peninsula in Yugoslavia. Most of the species in the fauna of the latter site belong to the middle and upper Villafranchian like the *Oryctolagus* cf. *lacosti*, *Canis etruscus*, *Ursus etruscus*, *Euryboas lunensis*, *Equus stenosis*, *Sus strozzi*, *Anoglochis ramosus*, *Cervus philisi* and *Leptobos stenometopon* (Malez 1976:110). Towards east we may mention Bugiulești in Romania investigated in 1961. *Equus* and *Cervus* are dominating in Bugiulești, the carnivorous animals are present in smaller quantity, and the rodents are even rarer. This fauna was placed in the advanced upper Villafranchian (Nicolăescu-Plopșor C.S. and Nicolăescu-Plopșor, D. 1963:12).

Altogether the climate of the European Villafranchian from where the oldest finds are known was warm or warmer than temperate.

The simplified and shortened form of the process of evolution as known today is

the following: after the pongid-hominid divergence at the end of the Miocene the way of evolution leads from the *Ramapithecus* through *Australopithecus* towards *Homo*. The European palaeoanthropological data have never gained enough importance in technical literature. It is due to the poor find material on one hand and to the fact that many sporadic finds could not be dated even stratigraphically, on the other hand.

The European apes were known already in the first half of the 19th century. Schleiermacher found an anthropoid femur in the Lower Pleistocene Hipparion fauna of Eppelsheim in 1820. The first homoid teeth found in the peat ore site of Schwabische Alb were described in 1835 by Jäger. Lartet mentioned a jawbone in the Middle Miocene fauna of Sansan which he compared to that of a gibbon. The St. Gaudens jaw was published in 1856; Lartet described it as the real member of the great pongid-hominid apes. Fuchs mentioned a similar tooth of the Upper Miocene of Dévényújfalu in 1877. Depéret described an upper M^3 from the Upper Miocene fauna of La Grive-St-Alban in 1911. Two years later, in 1913, Vidal reported a *Dryopithecus* mandible with teeth probably from Pliocene from Seu d'Urgel in North Spain. Mottl described *Dryopithecus* remains, the frontal part of a mandible in 1957.

Lastly Hernyák found a hominid mandible body with P_4-M_3 teeth and enriched the material with further finds in the following years. The Rudabánya find material consists of three Hominid taxons: *Rudapithecus hungaricus* Kretzoi 1967, *Bodvapithecus altipalatus* Kretzoi 1974 and *Pliopithecus* (*Anapithecus*) *hernyáki* Kretzoi 1974. According to Kretzoi the Rudabánya find material enables the division of the two lines 'specialized apart' in the Lower Pleistocene; (a) a small bodied hominization line with reduced canine and incisives, i.e. short faced one, and (b) a Spanish-Greek-Anatolian robust specializational trend with immense canines, strong incisives which can be considered as pongoid (Kretzoi 1974:126).

Turning back for a moment to Šandalja I: one of its important finds is the upper first left incisor of a *Homo* genus. The tooth is well preserved, only the enamel was damaged on the top of the occlusal surface. Though the exact taxonomical definition of the isolated tooth is problematic, Malez (1976:116) holds that "the discovery of the afore-mentioned tooth in the Villafranchian deposits of Šandalja I proves undoubtedly that the genus *Homo* had lived in Europe in the Lowermost Pleistocene and this tooth probably belongs to a representative of the group of the advanced australopithecine".

We must remember that not only the apes of the Pleistocene can be found in Europe but also the very old remains of fossil man in the Middle Pleistocene deposits. Such are Mauern, Swanscombe, Vértesszőlős, Steinheim, Lazaret cave, Montmaurin, Arago. Earlier the European anthropological find material was actually not taken into consideration in the theories endeavouring to reconstruct the first phases of human evolution. The discovery of the above-mentioned hominids, especially the Rudabánya material, became the most important documents in research of hominization. Perhaps we should agree with Kretzoi (1975:581): "Hominization did not originate in certain isolated and more or less small tropical-subtropical gene pools but was an evolution-

ary trend covering the whole Afro-Eurasian fauna radiation with its pongo-hominides". The above-mentioned palaeoanthropological finds prove that Europe may have been a territory of the complex process of hominization.

If the faunistical and palaeoanthropological remains provide such antecedents of the local or foreign origin of European man, we think that the archaeological material, more exactly the pebble industries can give even more exact evidence to solve the problem.

As it has already been mentioned, the pebble industries can be found in most of the European countries, in Portugal, Spain, France, Germany, Italy, Austria, Czechoslovakia, Hungary, Yugoslavia, Romania. It is enough to cast a glance at the diffusion map of the oldest pebble industries (Fig. 13) or at the above list to recognize a 'southern zone' which inspires automatically some suppositions concerning origin, though it proves by no means that the industries would have come from Africa. In the following only the sites of the corresponding phase of African 'Pebble Culture' i.e. those from the Donau glacial until the Günz-Mindel interglacial will be enlisted for the sake of shedding some light on the origin of the European pebble industries.



Fig. 13 Main sites of the oldest (Villafranchian) pebble industries of Europe, North Africa and the Near East: (1) Brenes (2) Puerto de Santa Maria (3) Mas Galtes (4) Mas Auriol (5) Fresquel (6) Mas Mester (7) Mas Ferreol (8) Mas Saint-Thérèse (9) La Garigue (10) Mas Goulin (11) Château Barnier (12) Chilhac (13) Vallonnet (14) Monte Peglia (15) Capo Rossello (16) Šandalja I (17) Dirjov (18) Ciuperceni (19) Rastan (20) Borj Qinnarit (21) Sidi Abderrahman (22) Ain Hanech (23) Qued Dra (24) Aoulef

According to the data at our disposal today, the oldest datable pebble-tools of Europe belong to the Upper Villafranchian. Several pebble industries of the age can be found on the territory of present-day France, especially in South France. We may say that Chilhac is the oldest site in Europe dating to the end of the Donau period or from the Villafranchian. Its evaluated age by Potassium-Argon method is 1.8 million years (Guth 1974:1072). This datum is worth comparing to Olduvai dated by the same method.

Pebble industries of three periods are known on the middle and lower Pleistocene terraces of the Rousillon plain: the ones from the end of the Günz, from the beginning of the Mindel and from the end of the Mindel. Sites linked to the end of the Günz are Mas Ferréol, Mas Saint-Thérèse (Cabestany district), Mas Mester (Canohès district), Mas Galtes, Mas Auriol (Perpignan district), Gourg, Oums (Baixas district) (de Lumley et al. 1976:785).

The Günz and Günz-Mindel age finds of 'Pebble Culture' can also be found on the terrace of the Fresquel river between Castelnaudary and Carcassone on sites St. André, Grazaillies, Bois des Castelles (Tavoso 1968-69:112). The oldest pebble industries from the early Günz were discovered lately on the surface of Costière du Gard. These sites are Garrigue, Mas Goulin-Mejanelles, Château Barnier (Caissargues), Cadenette, Pin de Candiac (Vestric Candiac) (de Lumley, Collina-Girard, Abelanet, Bazile and Meignen 1976:779). The industry of Grandes Caves lying on an old Günz terrace and dated to the end of the Günz or to the Mindel is somewhat younger (Roudil 1974:658).

The well-known Vallonnet site can be found in Provence: a researcher placed the find material with high probability to the beginning of the Mindel (Bonifay 1975:206), while someone else dated it to the Günz (0.9-0.95 million years) (de Lumley 1976a:765).

Furthermore a pebble-tool was found on Ferme du Vallon site on the surface of the Entressen terrace dated to the Günz. Several pebble-tools were collected from site Petite Crau or Crau de Saint-Remy, the older series of which can be put, with its rough tools, into the Günz-Mindel interglacial (de Lumley 1976a:775). Some sporadic tools from the Günz were also found in North France e.g. in the really Günz sediments in Montières district at Amiens. Bourdier found two tools near Senart on the terrace of the Seine dated to the Günz I (Bourdier 1967:155).

Some pebble-tools from the Villafranchian were found southwest of France in Spain. Pebble industries technologically and typologically identical with the advanced 'Pebble Culture' of the Moroccan Casablanca-Rabat were collected in Carmona district (Sevilla county), on the surface of Brenes and Lora del Rio (IIIrd phase of development) (Bordes and Viguier 1969:1946). Pre-Mindel ('Upper Villafranchian') pebble industry can be found in Puerto de Santa Maria near Cádiz (Bordes and Viguier 1971:1748).

The oldest material on the Appenine peninsula seems to be the stone industry of Monte Peglia in Oviedo district, dated to the end of the Günz-Mindel interglacial

(Piperno 1972:53). The rest of the old pebble industries can be found in Sicily in great density. Their sites are Faro Rosello, Casa Bioni, Pergole, Punta Grunde, Punta Bianca, Mandrascava, Bertolino di Mare and Menfi. As it has already been mentioned these industries were grouped into two facies: macrolithic and microlithic ones and chronologically the industries of the macrolithic facies were parallelized with the African 'Pebble Culture' the finds of the Maghreb region, being contemporary with the Sicilian ones (Bianchini 1970:143).

The pebble industry of Capo Rossello, an important site in Sicily, stands close, typologically, to the advanced tool assemblage of the Villafranchian 'Pebble Culture' of Sidi Abderrahman (Bianchini 1969:178).

In Yugoslavia the industry of Šandalja I with Villafranchian fauna (Upper and Middle) can be considered to be the oldest find. Some researchers think that very old Palaeolithic industries had existed before the Elster glaciation. Such sites are Bečov I-T, Prague-Suchdol, Seňa in Czechoslovakia; Bugiulești in Romania, the bone industry of which can be correlated with materials from the lower part of the layers I and III of Olduvai Gorge (Friedrich 1976:8). Beside Bugiulești the industry of Dîrjov in Romania is called Pre-Palaeolithic, dated to the first interglacial (Nicolăescu-Plopșor and Moroșan 1959:23).

Returning to the mentioned archaeological evidence it can be seen that before the appearance of the people of Abbevillian-Acheulean and Clactonian cultures, the makers of the pebble industries had already inhabited Europe during the Villafranchian or Pre-Mindel.

Tracing further the question of origin we may state that if the 'Pebble Culture' had arrived to Europe from East Africa its traces would have been left on the route of migration, thus in North Africa, on the eastern and northeastern territories of the Mediterranean and especially on the 'migration bridges'.

It seems, however, that though most of the remains of the *Australopithecus* were found in South and East Africa, there were no signs of fossil anthropoids and hominids in North Africa. There are no Pre-Abbevillian industries in the Nile valley. The material of the 'Chellean-Acheulean' culture have been found on the 25-30 m levels of the high terraces of the river. Choppers and hand axes of Lower Palaeolithic features were discovered on the terrace of Abbasiyah at Cairo.

Going on towards west Villafranchian industries can be found in Algeria, Morocco, sometimes even on more southern territories, in the Sahara. The most important one of them is the Upper Villafranchian (Günz) find of Ain Hanech in Algeria, which contains tools of Olduvai type as well. The spheroids or bolas are especially characteristic of this industry (Arambourg and Balout 1952).

Montelmans, Choubert and Hollard unearthed Pre-Chellean-Acheulean pebble-tools on site Qued Dra in Morocco in 1952. The industry group of the territory around Casablanca and the Atlantic coast, characterized in general by the Sidi Abderrahman site, is even more significant. A culture of hand axes with young *Atlantropus* remains was found on site Sidi Abderrahman itself.

Pebble industries are known from more southern territories, in Tibesti, Kedama, Fort de Polignac, Tihenboka, Aoulef, Saoura, Djebel Idjerane sites in the Sahara (Dalloni 1934, Hugot 1955, Bonnet 1961, etc.).

Returning to the Lower Palaeolithic of the Atlantic Morocco, the local 'Pebble Culture' industries were classified into two large groups by Biberson (1961:39): the old and the advanced 'Pebble Culture'. Some of the materials of the older group are archaic (phase I) dated to the 'Donau' period, some are old ones (phase II) dated from the 'Donau-Günz'. The middle phase belongs to the advanced 'Pebble Culture', dated to the Günz (phase III) and the last phase belongs also here (phase IV), which can be dated to the Günz-Mindel interglacial.

There are only a few Villafranchian finds on the eastern territories of the Mediterranean. The age of the most important site, Ubeidiya in Israel is no older than the Mindel (Stekelis 1966). The material of Borj Qinnarit in Lebanon can be dated perhaps from the end of the Günz-Mindel interglacial, while the industry of Joub-Jannine II site can be put in the Mindel.

Industries called 'Para-Acheulean' are known from Sharia and Er-Rastan sites on the middle terrace of the Orontes Valley in Syria (Van Liere 1960, Van Liere 1966).

There is no Villafranchian industry towards north in Turkey, only finds from the Acheulean can be found. The oldest finds, showing similar features as Olduvaian, Patjitanian, Soanian, though of uncertain dating, were reported by Erdbrink and Heekeren from the 40 m high terrace of Kizilirmak.

It can be said that the oldest industries in North Africa and the Near East region are not much older than the European pebble industries. The above classification by Biberson is more interesting theoretically than practically. At the same time some pebble industries in Europe are not much younger than the ones in East Africa. One can even find contemporary ones. It all shows that the migration of the pebble industry makers from Africa to Europe is rather questionable. There are no data strengthening that the Straits of Gibraltar or the territory between Asia Minor and the Near East and Europe had been a 'migrational bridge'.

Another problem is whether the contact between the Apennine peninsula and Sicily could be used as a 'bridge'. According to investigations by Bianchini there is an underwater ridge in the Messina Strait between Sicily and the Apennine peninsula about 70–100 m under sea level. This level changed several times during the Pleistocene with a water level fluctuation of 50–100 metres, according to the glaciations and interglaciations. The water level was the lowest during the Würm.

The development of the fauna shows that there was no contact between the Apennine peninsula and Sicily during the Riss-Würm interglacial. Up to that time the contact could have existed between the two territories: the *Cervus elaphus*, which disappeared from the Apennine peninsula during the Mindel glaciation could have got to Sicily on dry ground during this period. This was the first time when the hunters of the Palaeolithic arrived in Italy and, during the Mindel-Riss interglacial, in Sicily. The contact ceased during the period between the Riss and the Würm.

Concerning the contact towards Africa there is an underwater hill range of 100–200 metres and of several km width between Sicily and Tunisia. There are several underwater volcanoes in this area, it is a highly seismic zone. The centre of this seismic zone can be found near Sicily at the Pantelleria island. A small volcanic island formed from the 150–200 m deep sea in this area in 1831. The formation of the island and the different surveys suggest that similar movements could have happened during the Pleistocene as well, at the time when also a terrestrial bridge had existed between Sicily and Africa (Bianchini 1971:103–106).

So we accept the possibility of a terrestrial contact between the Apennine peninsula–Sicily, Sicily and Africa, supposing that if ever such a contact existed it could not have been unidirectional, but reciprocal. There is no proof to support that the pebble industries would have spread to the inner parts of Europe from Africa through Sicily and the Apennine peninsula. We have underline that the oldest industries of the Apennine peninsula are younger than the ones in France.

The above statements do not deny migrations in the Palaeolithic—it is just not advisable to overestimate the role of migration in the earliest phase of human history. Even if we do not take into consideration the mentioned archaeological and palaeoanthropological evidence, supporting the local origin of the European pebble industries, the general logic of thinking rejects that the human groups making the pebble industries which were naturally small, physically primitive, could have migrated from East Africa to Europe and even from Africa to Southeast Asia.

If we still accept the theory that the makers of pebble industries migrated to Europe from another continent, the quick spreading of European cultures cannot be explained, neither their flourishing. A series of Mindel age industries are known from the territory beside the above-mentioned Villafranchian ones.

The oldest pebble industries found in Europe, especially according to the excavations of Vallonnet cave “suffisent au moins à mettre en doute l’hypothèse selon laquelle seul l’Afrique aurait assisté à l’aurore de la civilisation” (Zotz 1968:524). Bordes (1968:50) is right when he writes that “dès le Villafranchien supérieur, l’homme (probablement au niveau de l’Australopithèque) était déjà répandu sur toute l’Afrique probablement l’Asie du Sud, et au moins le Sud de l’Europe”.

Faunistical, palaeoanthropological and archaeological evidence shows that the European pebble industries developed locally in the European inner territories with the original centre in the South European area. The multidirectional analyses of the contemporary natural surroundings, the fauna, the palaeoanthropological finds and of the archaeological finds seem to support that the vast territory of the Mediterranean – containing Southwest, South, Southeast Europe and also North Africa and the Near East – can be considered as a comprehensive cultural province from the Villafranchian on. Their common features can be detected step-by-step, appearing most clearly during the Upper Acheulean and the comprehensive ‘Mousterian’.

It was not by chance that several authors connected North Africa and the territories North of the Sahara with Europe. The area of the Mediterranean, this vast territory

can be considered in itself as a centre of human evolution and development. The archaeological and palaeoanthropological finds of the last years suggest that the process of human evolution and development took place probably in a large, approximately triangular territory, the three angles of which are the three centres where the oldest palaeoanthropological and archaeological finds were the densest. Such centres are East and South Africa, South and Southeast Asia and the Mediterranean. We think that transitional forms of cultures, cultural 'domains' can be found at the borders of the three centres.

Lastly looking back on the short history of research of the pebble industries two observations should be recalled. One of them is already a fact, the other is very close to reality.

One is that Vértés was right when without knowing the discoveries of the past years, he located the diffusion of the pebble industries in the southwestern and southern zone of Europe. The same 'Mediterranean zone' was recognized by Gábori-Csánk independent of the former, on the apropos of the diffusion of the much later, though perhaps also related pebble manufacturing Middle Palaeolithic industries. The other observation discussed above is that those who supposed that we are close to the time when the origin of the oldest European industries will not be searched for in the tropics of East Africa, were right. The newer and newer discoveries from the earliest phase of human evolution certify this supposition and the European finds strengthen it.

References

- ABRAMOVA, Z. A. (1972): Pebble-tools in the Palaeolithic of Yenisei (in Russian). *Palaeolithic and Neolithic of the USSR*. t.VII (MRA, n° 185) Leningrad.
- AGACHE, R. (1968): Informations archéologiques. In *Gallia Préhistoire*, t.XI, fasc. 2.
- ALIMEN, H. (1965): *Préhistoire*. T. I, Paris.
- ALIMEN, H. and CHAVALILLON, J. (1962): Position stratigraphique et évolution de la Pebble Culture au Sahara nord-occidental. *Actes du IV^e Congr. Panafricain de Préhistoire et de l'Etude du Quaternaire*, sect. III, Léopoldville.
- AMBRUSTER, R. and ANTOINE, R. C. (1955): Note préliminaire sur quelques stations lorraines à quartzites paléolithiques. *Bulletin de la Société Préhistorique Française*, t.LII, fasc. 8.
- AMIOT, C. (1979): Les industries archaïques de Montsaugéon. *Bulletin de la Société Préhistorique Française*, t.76, n° 5.
- ARAMBOURG, C. (1962): Les faunes mammalogiques du Pléistocène circumméditerranéen. *Quaternaria*, VI.
- ARAMBOURG, C. and BALOUT, L. (1952): Du nouveau à l'Aïn Hanech. *Bull. Soc. Hist. nat. Afr. N.*, t.XLIII.
- ARAMBOURG, C., CHAVALILLON, J. and COPPENS, Y. (1968): Résultats de la nouvelle mission de l'Omo (2^e campagne 1968). *Comptes Rendus de l'Académie des Sciences*, 268, série D, 5.
- BAISSAS, P. (1972): Étude sédimentologique sommaire du remplissage de la grotte d'Aldène (Cesseras, Hérault). *Bull. du Musée d'Anthropologie Préhist. de Monaco*, n° 18.
- BALOUT, L., BIBERSON, P. and TIXIER, J. (1970): L'Acheuléen de Ternifine (Algérie), gisement de l'Atlantropé. *Actes du VII^e Congr. Inter. des Sc. Préhist. et Protohist.* Prague 21-27 août 1966.
- BARRAL, L. and SIMONE, S. (1972): Le Mindel-Riss et le Riss à la grotte d'Aldène (Cesseras, Hérault). *Bull. du Musée d'Anthropol. Préhist. de Monaco*, n° 18.
- BAYER, J. (1929): Die Universalgeschichte der Menschheit. *Eiszeit und Urgeschichte*, 6.
- BAZILE, F. (1972): La station paléolithique de Jean Thomas Vauvert (Gard). Note préliminaire. *Bulletin de la Société Préhistorique Française*, t.69, n° 9.
- BEDEN, M. and GUTH, CH. (1970): *Nouvelles découvertes de restes de Mammifères dans le gisement villafrançien de Chillac (Haute-Loire)*. Comptes Rendus de l'Académie des Sciences, t.270, série D, n° 17.
- BIANCHINI, G. (1969): Manufatti delle 'Pebble culture' in Sicilia. *Rivista di scienze preistoriche*, vol. XXIV, fasc. 1.
- BIANCHINI, G. (1970): Nuovi rinvenimenti della 'Pebble Culture' nei terrazzi del quaternario antico della Sicilia Sud-Occidentale. *Atti XIV Riun. Sc. I.I.P.P.* Florence.
- BIANCHINI, G. (1971): Risultati delle ricerche sul Paleolitico inferiore in Sicilia e la scoperta di industrie del gruppo della 'Pebble Culture' nei terrazzi quaternari di Capo Rossello in territorio di Realmonte. *Atti XIII Riun. Sc. I.I.P.P.*, Florence.
- BIBERSON, P. (1961): *Le Paléolithique inférieur du Maroc Atlantique*. Publications du Service des Antiquités du Maroc, fasc. 17, Rabat.
- BIBERSON, P. (1968): Galets aménagés du Maghreb et du Sahara. *Fiches typologiques Africaines*, 2^e cahier, Paris.
- BIDDITTU, I. (1972): Pleistocene e industrie litiche pre-acheuleane ad Arce e Fontana Liri (Frosinone). *Quaternaria*, XVI, Rome.
- BIDDITTU, I. and PIPERNO, M. (1972): Nuove segnalazioni di 'pebble Culture' in Sicilia. *Quaternaria*, XVI, Rome.

- BLANC, A. C. (1937): Fauna à Ippopotamo ed industrie paleolitiche nel riempimento delle grotte litoranee del Monte Circeo. I La Grotta delle Capre. II La Grotta del Fossellone. *R.C.R.Acc.Naz.Lincei*, XXV, serie 6, I sem., fasc. 2, Rome.
- BLANC, A. C. (1938): Sulla posizione della Grotta del Monte delle Gioie nella valle dell'Aniene. *Boll. Soc. Geol. Ital.*, LVII, I, Rome.
- BLANC, A. C. (1939): Un giacimento aurignaziano medio nella Grotta del Fossellone al Monte Circeo. *Atti Soc. It. Prog. Sc. Riun.* XXVII, 4-11 settembre 1938, vol. VI, fasc. 1, Rome.
- BLANC, A. C. (1942): I Paleantropi di Saccopastore e del Circeo. *Quartär*, 4.
- BLANC, A. C. (1948): Notizie sui trovamenti e sul giacimento di Saccopastore e sulla sua posizione nel Pleistocene Laziale. *Palaeontographia Italica*, vol. XLII, Pisa.
- BOECKING, H. and GUILLAUME, CH. (1979): La station paléolithique à quartzites du "Grossenbüsch", à Oberbillig près de Trèves (R.F.A.) comparée aux stations lorraines. *Bulletin de la Société Préhistorique Française*, t.76, n° 5.
- BONIFAY, E. (1968): Stratigraphie et industrie lithique de la grotte N° 1 du Mas des Caves à Lunel-Viel (Hérault). *La Préhistoire. Problèmes et Tendances*. Paris.
- BONIFAY, E. (1975): Stratigraphie du quaternaire et âge des gisements préhistoriques de la zone littorale des Alpes-Maritimes. *Bulletin de la Société Préhistorique Française*, t.72, n° 7.
- BONNET, A. (1961): La 'Pebble Culture' in situ de l'Idjérane et les terrasses de pied-mont du Sahara central. *Bulletin de la Société Préhistorique Française*, t.LVIII, fasc. 1-2.
- BORDES, F. (1961): *Typologie du Paléolithique Ancien et Moyen*. Bordeaux.
- BORDES, F. (1968): *Le Paléolithique dans le monde*. Paris.
- BORDES, F. (1971): Question de vocabulaire: galets amonagés uni- ou bidirectionnels. *Bulletin de la Société Préhistorique Française, C.R.S.M.*, 68, fasc. 3.
- BORDES, F. and VIGUIER, C. (1969): Présence de galets taillés de type ancien dans la région de Carmona (Province de Séville, Espagne) *Comptes Rendus de l'Académie des Sciences*, t.269, série D.
- BORDES, F. and VIGUIER, C. (1971): Sur la présence de galets taillés de type ancien dans un sol fossile à Puerto de Santa Maria au Nord-Est de baie de Cadix (Espagne). *Comptes Rendus de l'Académie des Sciences*, t.272, n° 13, série D.
- BORISKOVSKI, P. I. (1971): *Palaeolithic of South and South-East Asia* (in Russian). Leningrad.
- BOSINSKI, G. (1967): *Die mittelpaläolithischen Funde im westlichen Mitteleuropa*. Fundamenta Reihe A/4.
- BOURDIER, F. (1962): A propos de la découverte d'un couperet en quartzite dans le Bas-Dauphiné: les problèmes des industries sur galets et du Pré-Abbevillien. *Bulletin de la Société Préhistorique Française*, t.LIX, fasc. 5-6.
- BOURDIER, F. (1976): Les premières industries humaines dans le Nord-Ouest. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- BROCHIER, J. E. (1976): Les civilisations du Paléolithique inférieur dans la Basse-Isère. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- CHALINE, J. (1974): Les rongeurs de la grotte d'Aldène, une nouvelle séquence climatique du Pléistocène moyen. *Bull. du Musée d'Anthropologie Préhistorique de Monaco*, n° 169.
- CHAVAILLON, J. (1961): Quelques aspects typologiques du Paléolithique inférieur de Charente. *Bulletin de la Société Préhistorique Française*, t.LVIII, fasc. 11-12.
- CLAUDE A. and GUILLAUME, CH. (1971): Stations de surface inédites du Paléolithique inférieur des Vosges. *Revue Archéologique de l'Est et du Centre-Est*, t.XXII, fasc. 1-2.
- CLOTTES, J. (1976): Les civilisations du Paléolithique supérieur dans les Pyrénées. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- COLLINA-GIRARD, J. (1978): Évolution des industries à galets aménagés de la vallée de la Têt (Pyrénées-Orientales). *Bulletin de la Société Préhistorique Française*, t.75, n° 6.
- CORDIER, G. (1965): Existe-t-il une pebble culture en Touraine? *L'Anthropologie*, 69.
- DALLONI, M. (1934): Mission au Tibesti (1930-31). *Mémoires Acad. Sci.*, t.LXII.

- DEBENATH, A. (1976): Les civilisations du Paléolithique inférieur en Charente. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- DELPORTE, H. (1976): Les premières industries humaines en Auvergne. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- DESPRIÉE, J. and LORAIN, J. M. (1972): Une industrie à choppers dans les alluvions du Loir à Pezou (Loir-et-Cher). *Gallia Préhistoire*, t.15, fasc. 1.
- DOBOSI, V. (1990a): Archaeological Research at Vértesszőlős (1963–68) In: *Vértesszőlős. Man, Site and Culture*. Ed. by M. Kretzoi and V. Dobosi. Budapest.
- DOBOSI, V. (1990b): Description of the Archaeological Material In: *Vértesszőlős. Man, Site and Culture*. Ed. by M. Kretzoi and V. Dobosi. Budapest.
- DUBAR, M. (1975): Les formations quaternaires de la rive gauche de la Moyenne-Durance des Mées à Oraison (Alpes-de-Haute-Provence). *Géologie méditerranéenne*, t.II, n° 2.
- ESCALON DE FONTON, M. (1968): Informations archéologiques. In: *Gallia Préhistoire*, t.XI, fasc. 2.
- FEJFAR, O. (1976): Recent Research at Přezletice. *Current Anthropology*, vol. 17, n° 2.
- FRIDRICH, J. (1976): The first industries from Eastern and South-Eastern Central Europe. *Actes du IX^e Congrès international des Sciences Préhistoriques et Protohistoriques*, Colloque VIII. Nice.
- GÁBORI, M. (1968): Archaeology and Prehistory of the Hungarian 'Loess-Palaeolithic'. *La Préhistoire. Problèmes et Tendances*, Paris.
- GÁBORI, M. (1976): *Les civilisations du Paléolithique moyen entre les Alpes et l'Oural*. Budapest.
- GÁBORI-CSÁNK, V. (1966): *Az érdei középső-paleolit telep* (Middle Palaeolithic Settlement in Érd). Manuscript. Budapest.
- GÁBORI-CSÁNK, V. (1967): Un nouveau site moustérien en Hongrie. *Acta Arch. Hung.*, t.XIX, fasc. 3–4.
- GÁBORI-CSÁNK, V. (1968a): *La station du Paléolithique moyen d'Érd, Hongrie*, Budapest.
- GÁBORI-CSÁNK, V. (1968b): L'industrie moustérienne d'Érd (Hongrie). *La Préhistoire. Problèmes et Tendances*, Paris.
- GÁBORI-CSÁNK, V. (1971): *Az érdei középső-paleolit telep*. [Middle Palaeolithic Settlement in Érd.] *Budapest régiségei*, XXII.
- GAGNIÈRE, S. (1959): Informations archéologiques. In: *Gallia Préhistoire*, II.
- GAMBASSINI, P. and PALMA DI CESNOLA, A. (1972): Notizie sui giacimenti Acheuleani delle dune fossili di Marina di Camerota (Salerno). *Atti della XIV riunione scientifica dell'istituto italiano di Preistoria e Protoistoria in Puglia 13–16 Ottobre 1970*.
- GARROD, D. A. E. and BATE, M. A. (1946): *Environment, Tools and Man: an inaugural lecture*. Cambridge.
- GUILLAUME, CH. (1974): Bifaces en quartzite du Paléolithique ancien en Lorraine. *Bulletin de la Société Préhistorique Française*, t.71, fasc. 1.
- GUILLAUME, CH. (1976): Les civilisations du Paléolithique inférieur en Lorraine. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- GUTH, CH. (1974): Découverte dans le Villafranchien d'Auvergne de galets aménagés. *Comptes Rendus de l'Académie des Sciences*, t.279, Série D, n° 13.
- HATT, M. J. J. (1968): Informations archéologiques. In: *Gallia Préhistoire*, t.XI, fasc. 2.
- HENRI-MARTIN, G. (1957): La grotte de Fontéchevade. *Annales de l'Institut de Paléontologie humaine, Mémoire 28*.
- HENRI-MARTIN, G. (1965): La grotte de Fontéchevade. *Bull. de l'Ass. Fr. pour l'Et. du Quaternaire*.
- HUGOT, H. (1955): Un gisement de pebble tools à Aoulef. *Travaux de l'Institut de Recherches Sahariennes*, t.XIII, Algiers.
- HUGUENIN, G. (1978): Une station inédite à quartzites paléolithiques à Bleurville (Vosges). *Bulletin de la Société Préhistorique Française*, t.75, n° 11–12.
- HUGUENIN, G. and MEUNIER, M. (1972): Nouvelles stations à quartzites paléolithiques dans le département des Vosges. *Bulletin de la Société Préhistorique Française*, t.69, n° 6.
- KADIĆ, O. (1942): A budavári barlangpincék (Cave Cellars of Buda Castle Hill). *Barlangvilág*, 12.
- KINH, P. D. and TIEU, L. T. (1973): *The oldest remains of Man in Vietnam* (in Vietnamese). Hanoi.

- KINH, P. V. and TIEU, L. T. (1976): La station paléolithique inférieure de Nui Do. *Études Vietnamiennes*, 46.
- KORMOS, T. (1909): A pleisztocén ősember nyomai Tatán (Traces of Pleistocene man in Tata). *Földt. Közl.*, XXXIX.
- KORMOS, T. (1912): A tatái őskőkori telep (Palaeolithic Settlement in Tata). *A magyar kir. Földtani Intézet Évkönyve*, XX. köt. 1.
- KORMOS, T. (1913): *La station moustérienne de Tata (Hongrie)*. Budapest.
- KOROBKOVA, G. F. (1972): Trace element analysis of stone tool-kit of the Samarkand site (in Russian). *Palaeolithic and Neolithic of the USSR*, t.VII (MRA, n° 185) Leningrad.
- KRETZOI, M. (1964): Die Wirbeltierfauna des Travertin-komplexes von Tata. *Tata, eine mittelpaläolithische Travertin-Siedlung in Ungarn* (Ed. L. Vértés). Budapest.
- KRETZOI, M. (1974): *Az emberreválás útján* (On the Way to Humanization). *Anthrop. Közl.* 18.
- KRETZOI, M. (1975): New ramapithecines and Pliopithecus from the Lower Pliocene of Rudabánya in northeastern Hungary. *Nature*, vol. 257, 5527.
- KRETZOI, M. and VÉRTES, L. (1964): A vértesszőlősi alsó paleolit őstelep (Lower Palaeolithic Settlement in Vértesszőlős). *MTA II. Oszt. Közl.* XIII/4.
- KRETZOI, M. and VÉRTES, L. (1965): Upper Biharian (Intermindel) Pebble industry Occupation Site in Western Hungary. *Current Anthropology*, vol. 6, n° 1.
- KRETZOI, M. (1968): Étude paléontologique. In: Gábori-Csánk, V.: *La station du Paléolithique moyen d'Érd- Hongrie*. Budapest.
- KRÜGER, H. (1959): Frühpaläolithische Geröllartefakte vom Typ "Pebble tool" in Oberhessen? *Eiszeitalter und Gegenwart*. n° 10.
- KRÜGER, H. (1975): Typologische und stratigraphische Kriterien zur präribzeitlichen Datierung der altpaläolithischen Geröllgerät-Industrie vom Münzenberger Typ in Oberhessen. *Fundberichte aus Hessen*, 1973-1975, 13.
- LAL, B. B. (1956): Palaeoliths from the Beas and Banganga Valleys. *Ancient India*, n° 12.
- LEAKEY, M. D. (1970): Early artefacts from the Koobi Fora area. *Nature*, 226.
- LEAKEY, M. D. (1971): *Olduvai Gorge. Vol. 3. Excavations in Bed I and II, 1960-1963*. Cambridge.
- LEFEBVRE, A. (1972): Le Paléolithique du dépôt marin de Coquelles (Pas-de-Calais). *Bulletin de la Société Préhistorique Française*, t.69, n° 6.
- LIÈRE, W. J. VAN (1960): Un gisement paléolithique dans un niveau pléistocène de l'Oronte à Latamne (Syrie). *Annales Archéologiques Arabes Syriennes*. Pamas, t.10.
- LIÈRE, W. J. VAN (1966): The Pleistocene and Stone Age of the Oronte river. *A.A.A.S.*, t.16.
- LUMLEY, H. DE (1966): Les fouilles de Terra Amata à Nice. Premiers résultats. *Bulletin du Musée d'Anthropologie Préhist. de Monaco*, n° 13.
- LUMLEY, H. DE (1969): A Paleolithic Camp Site at Nice. *Scientific American*. vol. 220, n° 5.
- LUMLEY, H. DE (1976a): Les premières industries humaines en Provence. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- LUMLEY, H. DE (1976b): Les premières industries humaines dans les Pyrénées et le Bassin de la Garonne. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- LUMLEY, H. DE (1976c): Les civilisations du Paléolithique inférieur en Provence. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- LUMLEY, H. DE (1976d): Les civilisations du Paléolithique inférieur en Languedoc méditerranéen et en Roussillon. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- LUMLEY, H. DE, GAGNIÈRE, S., BARRAL, L. and PASCAL, R. (1963): La grotte du Vallonnet Roquebrune-Cap-Martin (A-M.). *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 10.
- LUMLEY-WOODYEAR, H. DE (1969): *Le Paléolithique inférieur et moyen du Midi Méditerranéen dans son cadre géologique*, t.I.

- LUMLEY, H. DE and LUMLEY, M. A. DE (1971): Découverte de restes humains anténéandertaliens datés du début du Riss à la Caune de l'Arago (Tautavel, Pyrénées-Orientales). *Comptes Rendus de l'Académie des Sciences*, t.272, sér. D, n° 13.
- LUMLEY, H. DE, COLLINA-GIRARD, J., ABELANET, J., BAZILE, F. and MEIGNEN, F. (1976): Les premières industries en Languedoc méditerranéen et en Roussillon. *La Préhistoire Française*. Ed. by H. de Lumley. Paris.
- MALEZ, M. (1976): Excavation of the Villafranchian site Šandalja I near Pula (Yugoslavia). *Actes du IX Congr. intern. des Sc. préhist. et protohist.* Colloque VII, Nice.
- MÉROC, L. (1965): Le Languedocien de la Haute et de la Moyenne Vallée de la Garonne. *Miscelanea en Homenaje al Abate Henri Breuil*, t.II, Barcelona.
- MORIN, D. and JACQUEMOT, D. (1976): Une station à quartzites du Paléolithique inférieur dans la région messine: le Poirier d'Armenstein (Moselle). *Bulletin de la Société Préhistorique Française*, t.73, n° 5.
- MOVIUS, H. L. (1944): Early man and pleistocene stratigraphy in Southern and Eastern Asia. *Papers of the Peabody Museum*, vol. XIX, n° 3.
- MOVIUS, H. L. (1948): The Lower Palaeolithic Cultures of Southern and Eastern Asia. *Transactions of the American Philosophical Society*, n.s., vol. 38, pt. 4, Philadelphia.
- MOVIUS, H. L. (1957): Pebble-tool terminology in India and Pakistan. *Man in India*, vol. 37, n° 2.
- NICOLĂESCU-PLOPȘOR, C. S. (1964): Nouvelles données sur la possibilité de l'existence de protohominiens dans le Villafranchien de Roumanie. *Dacia*, VIII.
- NICOLĂESCU-PLOPȘOR, C. S. and MOROȘAN, I. N. (1959): Sur le commencement du paléolithique en Roumanie. *Dacia*, III.
- NICOLĂESCU-PLOPȘOR, C. S. and NICOLĂESCU-PLOPȘOR, D. (1963): The possible existence of the Proto-Hominids in Romania's Villafranchian. *Dacia*, VII.
- OCTOBON, F. C. E. (1955): Grotte du Lazaret (A-M.) Premier rapport sur les fouilles effectuées dans le locus VIII de cette grotte. *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 2.
- OCTOBON, F. C. E. (1956): Technique de débitage des galets et industrie de l'éclat dans la Grotte du Lazaret. *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 3.
- OCTOBON, F. C. E. (1958): Grotte du Lazaret (A-M.) Quatrième étude. *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 5.
- OCTOBON, F. C. E. (1961): Grotte du Lazaret (A-M.) Sixième étude. *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 8.
- OKLADNIKOV, A. P. (1966): Palaeolithic and Mesolithic of the Soviet Central Asia (in Russian). *Soviet Central Asia in the Stone and Bronze Ages*. Moscow-Leningrad.
- OKLADNIKOV, A. P. (1972): Ulalinka—A Lower Palaeolithic Site of Siberia (in Russian). *Palaeolithic and Neolithic of the USSR*. t.VII (MRA, n° 185). Leningrad.
- PALLARÉS, M., PERICOT, LI. (1926): Els jaciments asturians del Montgri. *Anuari de l'Institut d'Estudis Catalans*, 1921-1926, VII.
- PALMA DI CESNOLA, A. (1967): Il Paleolitico della Puglia (Giacimenti, periodi problemi). *Memorie Museo Civico di Storia Naturale di Verona*, vol. XV.
- PALMA DI CESNOLA, A. and ZORZI, F. (1961): Il giacimento preistorico alla foce del torrente Romandato presso Rodi Garganico. *Memorie del Museo Civico di Storia Naturale, Verona*, vol. IX.
- PATERSON, T. T. and DRUMMOND, H. J. H. (1962): *Soan—The Palaeolithic of Pakistan*. Karachi.
- PERICOT, LI. (1923): L'Asturià del Montgri. *Butlletí de l'Associació Catalana d'Antr., Etnol. Prehistòria*, vol. I.
- PIPERNO, M. (1972): The Monte Peglia Lithic Industry. *Quaternaria*, XVI.
- RADMILLI, A. M. (1976): The first industries of Italy. *Actes du IX Congr. intern. des Sc. préhist. et protohist.* Colloque VIII, Nice.
- RAMENDO, L. (1963): Les galets aménagés de Reggan (Sahara). *Libyca*, t.XI.
- RANOV, V. A. (1970a): Galets aménagés de l'Asie Centrale. *Actes du VII Congr. intern. des Sc. Préhist. et Protohist.* Prague 21-27 août 1966, I, Prague.

- RANOV, V. A. (1970b): Pebble-technique in the Stone Age Cultures of Soviet Central Asia and Siberia. (In Russian) *Siberia and its Neighbours in Antiquity*. Novosibirsk.
- RIET LOWE, C. VAN (1952): *The Pleistocene Geology and Prehistory of Uganda, Part II: Prehistory*.
- RIPOLL-PERELLO, E. and LUMLEY, H. DE (1965): *El paleolítico medio en Cataluña*. Monografias, XXIV. Barcelona.
- ROUDIL, J. L. (1974): Informations archéologiques. *Gallia Préhistoire*, t.17.
- SEN, D. (1957): The Soanian and the Pebble-tool complex in India. *Man in India*, vol. 37, n° 2.
- SHELINSKI, V. E. (1972): Study of the productive functions of pebble-tools from the upper palaeolithic sites of Yenisei (in Russian). *Palaeolithic and Neolithic of the USSR*, t.VII (MRA, n° 185. Leningrad.
- SIEVEKING, A. G. DE: The Palaeolithic Industry of Kota Tampan, Perak, Malaya. *Proceed. Prehist. Soc.* vol. XXVIII.
- SINGER, R., WYMER, J. J., GLADFELTER, B. G. and WOLFF, R. G. (1973): Excavation of the Clactonian Industry at the Golf Course, Clacton-on-Sea, Essex. *Proceedings of the Prehistoric Society*, vol. 39.
- SONNEVILLE BORDES, D. (1960): *Le Paléolithique supérieur en Périgord*, t.I-II. Bordeaux.
- SOUNDARA RAJAN, K. V. (1961): Quaternary Pebble, Core and Flake Cultures of India—An Appaisal of the Data. *Ancient India*, n° 17.
- STEKELIS, M. (1966): *Archaeological Excavation at Ubeidiya, 1960–1963*. Israel Academy of Sciences and Humanities. Jerusalem.
- TAN, H. V. (1973): Site of Nui Do and some problem of Vietnam and Southeast Asia's Palaeolithic (in Vietnamese). *The oldest remains of man in Vietnam*. Hanoi.
- TAN, H. V. (1976): Le hoabinhien dans le contexte du Viet-Nam. *Études Vietnamiennes*, 46.
- TASCHINI, M. (1967): Il 'Protopontiniano' rissiano di Sedia del Diavolo e di Monte delle Gioie (Roma). *Quaternaria*, IX.
- TASCHINI, M. (1968): La datation au C14 de l'Abri Blanc (Monte Circeo). Quelques observations sur le Mésolithique en Italie. *Quaternaria*, X.
- TAVOSO, A. (1969): Le Paléolithique ancien des terrasses du Fresquel (Aude). *Bull. du Musée d'Anthrop. Préhist. de Monaco*, 1968–1969, n° 15.
- TAVOSO, A. (1972): Les industries de la moyenne terrasse du Tarn à Técoü (Tarn). *Bull. du Musée d'Anthrop. Préhist. de Monaco*, n° 18.
- TAVOSO, A. (1973): La station acheuléen de Chaubard à Grazac (Tarn) *Bulletin de la Société Préhistorique Française*, t.70, n° 4.
- TAVOSO, A. (1976a): Les premières industries humaines dans le bassin du Tarn. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- TAVOSO, A. (1976b): Les civilisations du Paléolithique inférieur dans le bassin du Tarn. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- TAVOSO, A. (1976c): Les civilisations du Paléolithique moyen des Pyrénées et du bassin de la Garonne. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- THÉVENIN, A. (1965): L'outillage paléolithique et mésolithique du bassin supérieur de la Saône. *Annales scientifiques de l'Université de Besançon*, 3^e série, n° 1.
- THÉVENIN, A. (1976a): Les civilisations du Paléolithique inférieur en Alsace. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- THÉVENIN, A. (1976b): Les civilisations du Paléolithique moyen en Alsace. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- THIBAUT, CL. (1976): Les premières industries humaines dans le Sud-Ouest. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- TIEU, L. T. (1973): New discoveries and situation of the palaeolithic study in the latter years (in Vietnamese). *Van Vat*, n° 21.
- Toca, D. (1978): O importantă descoperire arheologică. *Revista Muzeelor si Monumentelor*, 5.
- TRUFFREAU, A. (1971): Quelques observations sur le Paléolithique de la Pointe-aux-Oies à Wimereux (Pas-de-Calais). *Bulletin de la Société Préhistorique Française*, t.68, fasc. 2.

- TRUFFREAU, A. (1976): Les civilisations du Paléolithique inférieur en Artois et dans le Cambrésis. *La Préhistoire Française*, Ed. by H. de Lumley. Paris.
- TURQ, A. (1978): Note préliminaire sur l'outillage en quartzite entre Dordogne et Lot. *Bulletin de la Société Préhistorique Française*, t.75, n° 5.
- VALOCH, K. (1961): Altpaläolitische Steingeräte aus der Umgebung von Brno (Brünn). *Anthropozoikum*, XI.
- VALOCH, K. (1965): Geröllgeräte aus Dolni Věstonice in Südmähren. *Alt-Thüringen*, 1964-1965, t.VII.
- VALOCH, K. (1968): Evolution of the Palaeolithic in Central and Eastern Europe. *Current Anthropology*, vol. 9, n° 5.
- VALOCH, K. (1976): Aperçu des premières industries en Europe. *Actes du IX Congr. intern. des Sc. préhist. et protohist.* Colloque VIII, Nice.
- VALOCH, K. (1977): The first lower palaeolithic pebble-tool industries in South Moravia. *Archeologické rozhledy*, XXIX, n° 5.
- VAUFREY, R. (1951): Pierres taillées villafranchiennes et synchronismes glaciaires. *L'Anthropologie*, 55.
- VENCL, S. (1969): Zu den Grobgeräten des Jungpaläolithikums bis Neolithikum. *Jahresschrift für Mitteleuropäische Vorgeschichte*, band 53.
- VÉRTES L. (ed.) (1964): *Tata—eine Mittelpaläolithische Travertinsiedlung in Ungarn*. Archaeologia Hungarica, XLIII. Budapest.
- VÉRTES, L. (1965a): Typology of the Buda Industry, a Pebble-tool Industry from the Hungarian Lower Palaeolithic. *Quaternaria*, VII.
- VÉRTES, L. (1965b): Az őskőkor és az átmeneti kőkor emlékei Magyarországon [The Palaeolithic and the Mesolithic in Hungary]. Budapest.
- VÉRTES, L. (1968): Bilan des decouvertes les plus importantes faites de 1963 à 1966 dans les fouilles du site paléolithique inférieur de Vértesszőlös (Hongrie). *Revue Anthropologique*.
- VÉRTES, L. (1969): *Kavicsösvény* (Pebble Path). Budapest.
- WERNERT, P. (1937): La station paléolithique d'Achenheim dans le cadre du formations pléistocènes de la vallée du Rhin. *Bull. de l'Association Philomathique d'Alsace et Lorraine*, t.VIII, fasc. 4.
- WERNERT, P. (1955): Un fossile directeur de la faune malacologique interglaciaire dans les limons loessiques de la station paléolithique d'Achenheim. Zonites acieformis Klein. Contribution à la climatologie de l'ère quaternaire dans le fossé rhénan. *Bull. serv. carte géol. Als. Lorr.*, 8,1.
- WERNERT, P. (1957): Stratigraphie Paléontologique et Préhistorique des sédiments quaternaires d'Alsace. Achenheim. *Mém. du service de la carte géologique d'Alsace et de Lorraine*, n° 14.
- WERNERT, P., MILLOT, G. and ELLER, J. P. VON (1962): Un "Pebble-tool" des alluvions rhénanes de la carrière Hurst à Achenheim. *Bull. serv. carte géol. Als. Lorr.* t.15, fasc. 2.
- ZAMJATNIN, S. N. (1951): About the appearance of local differences in the lower palaeolithic culture (in Russian). *Transactions of the Institute of Ethnography*. Moscow, n.s., vol. XVI.
- ZBYSZEWSKI, G. (1976): Rapport sur les plus anciennes industries paléolithiques du Portugal. *Actes du IX Congr. intern. des Sc. Préhist. et protohist.* Colloque VIII, Nice.
- ŽEBERA, K. (1952): Les plus anciens monuments du travail humain de Bohême. *Rozprawy du Service géologique de Tchécoslovaquie*, vol. XIV.
- ŽEBERA, K. (1965): Das "Bohémien", eine Geröll-Industrie als Vorläufer des mitteleuropäischen Moustériens. *Quartär*, 1964-65, 15/16.
- ZOTZ, L. (1968): Pebble culture en Europe Centrale. *La Préhistoire. Problèmes et Tendances*. Paris.
- ZOTZ, L. and FREUND, G. (1973): Die mittelpaläolithische Geröllgeräteindustrie aus der Umgebung von Kronach in Oberfranken. *Materialhefte zur bayerischen Vorgeschichte*, 27.

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it contains the President's message to the Congress at the beginning of his first term. The letter is written in a formal, dignified style, and it is one of the most important documents in American history.

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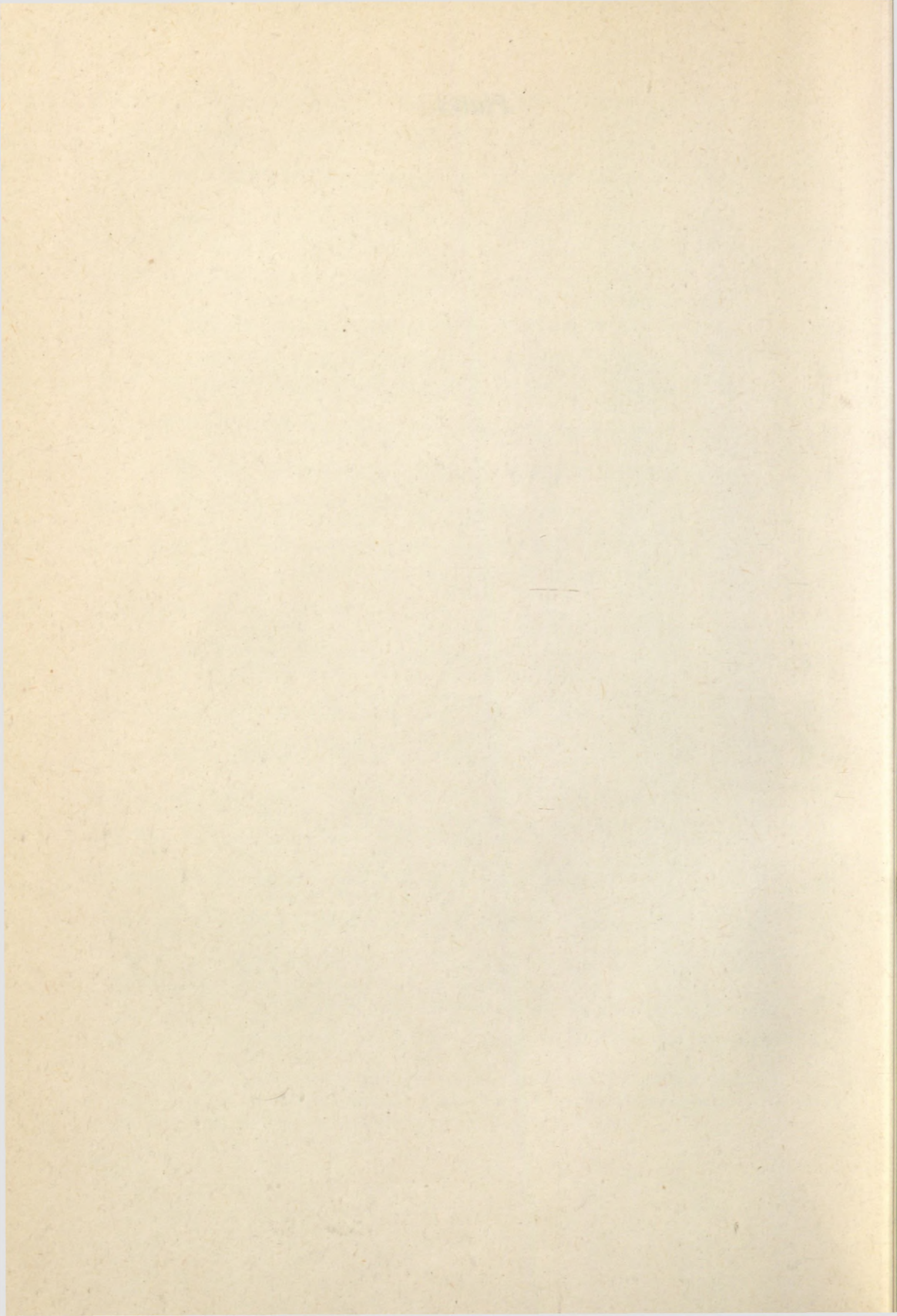
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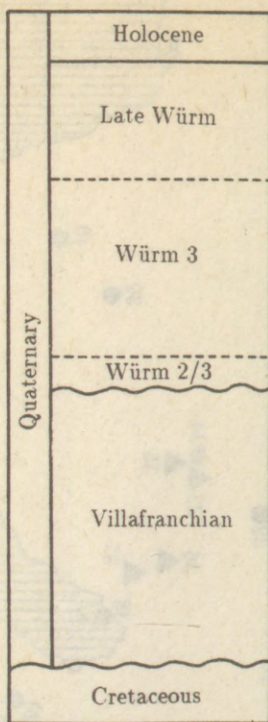
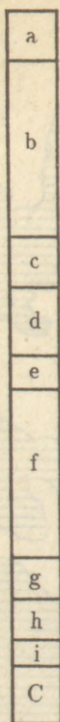
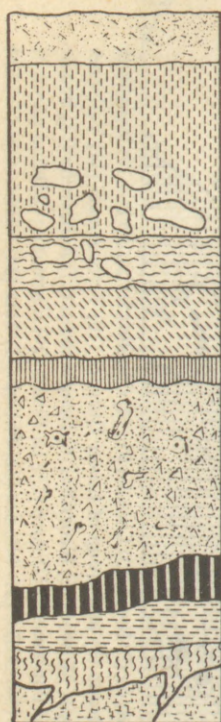
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Plates



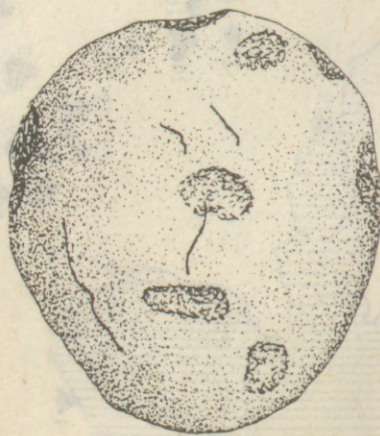
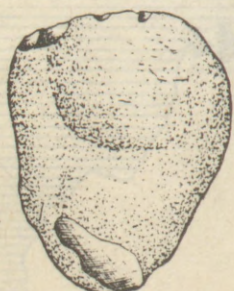
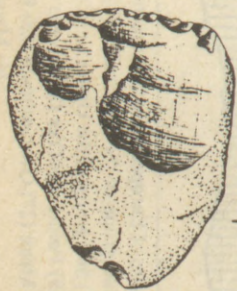
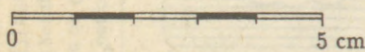


Pl. I: The main sites of European pebble industries—(1) Puerto de Santa Maria (2) Brenes (3) Lora del Rio (4) Castillo (5) Cau del Duc (6) Roussillon find group (7) find group of the Tarn valley (8) Costière du Gard find group (9) find group of Lower Durance (10) Terra Amata (11) Vallonnet (12) Chilhac (13) find group of the Tarn valley (14) find group of the Upper Moselle (15) Bleurville (16) Hengenbieten (17) Achenheim (18) Poirier d'Armenstein (19) Pointe-aux-Oies (20) Monte Perglia (21) find group of Pontiniano (22) Arce (23) La Pineta (24) Correntino (25) find group of Realmonte (26) Menfi (27) Grossenbüsch (28) Kronach (29) Oberhessen (30) Sedlec (31) Mlázice (32) Přibice (33) Tata (34) Vértesszölös (35) Érd (36) Mixnitz (37) Krapina (38) Šandalja I (39) Dirjov (40) Ciuperceni



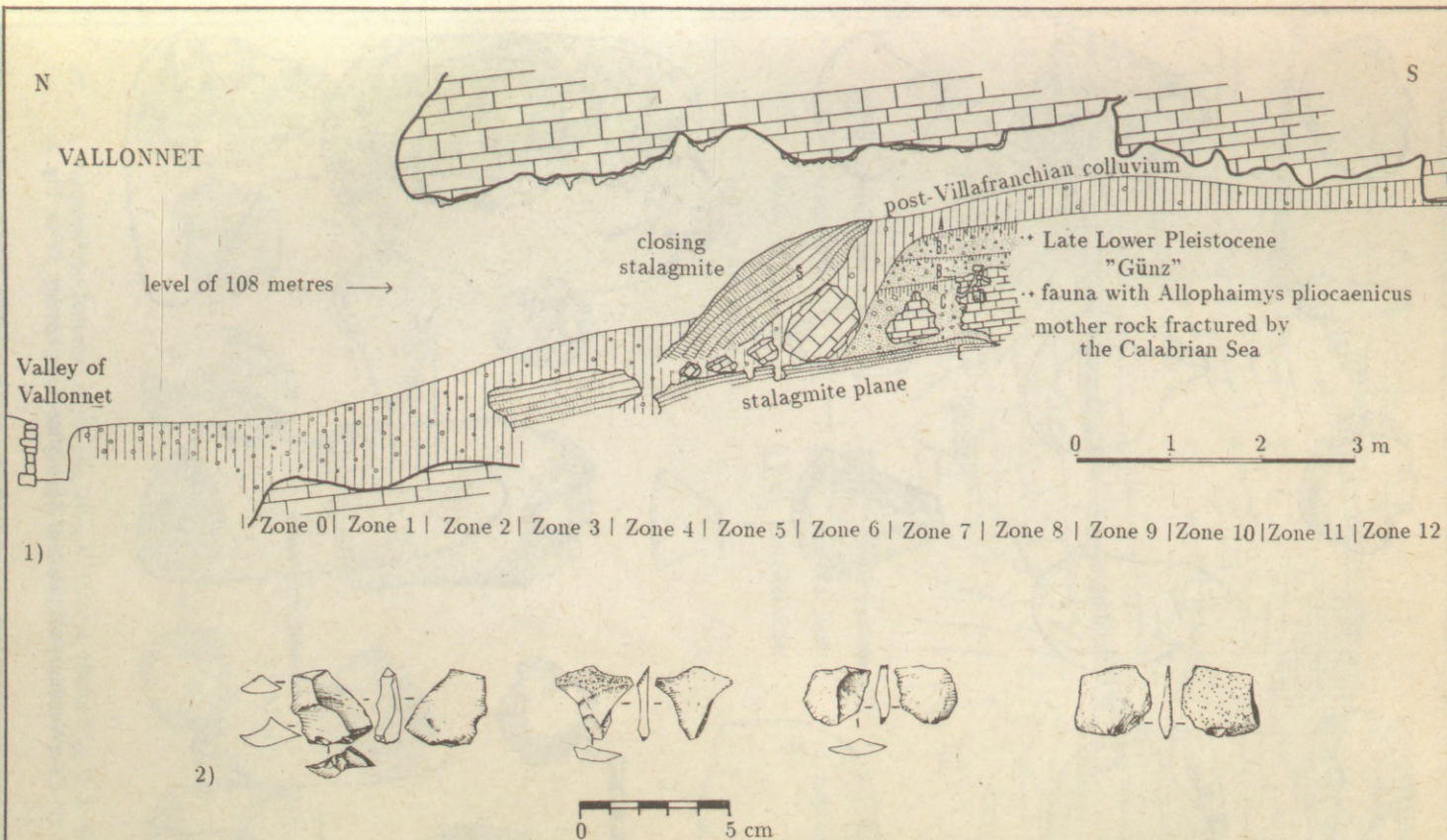
Metal	Age
	Neolithic
	Mesolithic
	Gravettian
	Chopping-Tool Culture + Osteodontokeratic Culture

1)

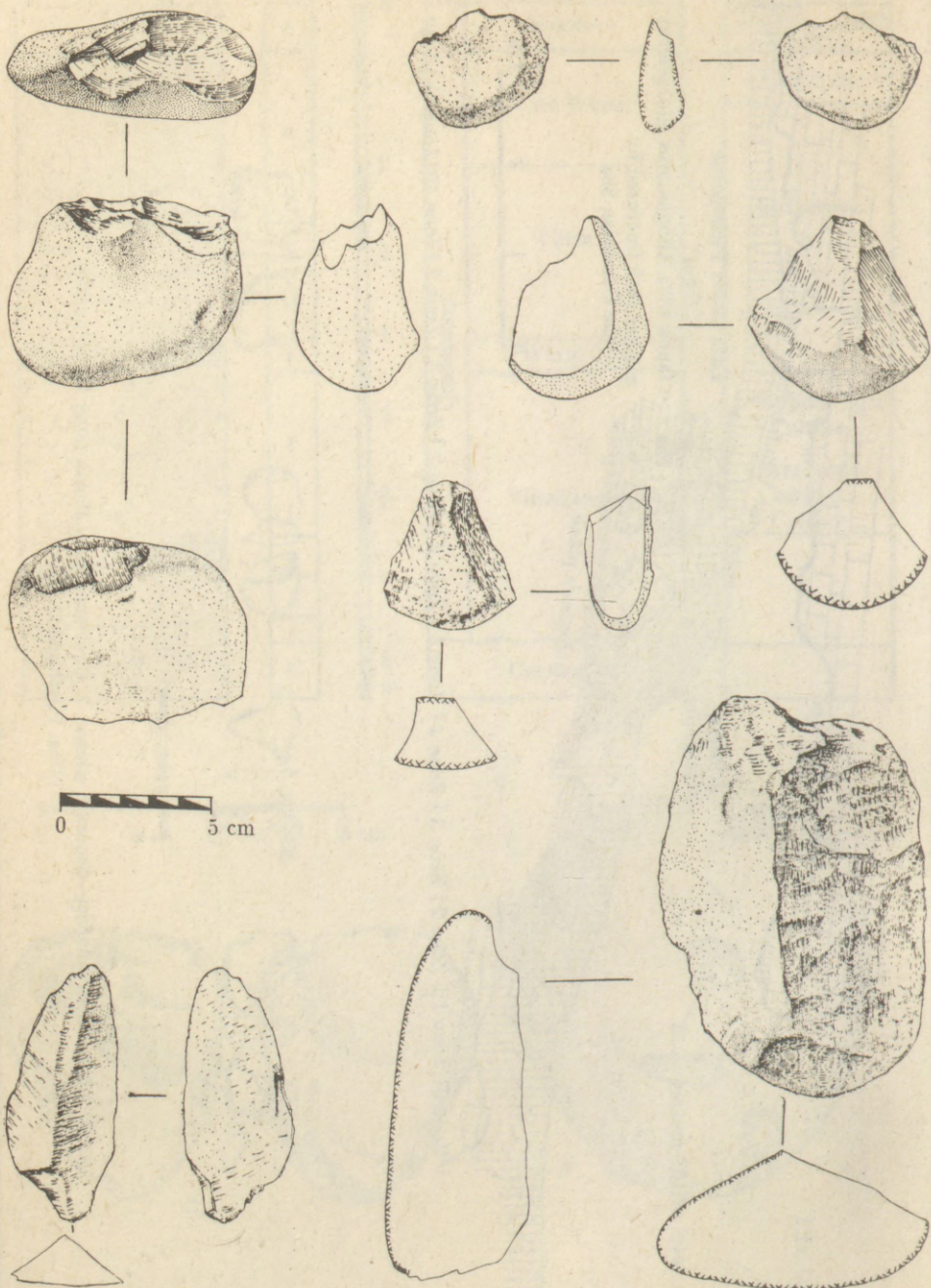


2)

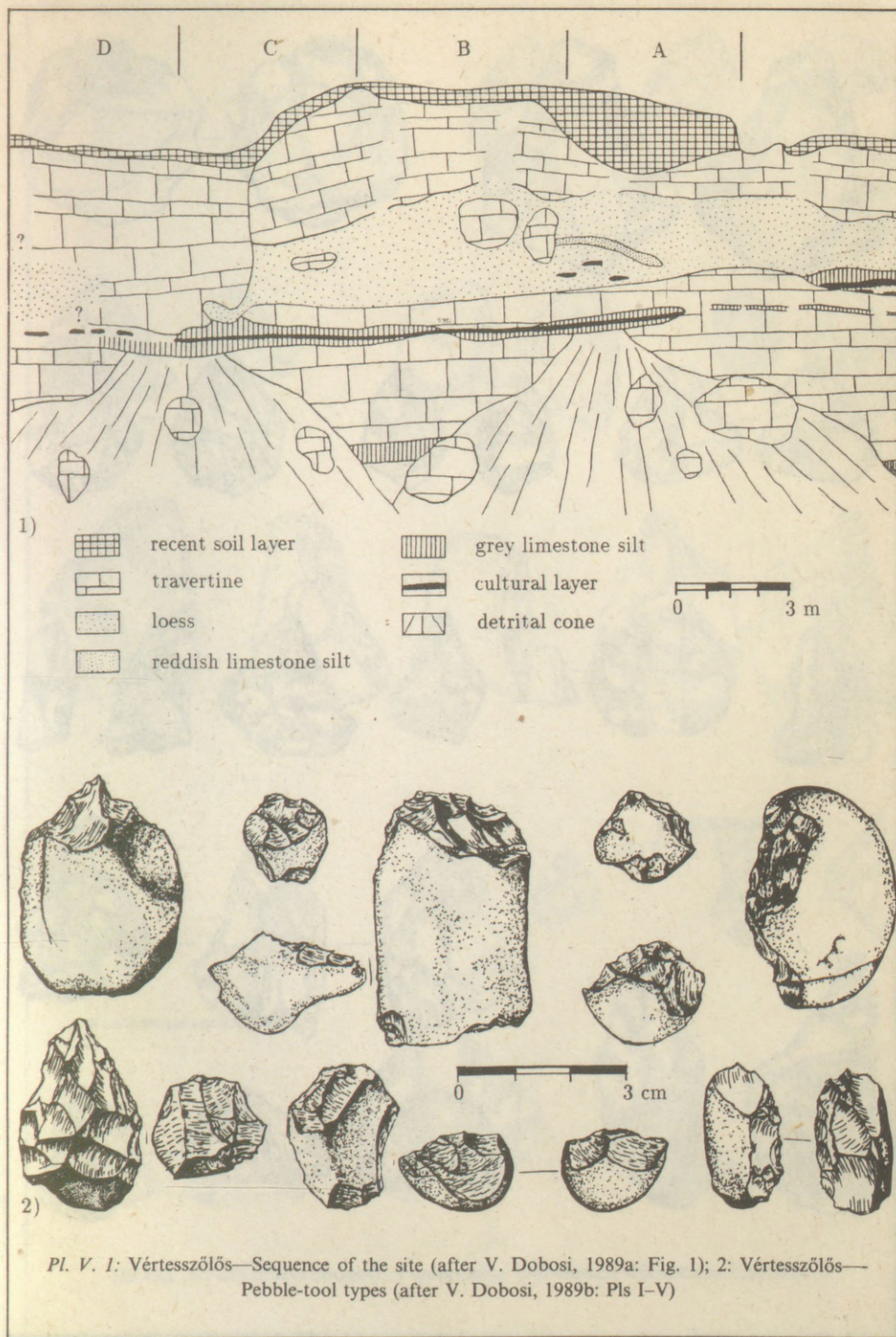
Pl. II. 1: Šandalja I—Section of the quaternary sediments; 2: Šandalja I—Pebble-tools (after M. Malez, 1976)

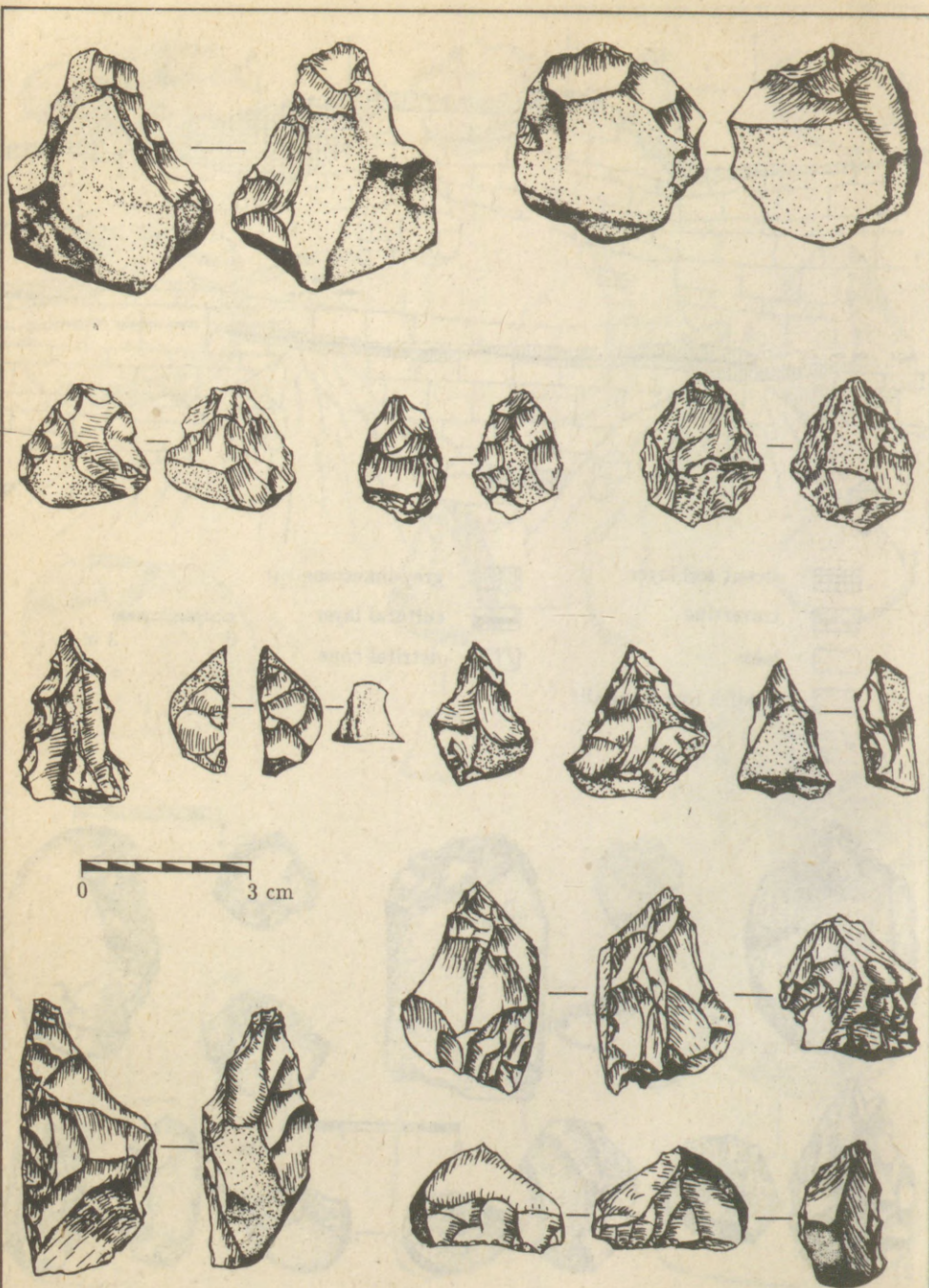


Pl. III. 1: Cave Vallonnet—Sequence scheme; 2: Cave Vallonnet—Flakes (after H. de Lumley, 1976a: Figs 1 and 2)

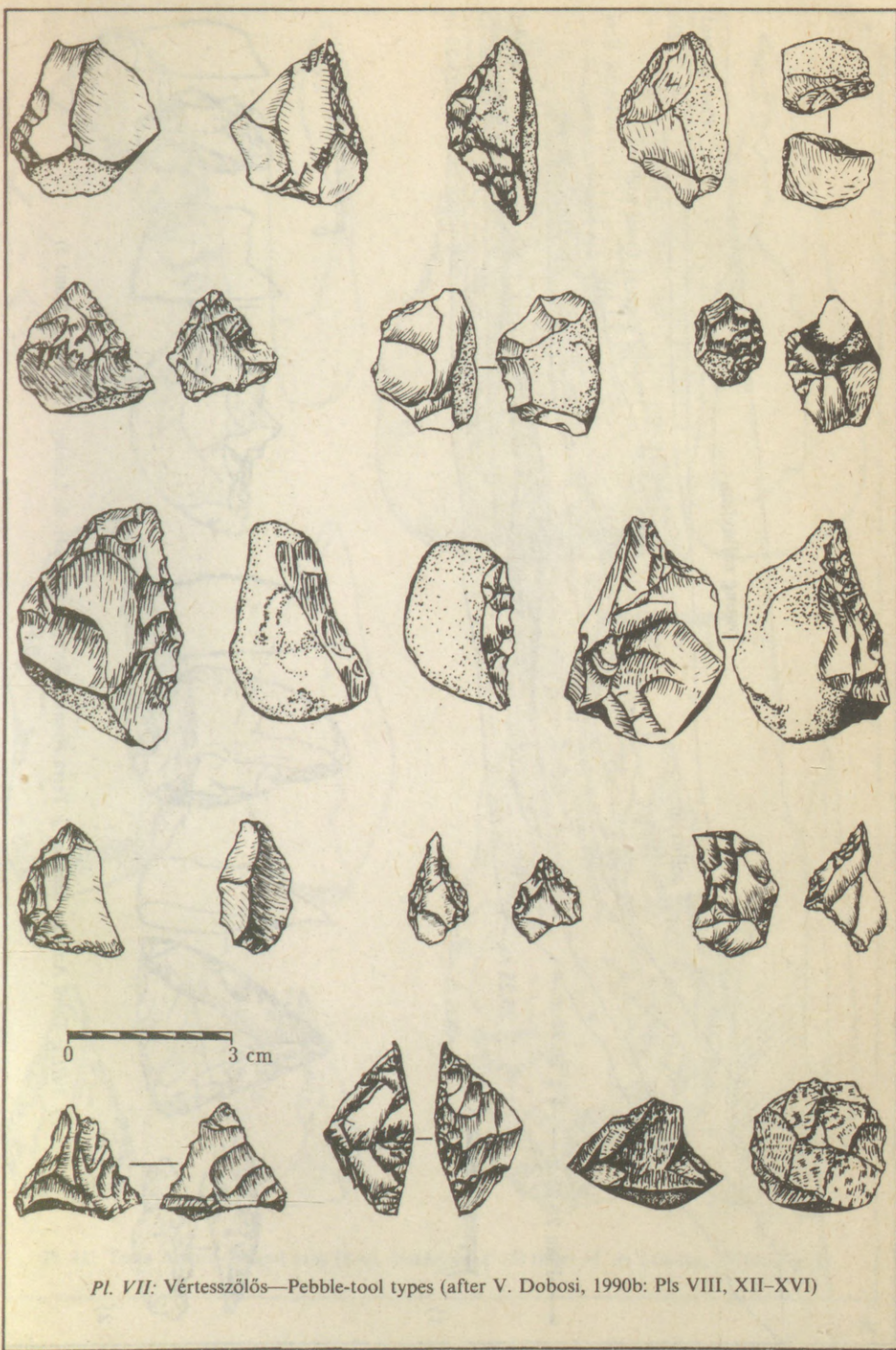


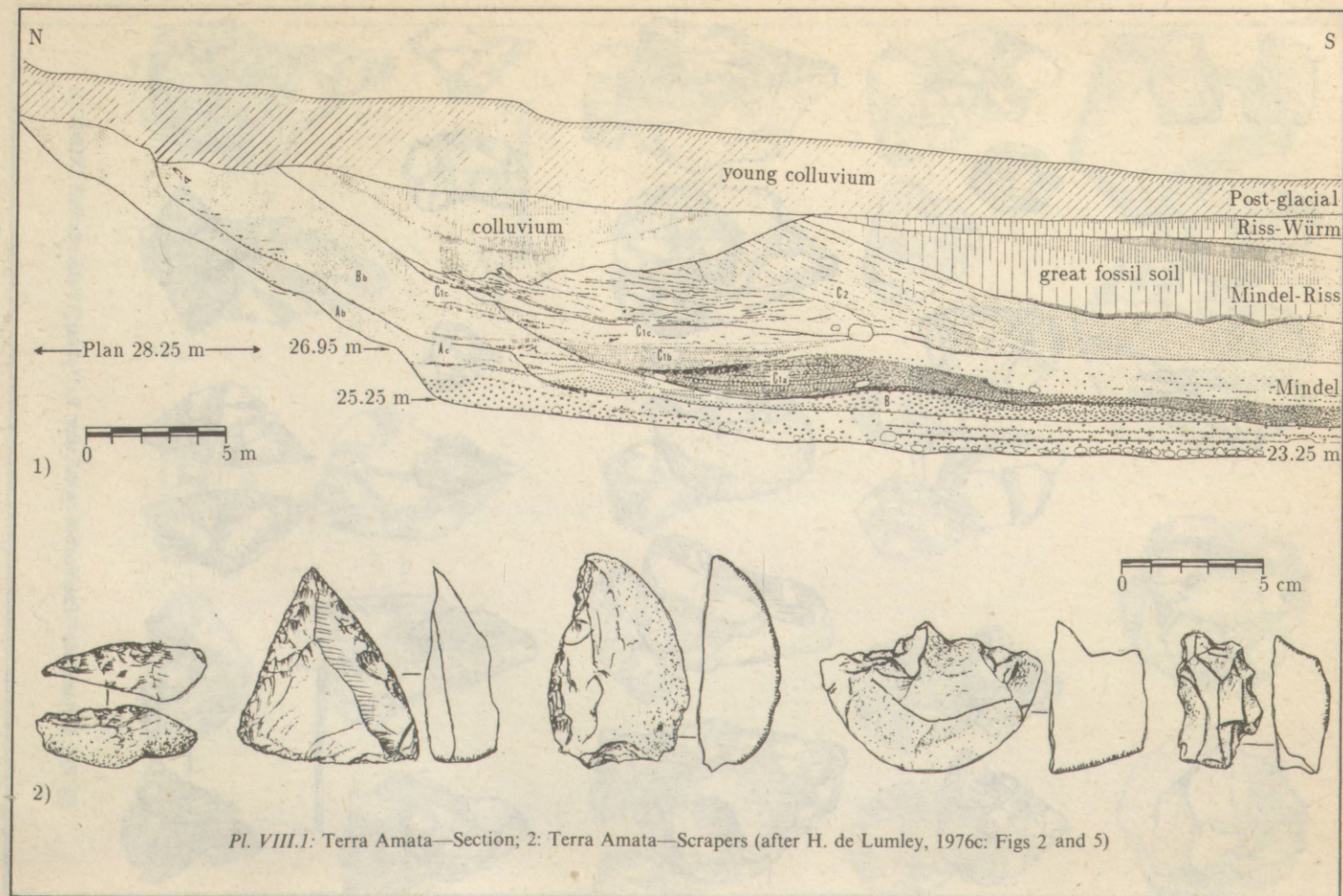
Pl. IV: Cave Vallonnet—Pebble-tool types (after H. de Lumley, 1976a: Fig. 2)

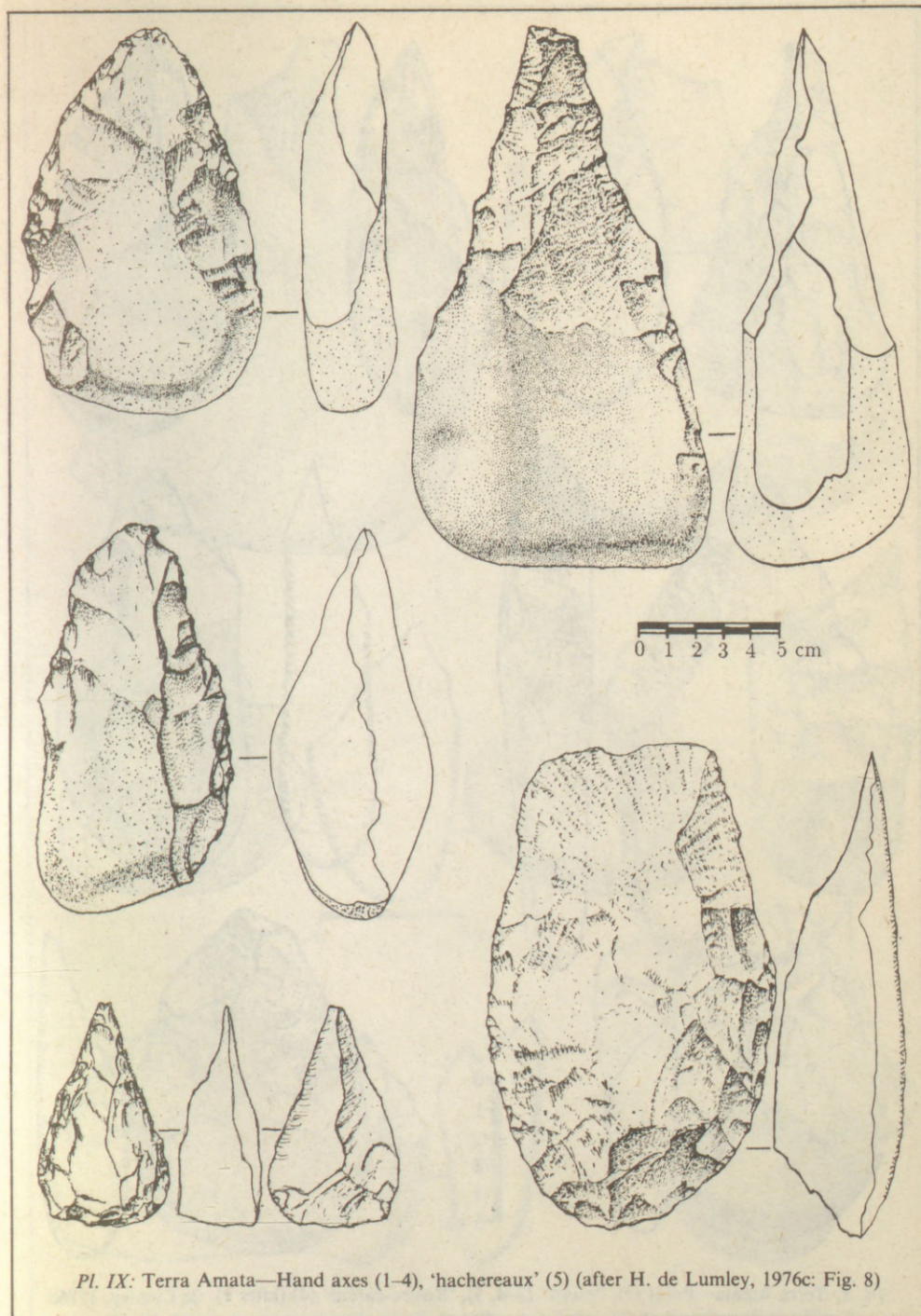




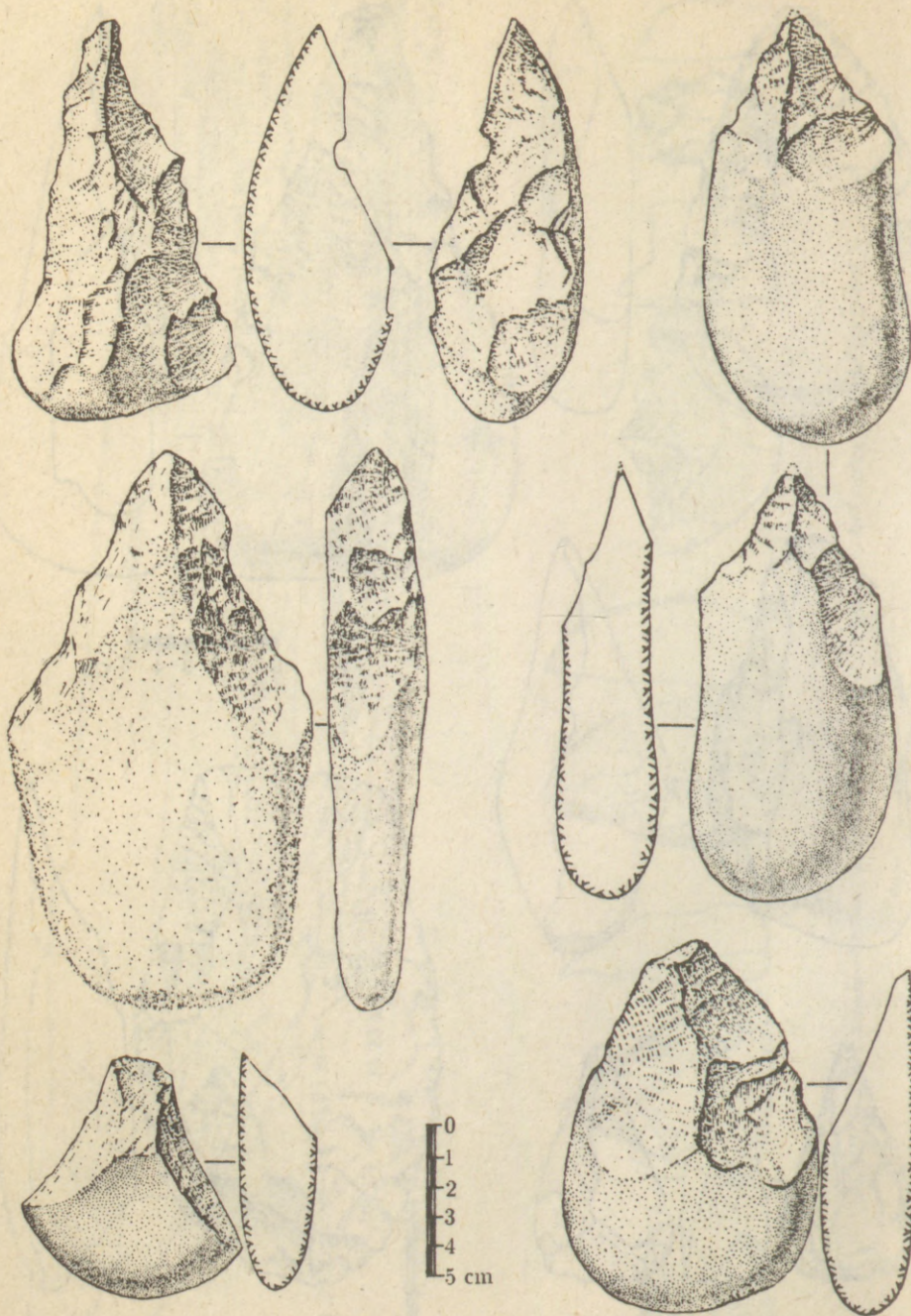
Pl. VI: Vértesszőlős—Pebble-tool types (after V. Dobosi, 1990b: Pls VII, IX–XI)



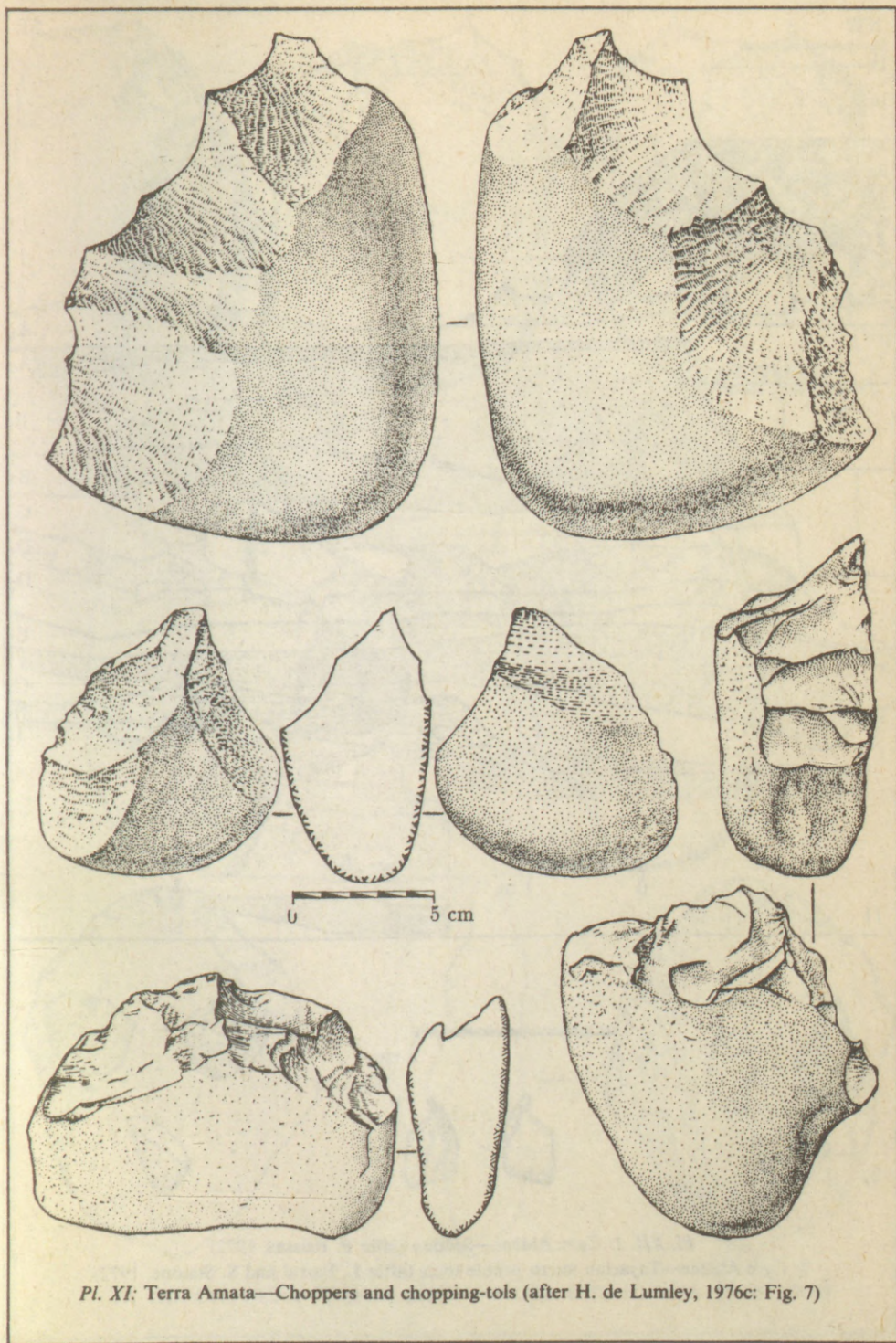




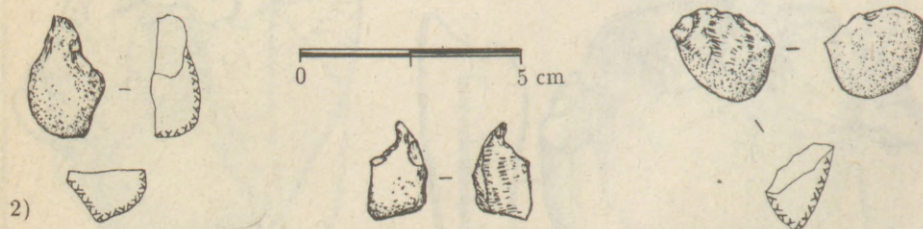
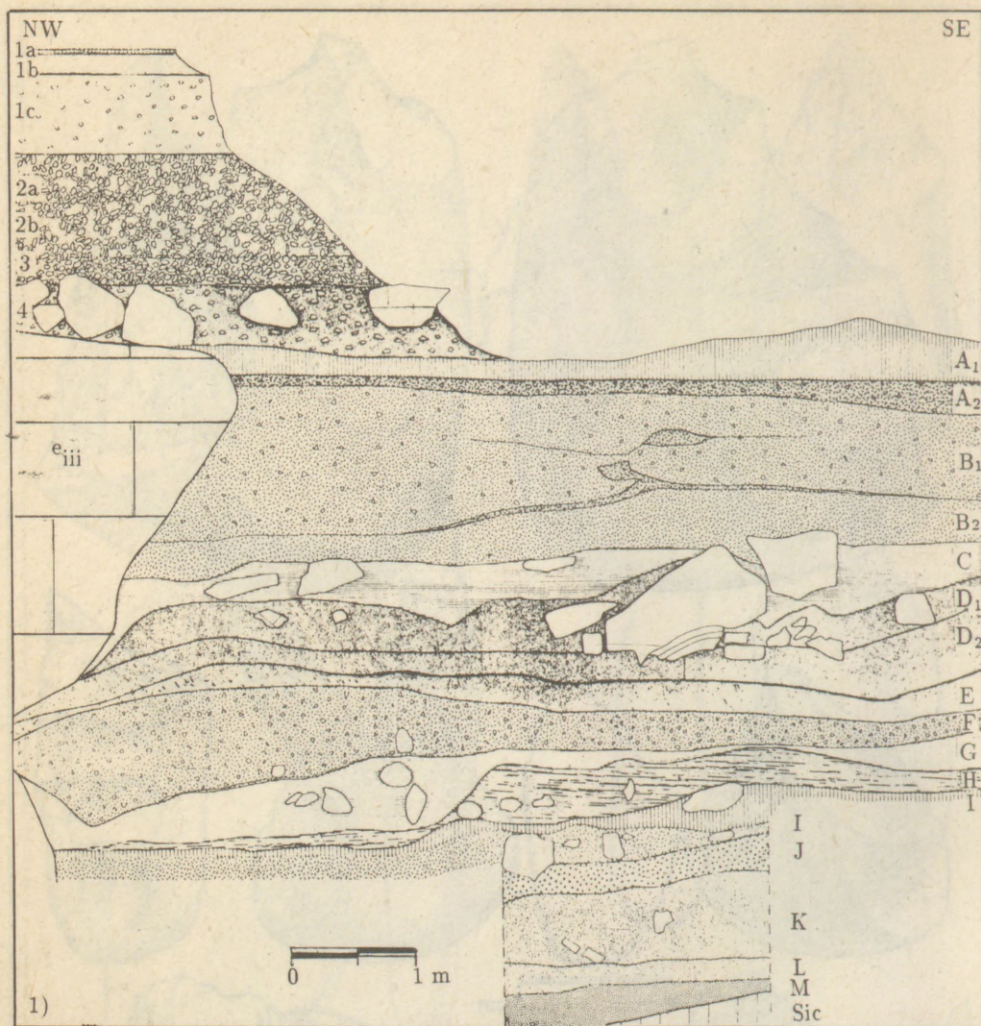
Pl. IX: Terra Amata—Hand axes (1–4), 'hachereaux' (5) (after H. de Lumley, 1976c: Fig. 8)



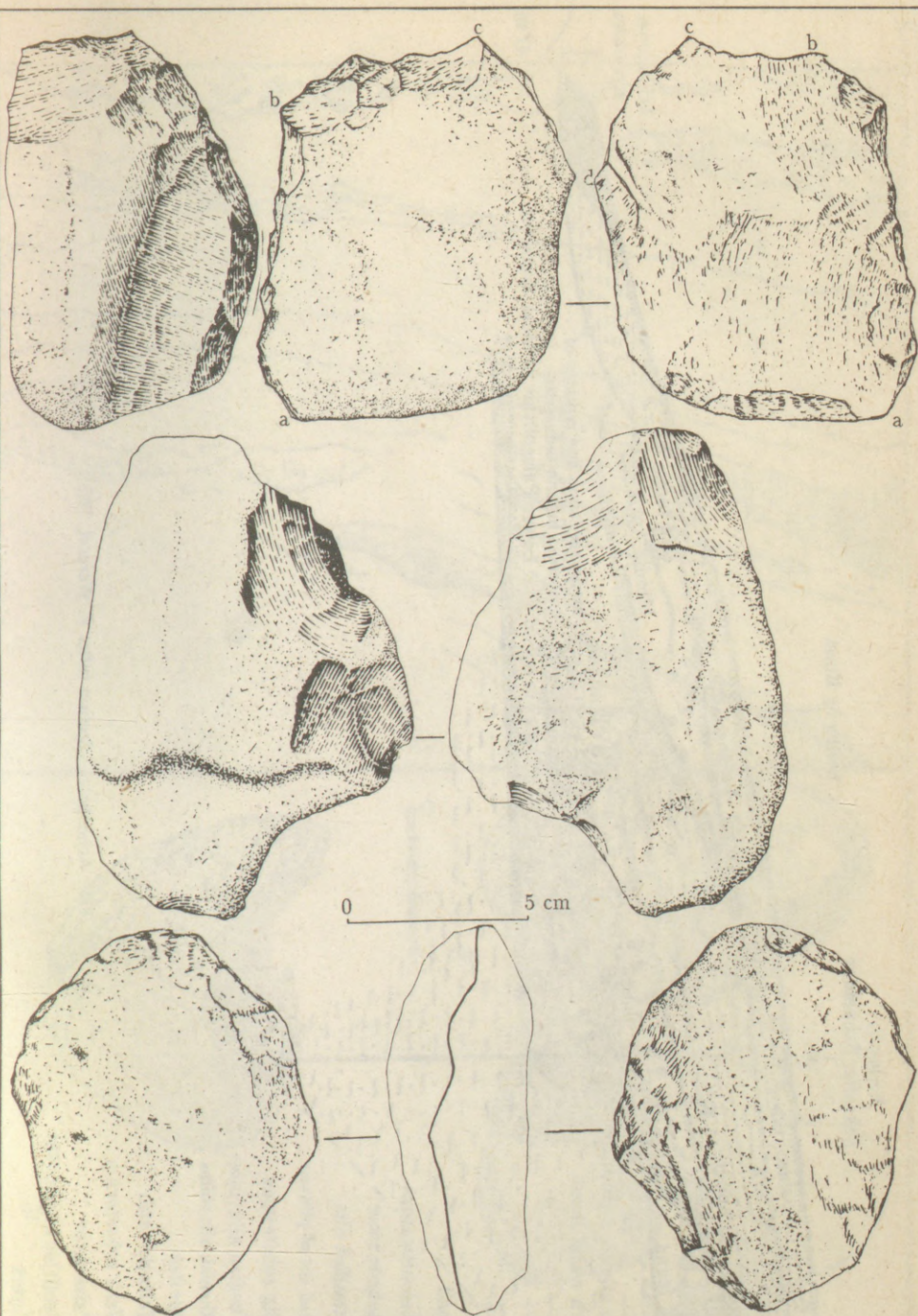
Pl. X: Terra Amata—Point (1), “picks” (2–4, 5), ‘Rostro-caréné’ (4) (after H. de Lumley, 1976c: Fig. 8)



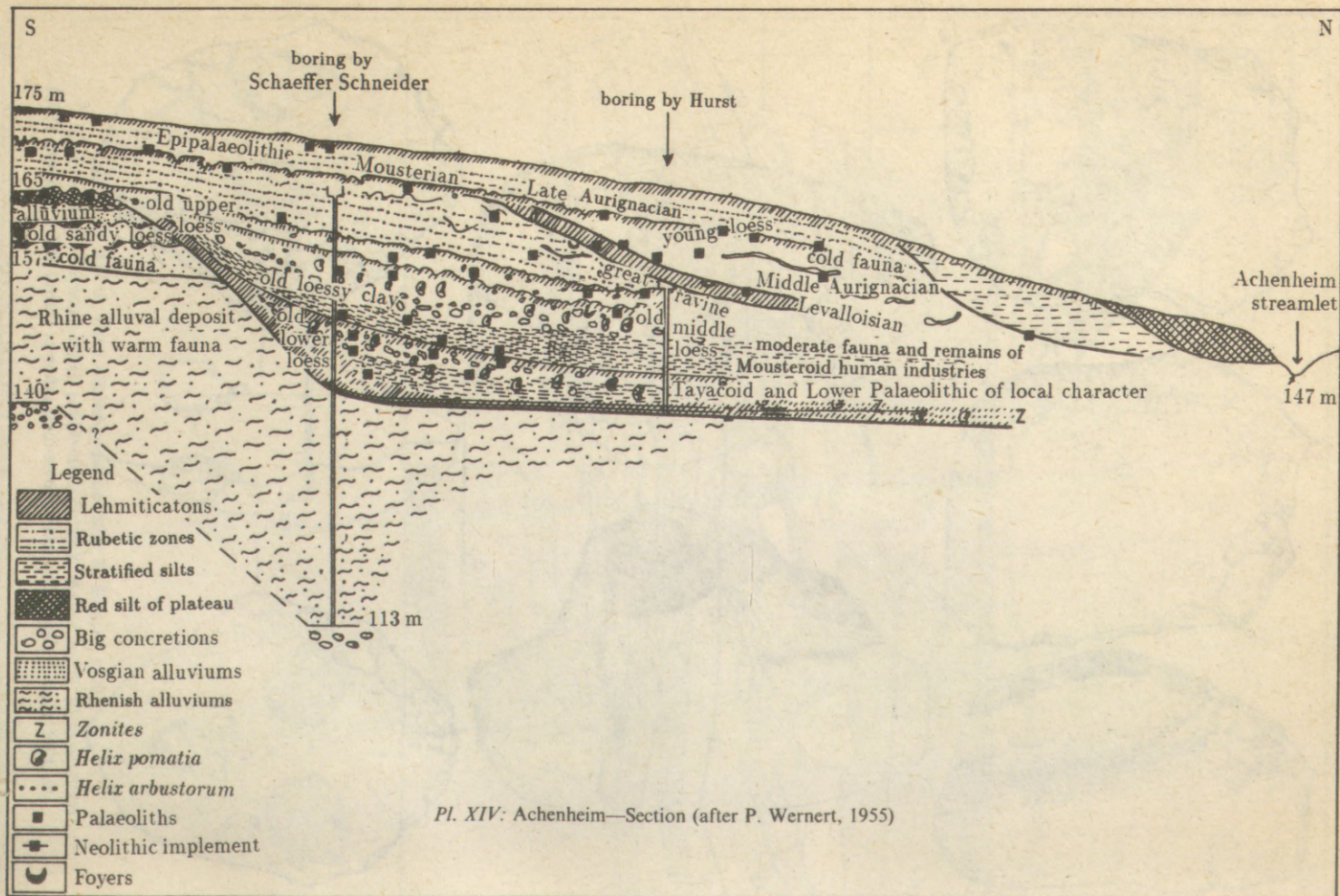
Pl. XI: Terra Amata—Choppers and chopping-tols (after H. de Lumley, 1976c: Fig. 7)



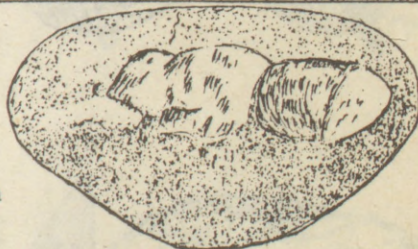
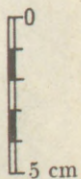
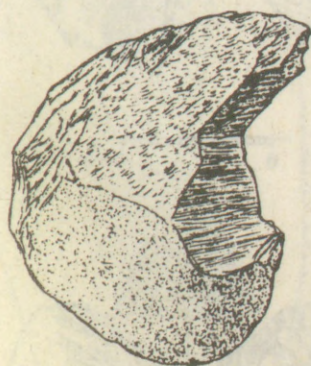
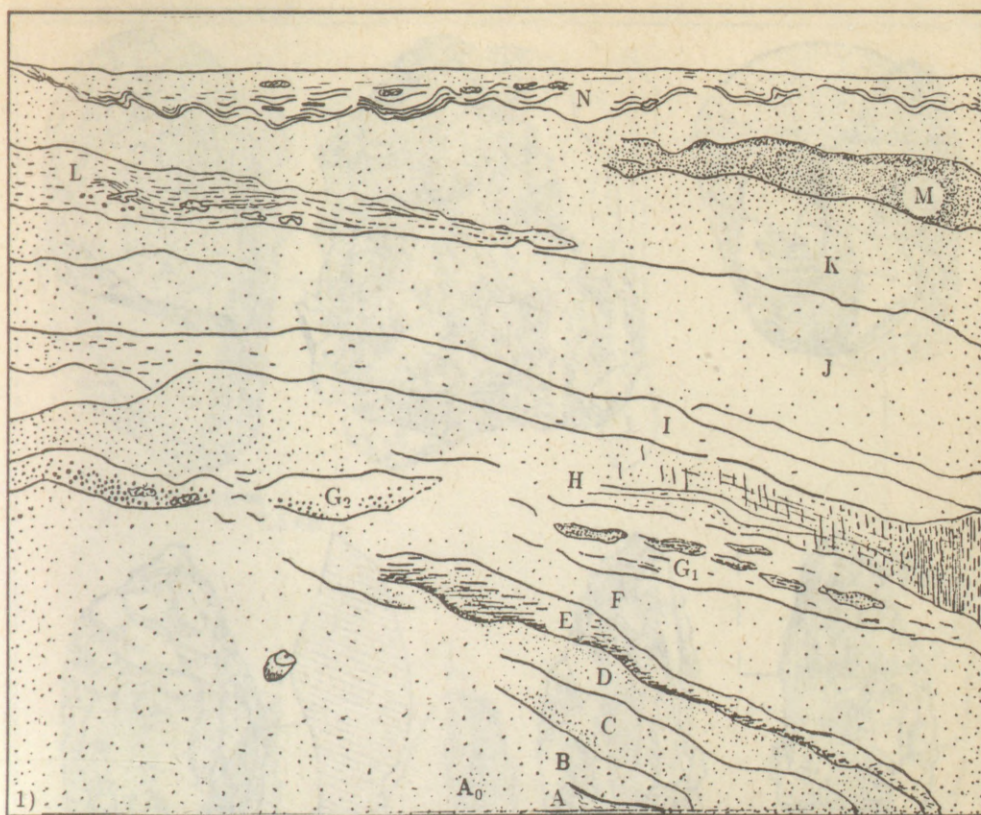
Pl. XII. 1: Cave Aldène—Section (after P. Baissas, 1972)
2: Cave Aldène—Tayacian micro pebble-tools (after L. Barral and S. Simone, 1972)



Pl. XIII: Cave Aldène—Tayacian pebble-tools (after L. Barral and S. Simone, 1972)



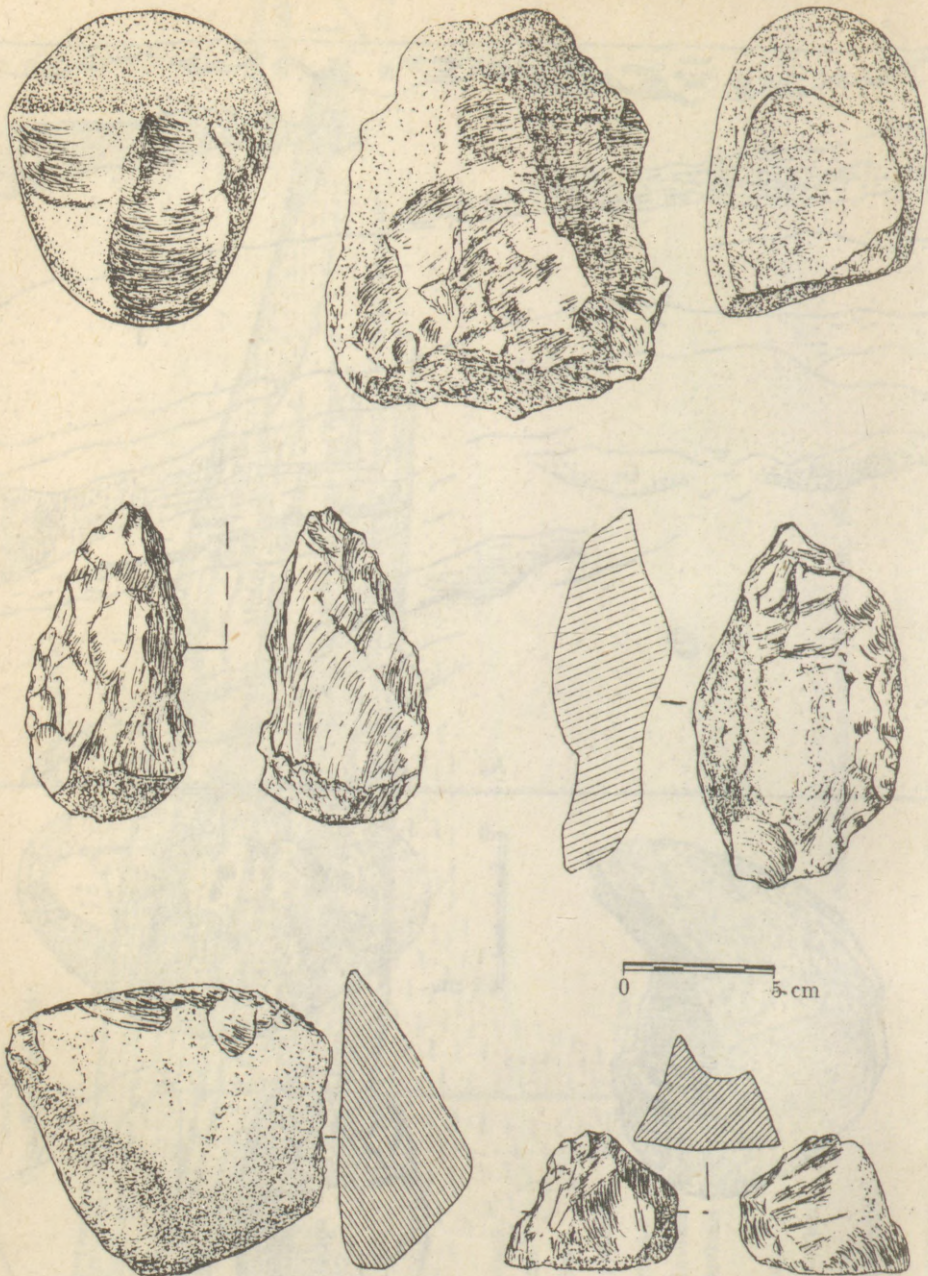
Pl. XIV: Achenheim—Section (after P. Wernert, 1955)



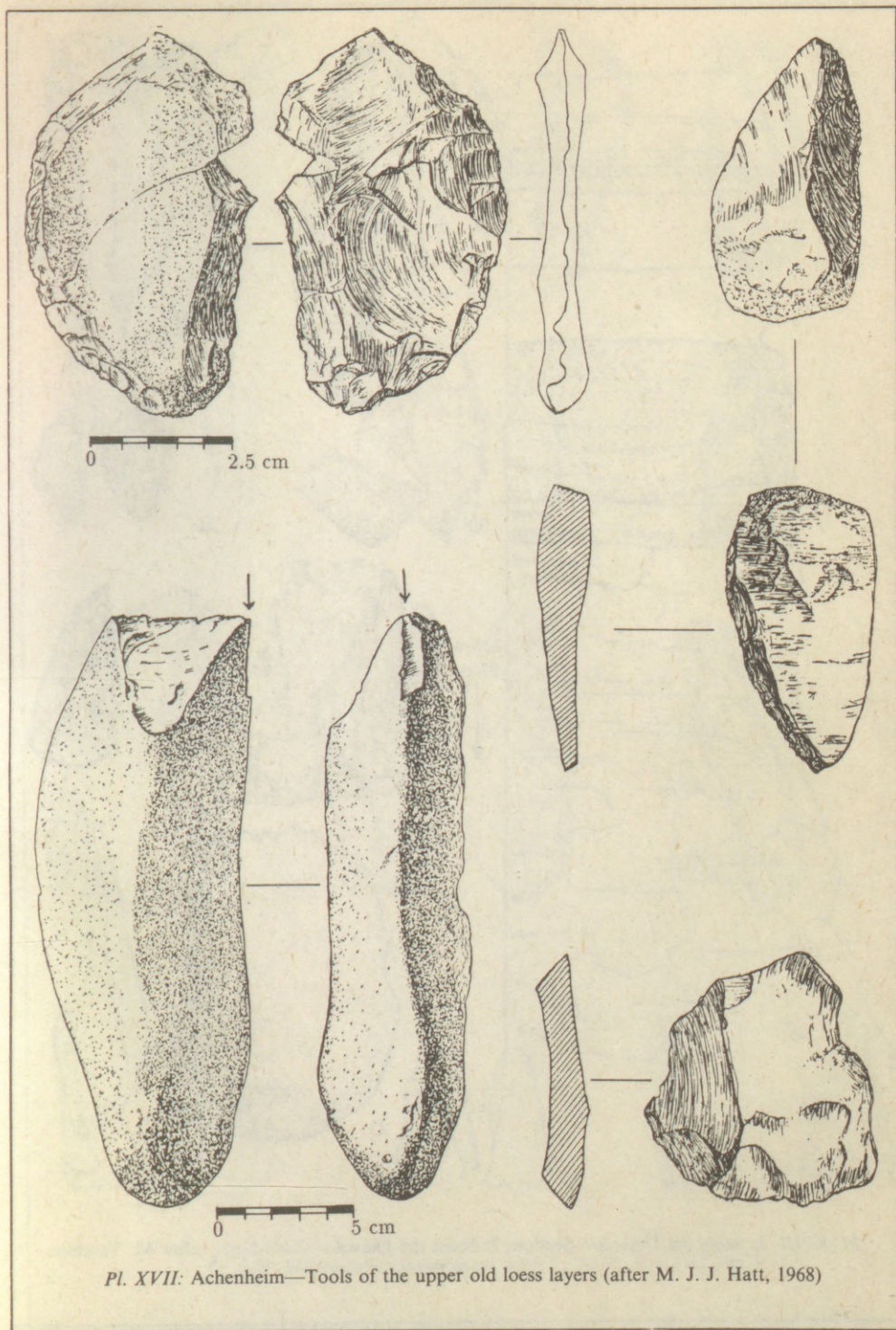
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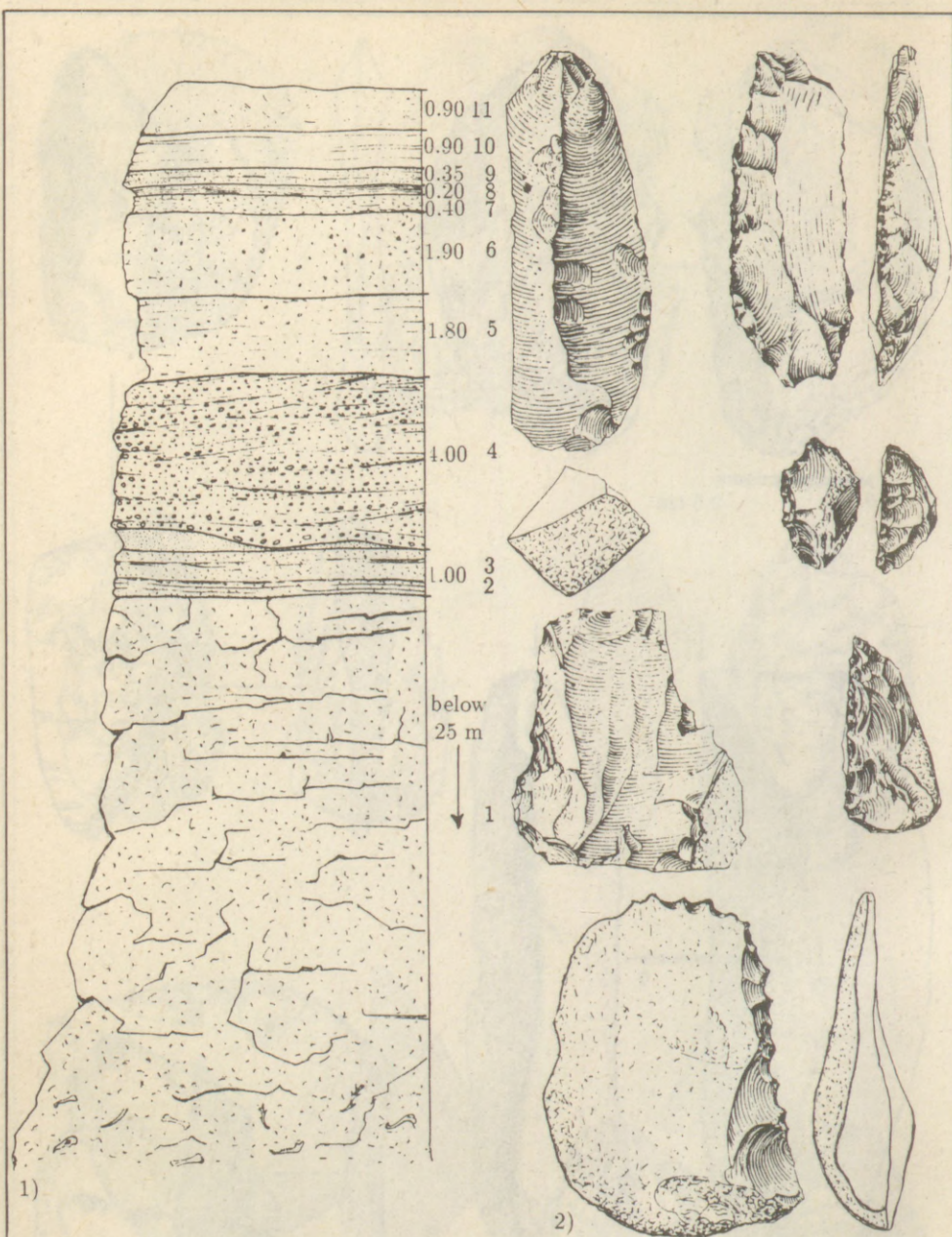
Pl. XV. 1: Achenheim—Section; 2: Achenheim—Tools of the lower old loess layers (after M. J. J. Hatt, 1968)



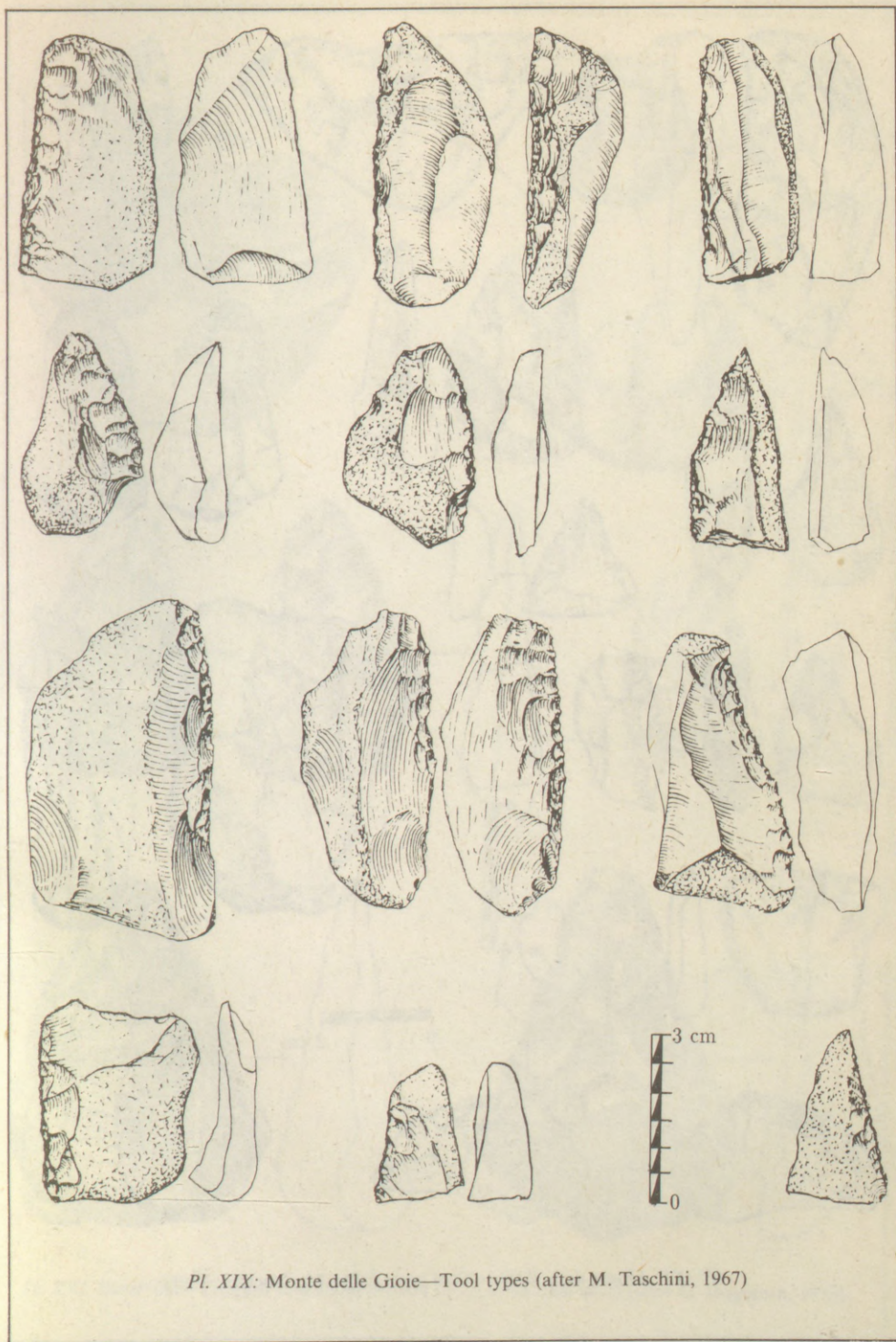
Pl. XVI: Achenheim—Tools of the middle old loess layers



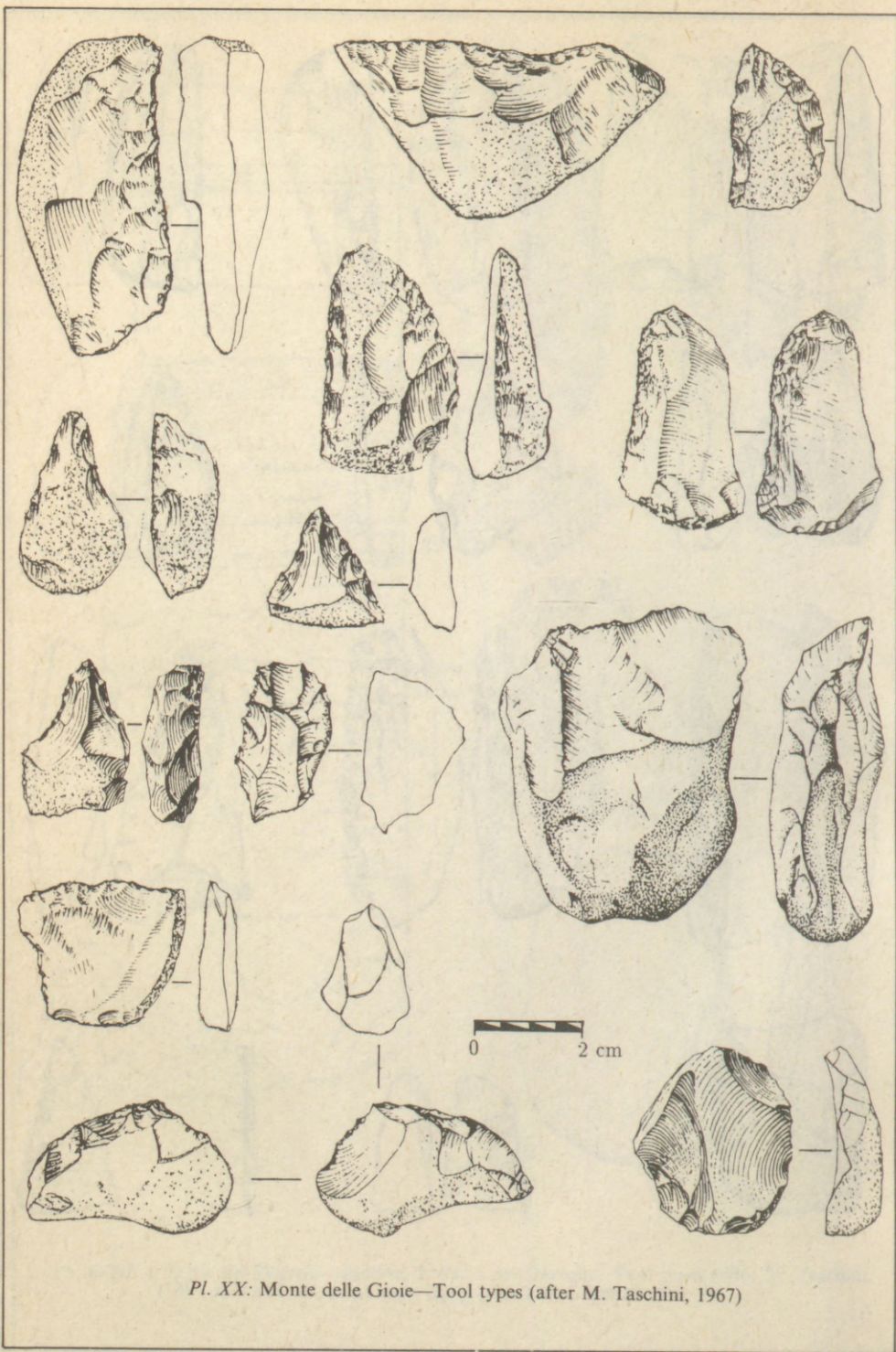
Pl. XVII: Achenheim—Tools of the upper old loess layers (after M. J. J. Hatt, 1968)



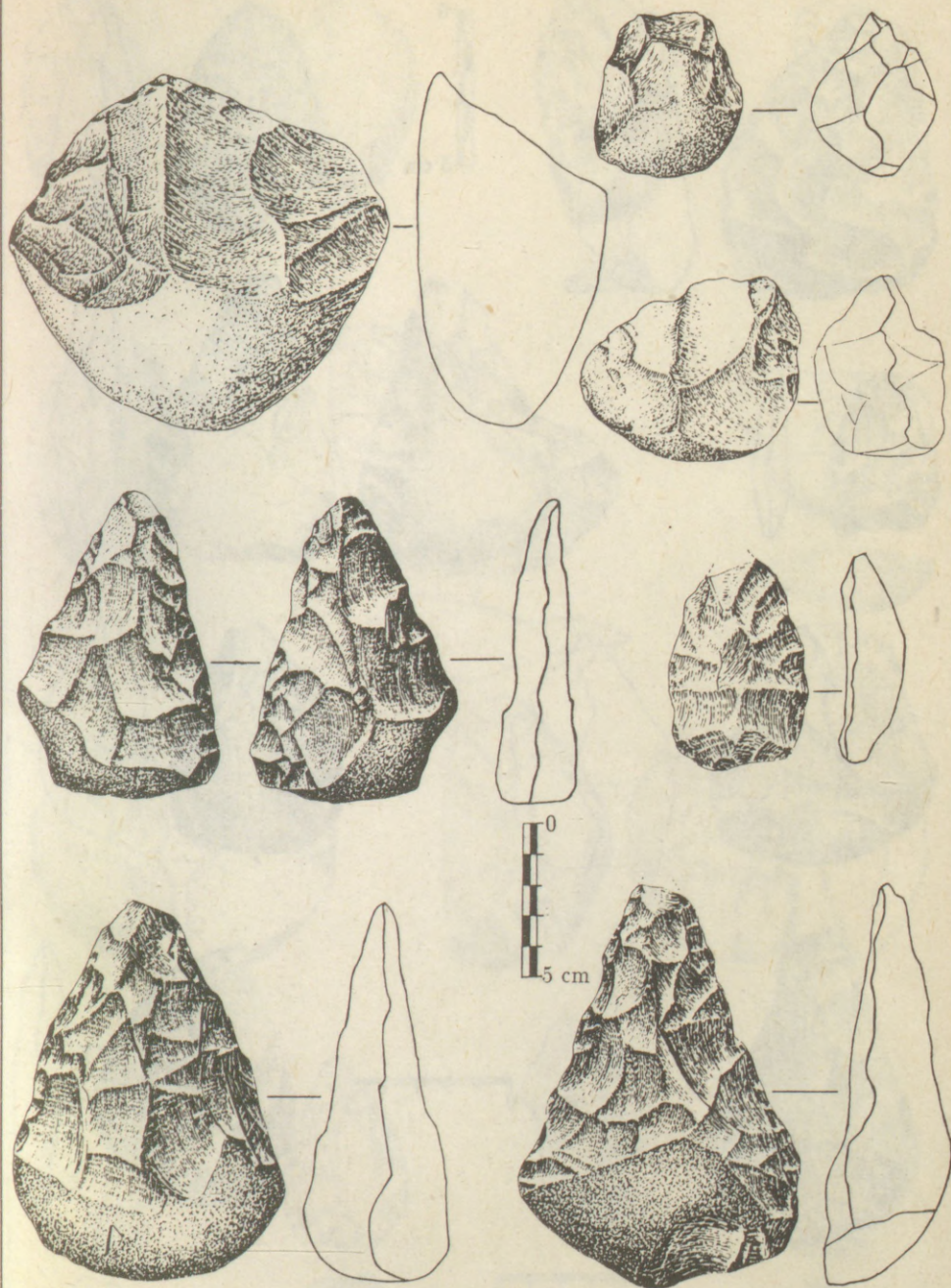
Pl. XVIII. 1: Sedia del Diavolo—Section; 2: Sedia del Diavolo—Tool types (after M. Taschini, 1967)



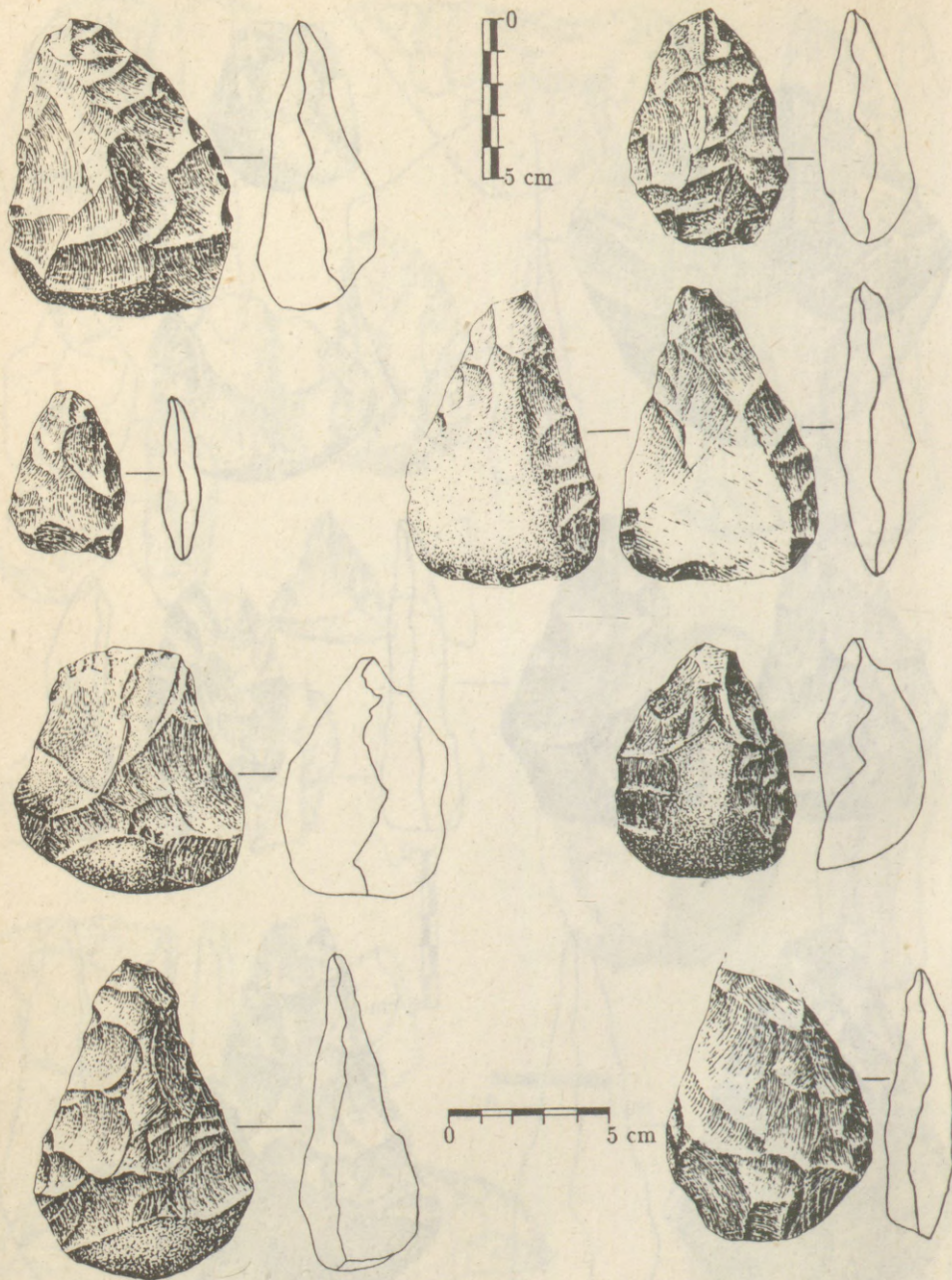
Pl. XIX: Monte delle Gioie—Tool types (after M. Taschini, 1967)



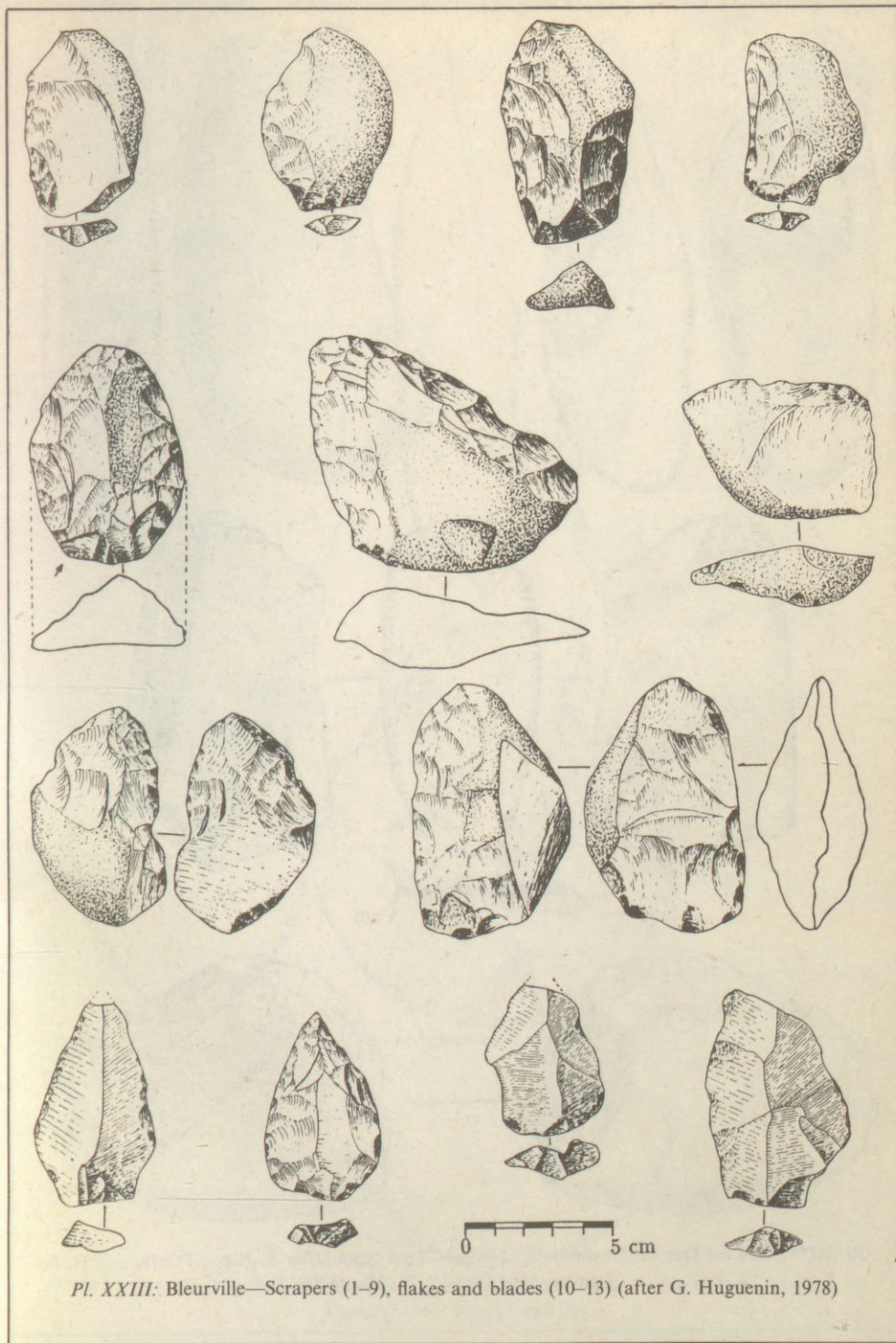
Pl. XX: Monte delle Gioie—Tool types (after M. Taschini, 1967)

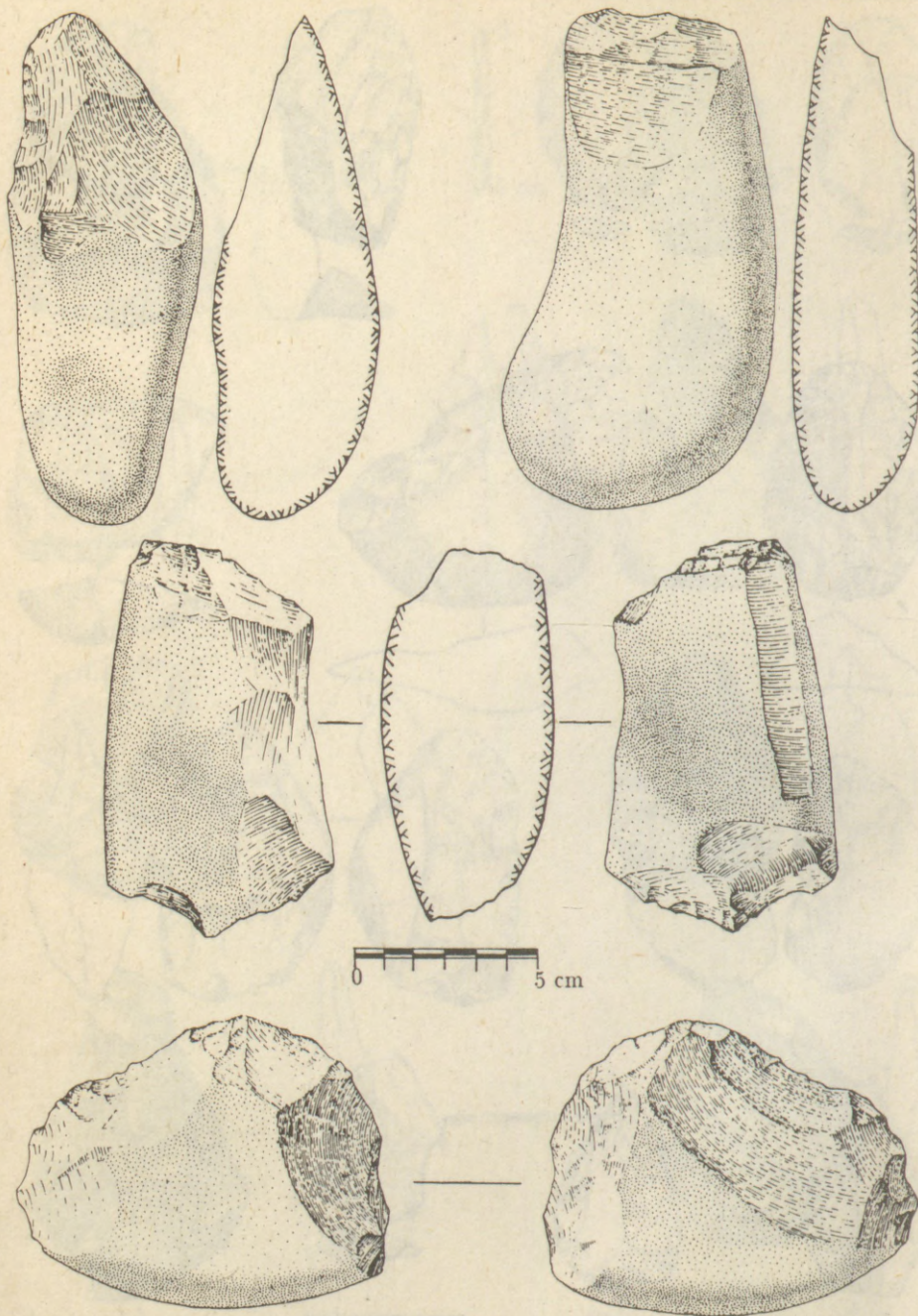


Pl. XXI: Bleurville—Chopper and chopping-tols (1-3), hand axes (4-7) (after G. Huguenin, 1978)

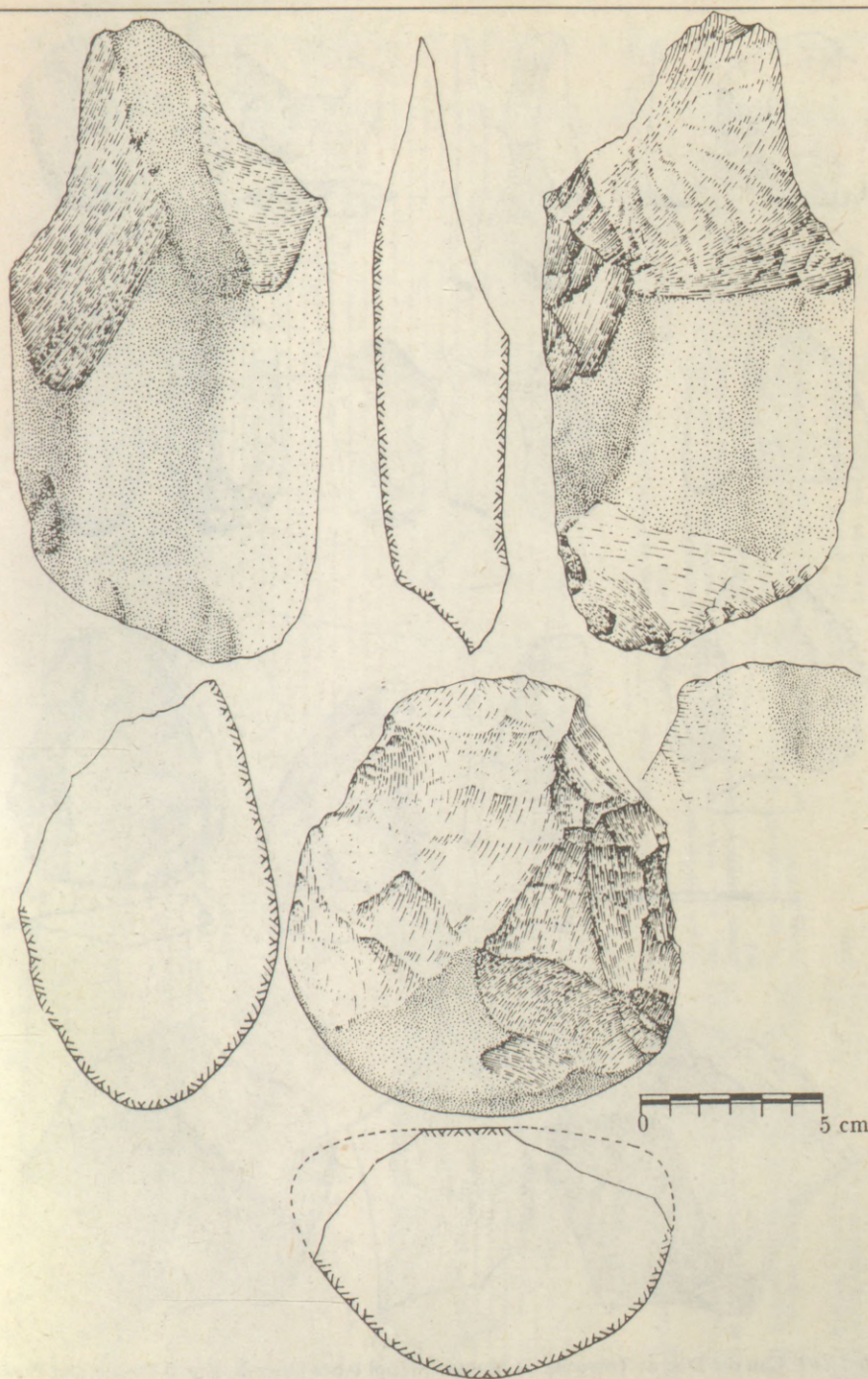


Pl. XXII: Bleurville—Hand axes (after G. Huguenin, 1978)

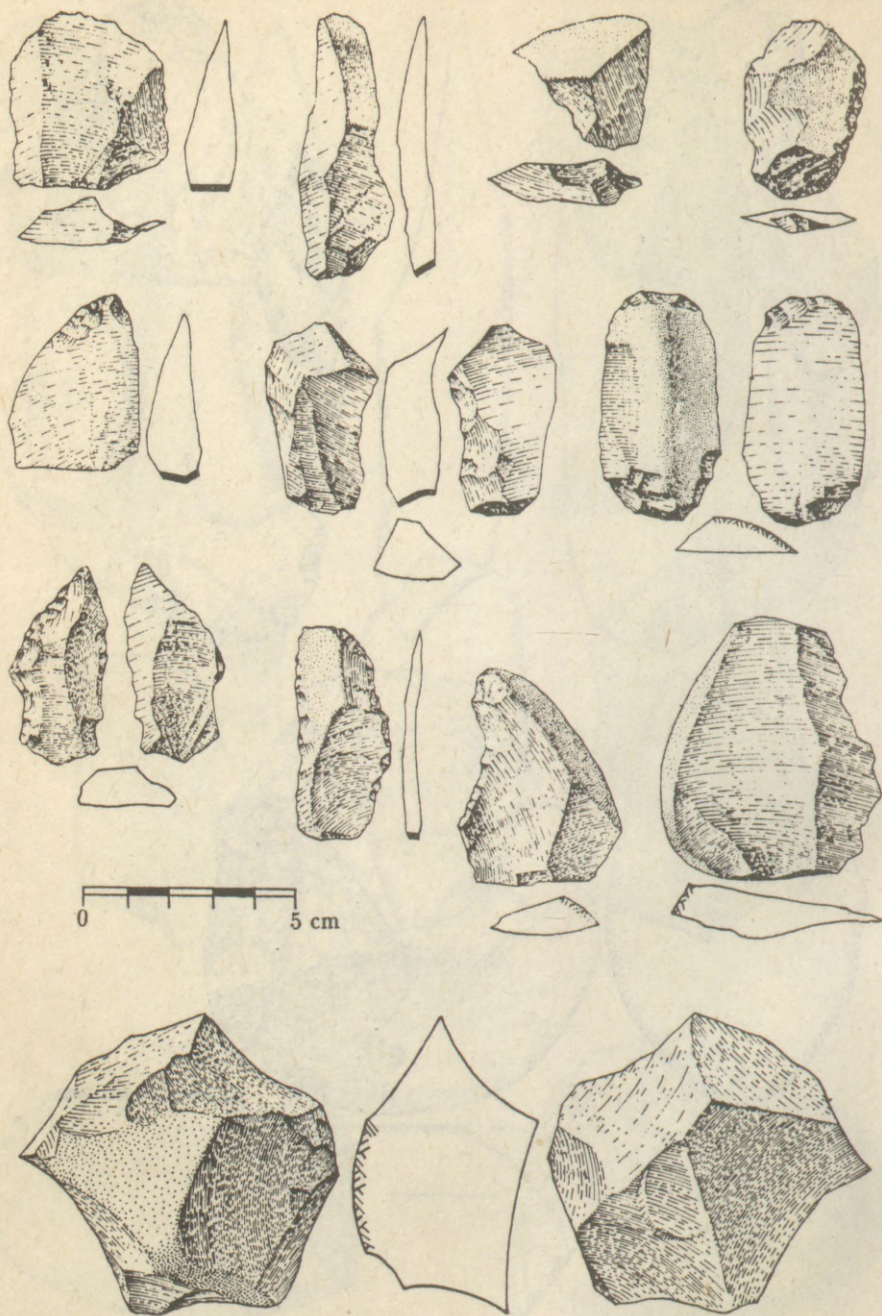




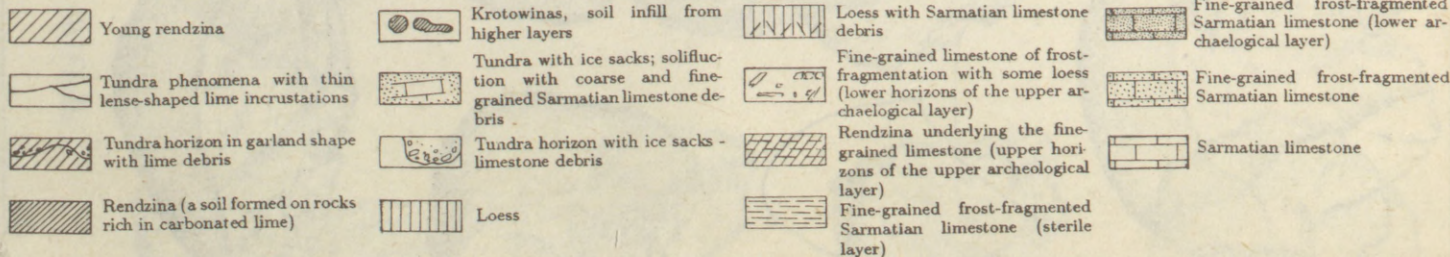
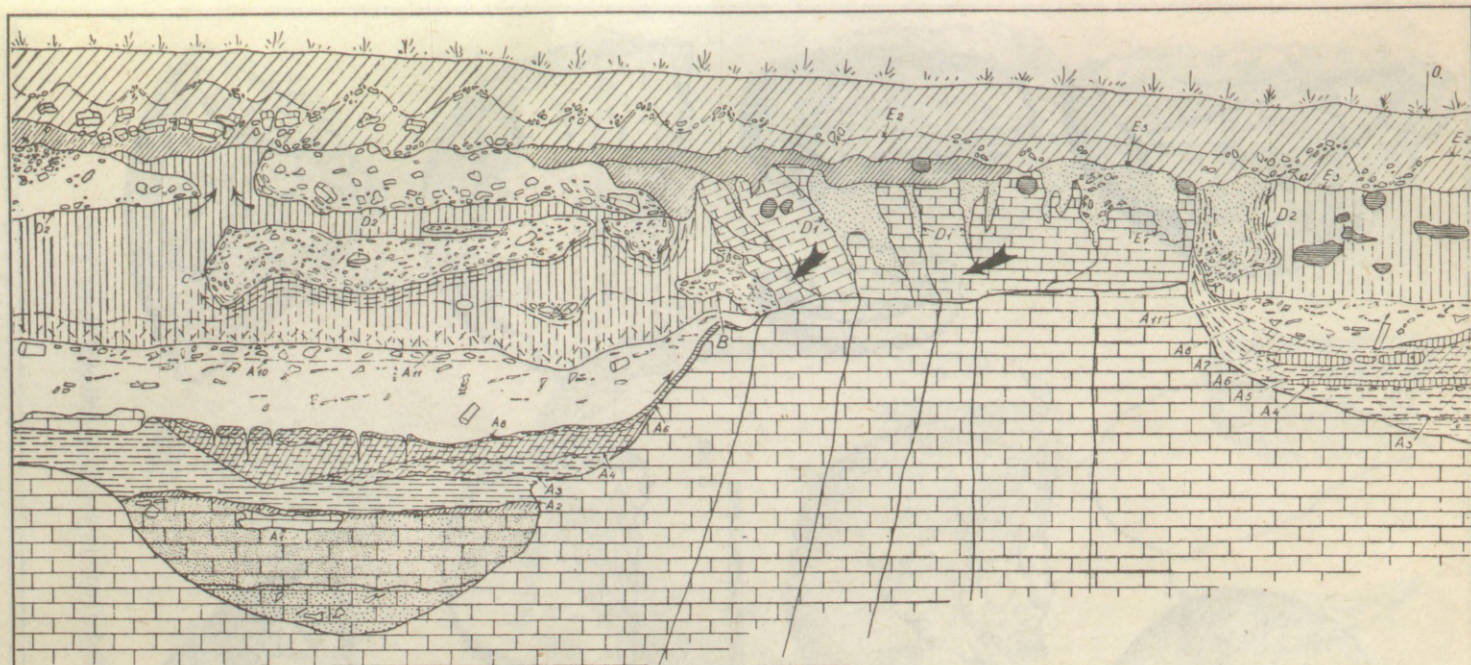
Pl. XXIV: Cau del Duc de Torroella de Montgri—Tool types (after E. Ripoll-Perello and H. de Lumley, 1965 Figs 17, 21, 22 and 25)



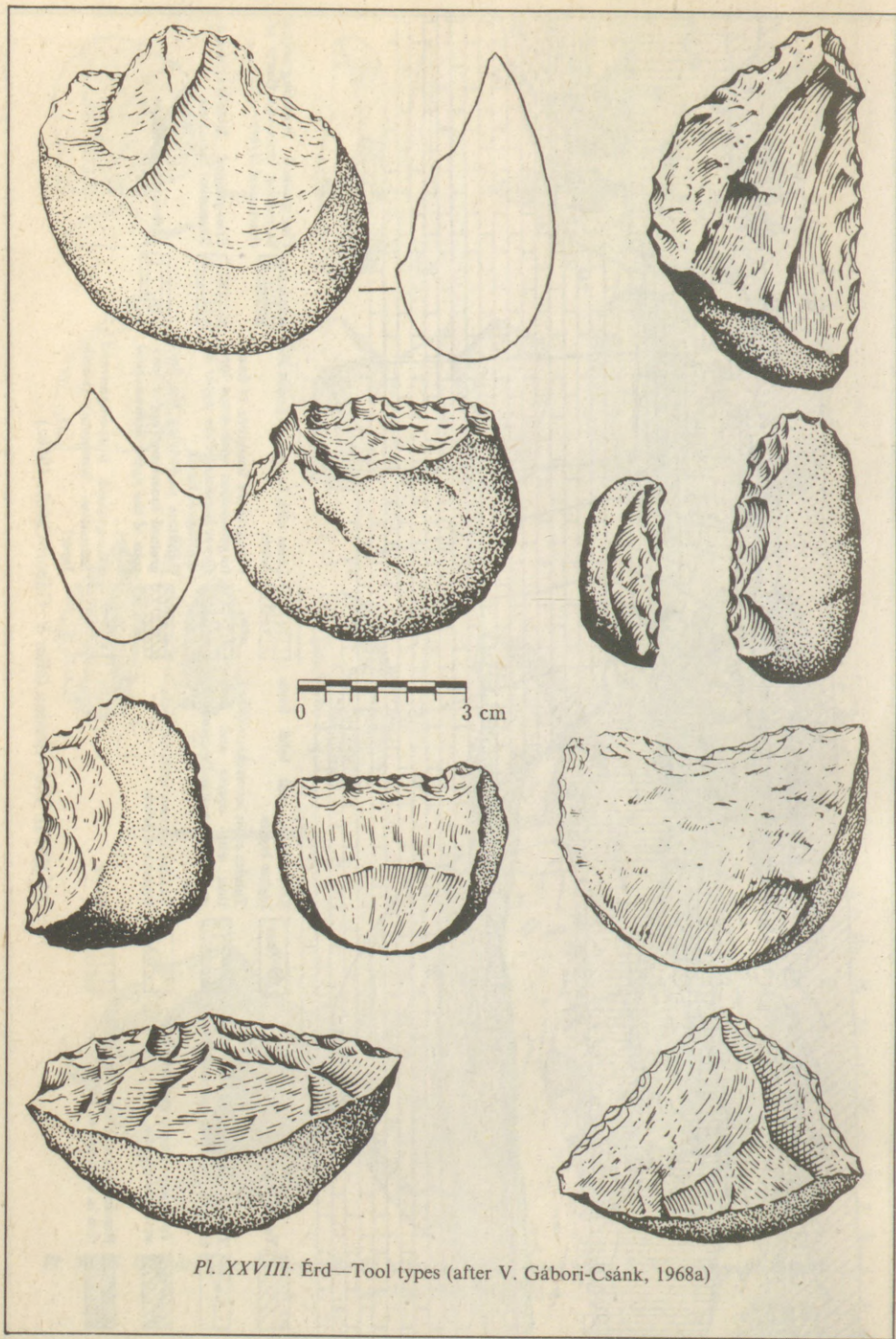
Pl. XXV: Cau del Duc de Torroella de Montgri—Tool types (after E. Ripoll-Perello and H. de Lumley, 1965: Figs 17 and 20)

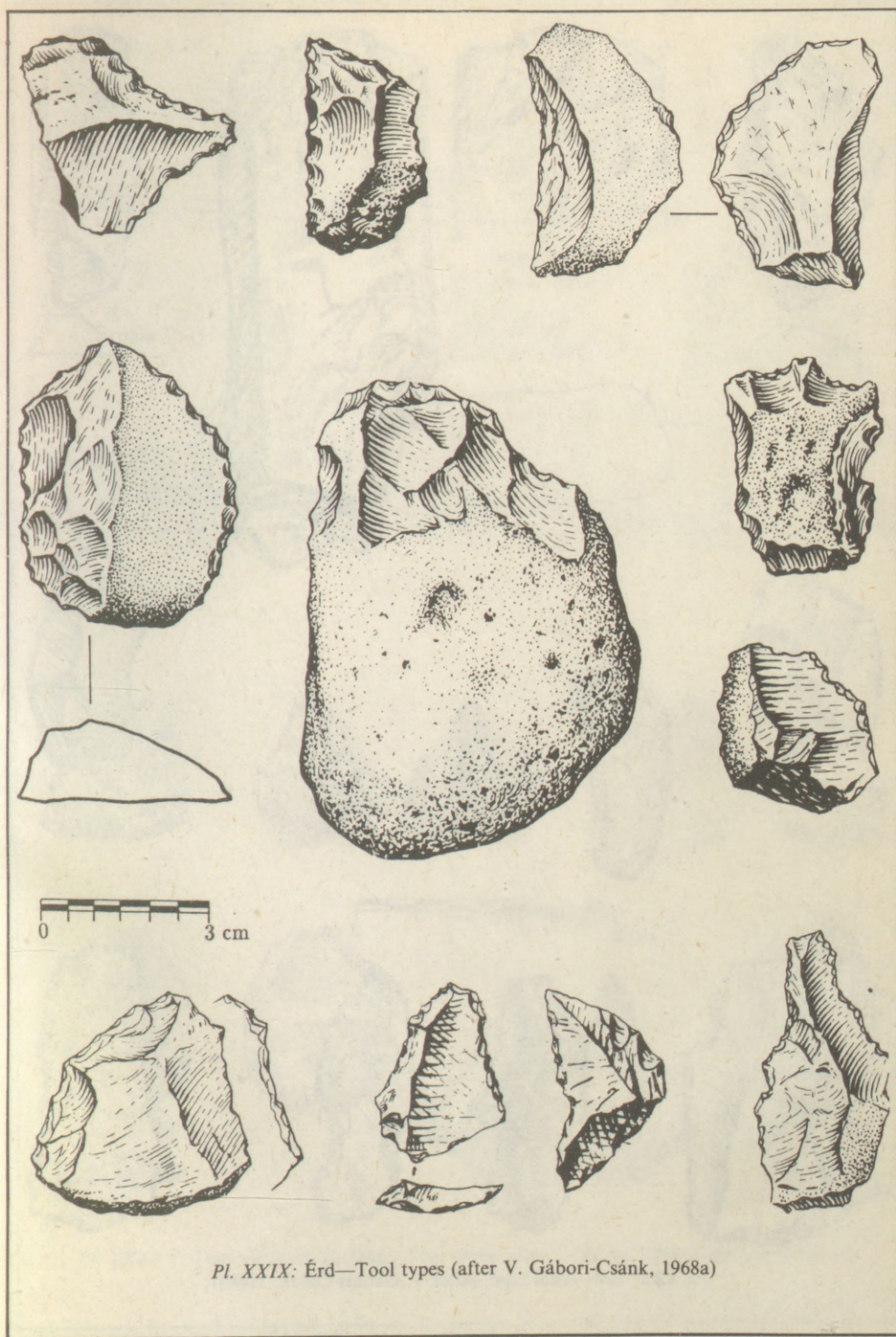


Pl. XXVI: Cau del Duc de Torroella de Montgrí—Tool types (after E. Ripoll-Perello and H. de Lumley, 1965: Fig. 16)

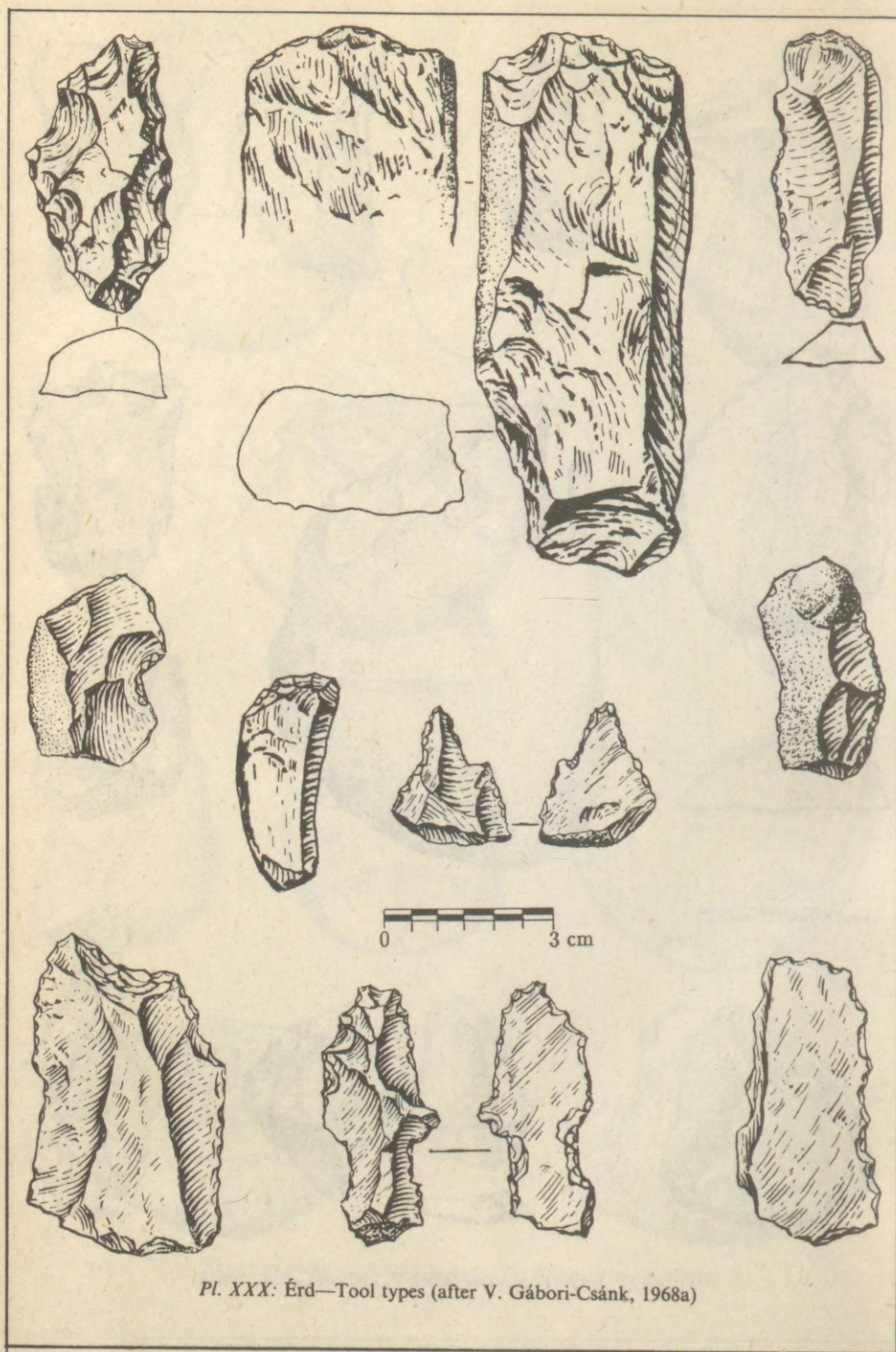


Pl. XXVII: Érd—Section (after V. Gábori-Csánk, 1968a)

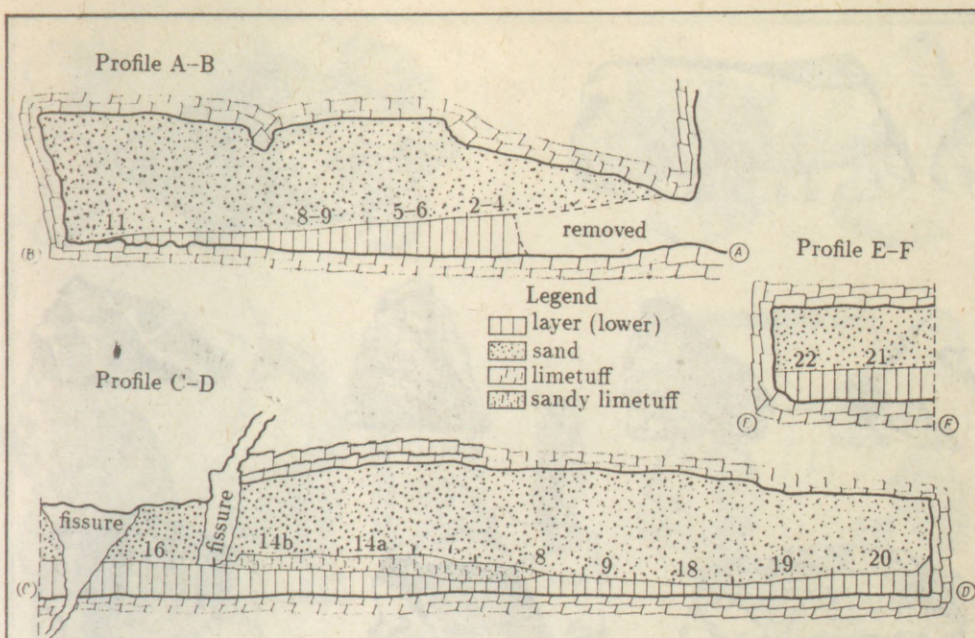




Pl. XXIX: Érd—Tool types (after V. Gábori-Csánk, 1968a)



Pl. XXX: Érd—Tool types (after V. Gábori-Csánk, 1968a)

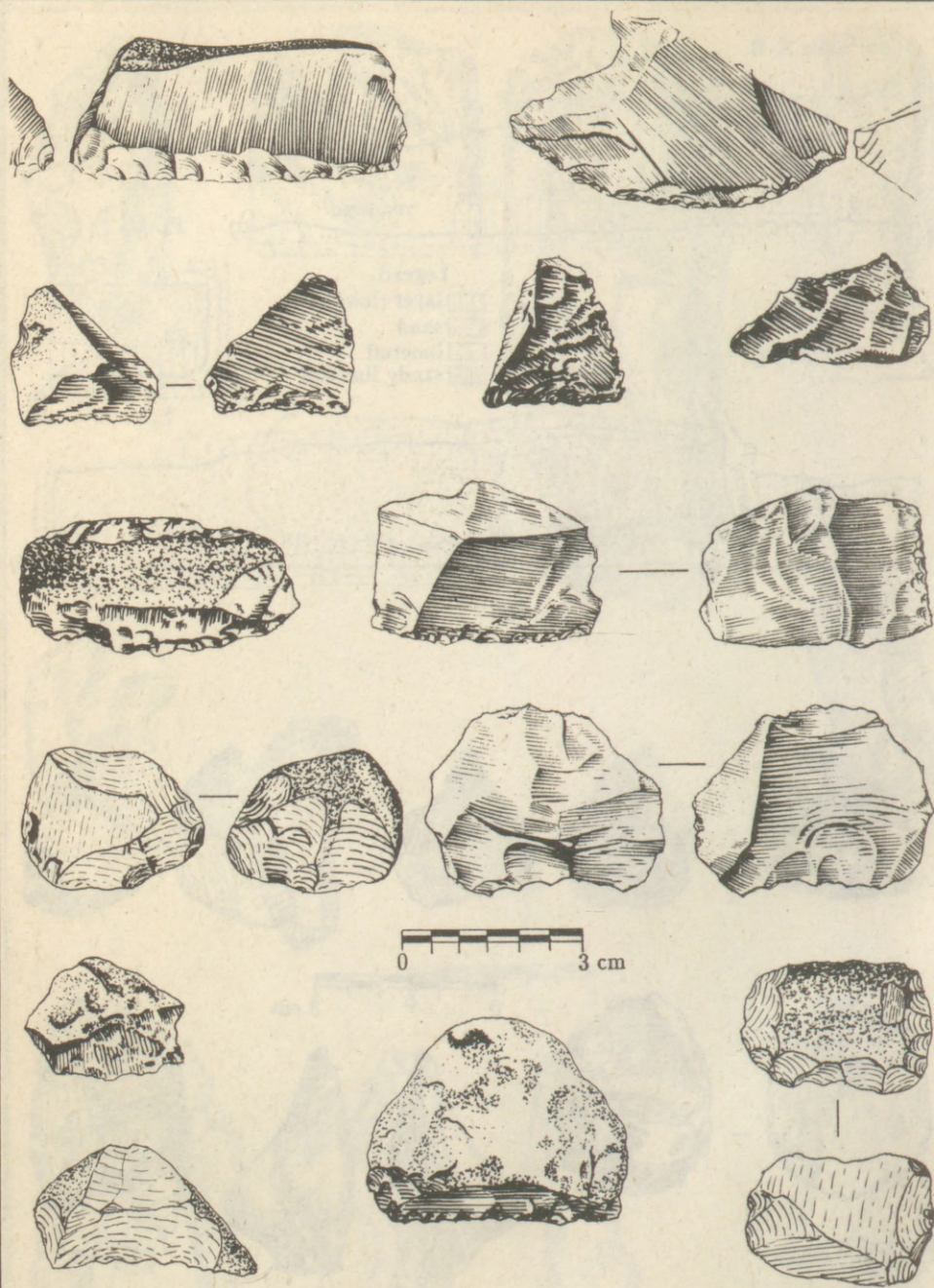


1)

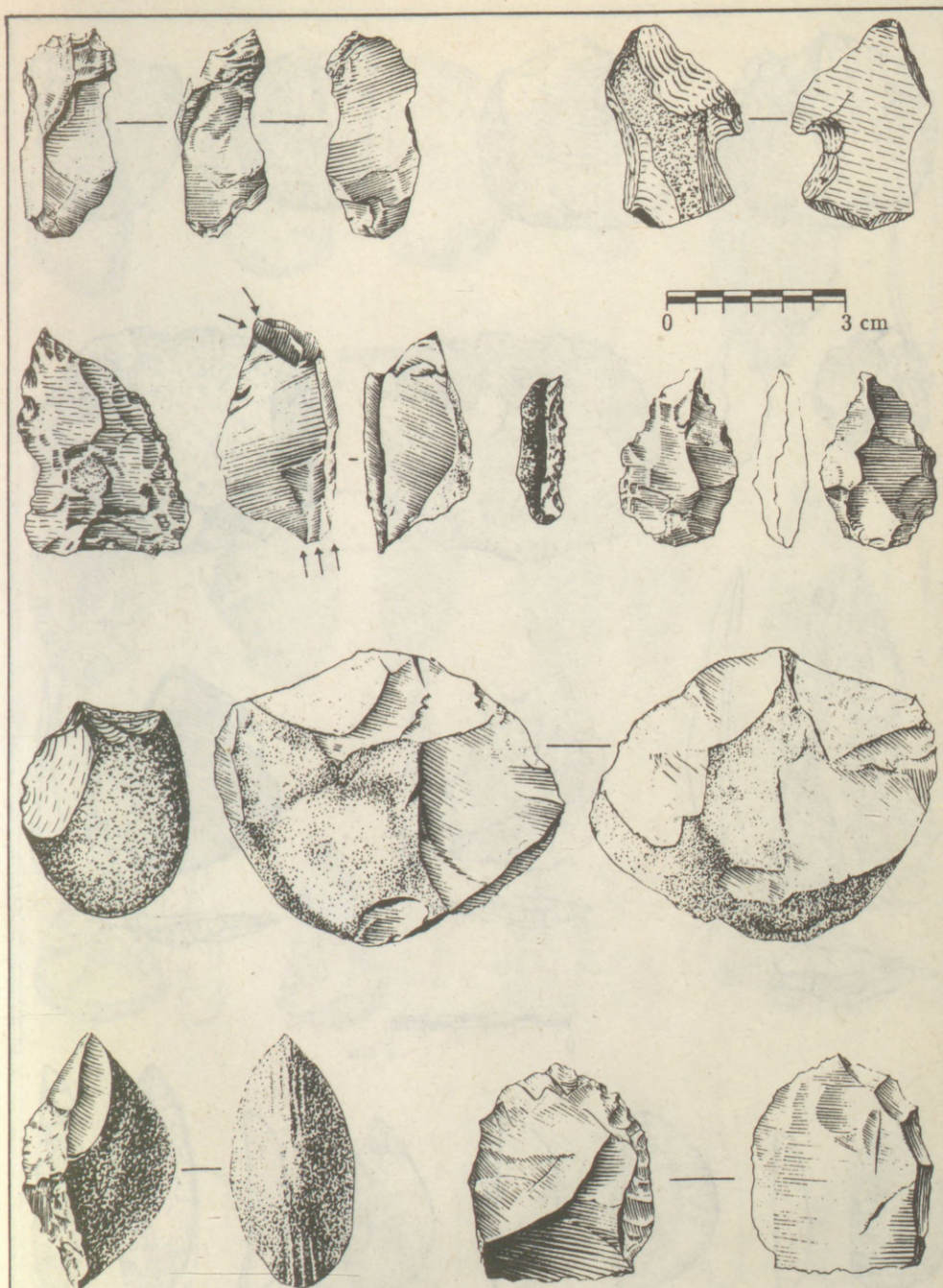


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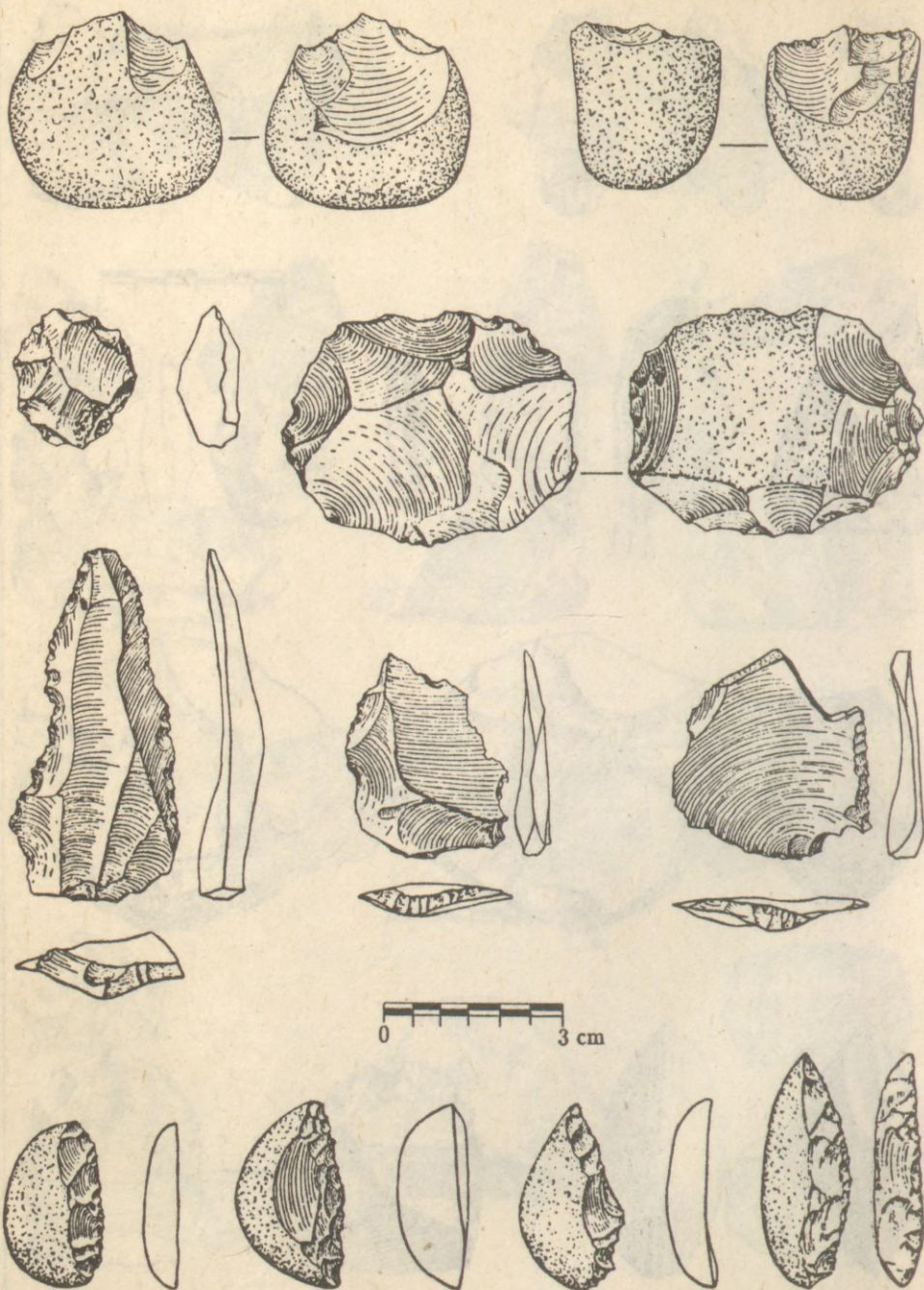
Pl. XXXI. 1: Tata—Section; 2: Tata—Tool types (after L. Vértés, 1964: Figs 2, 7, 8, 18–20)



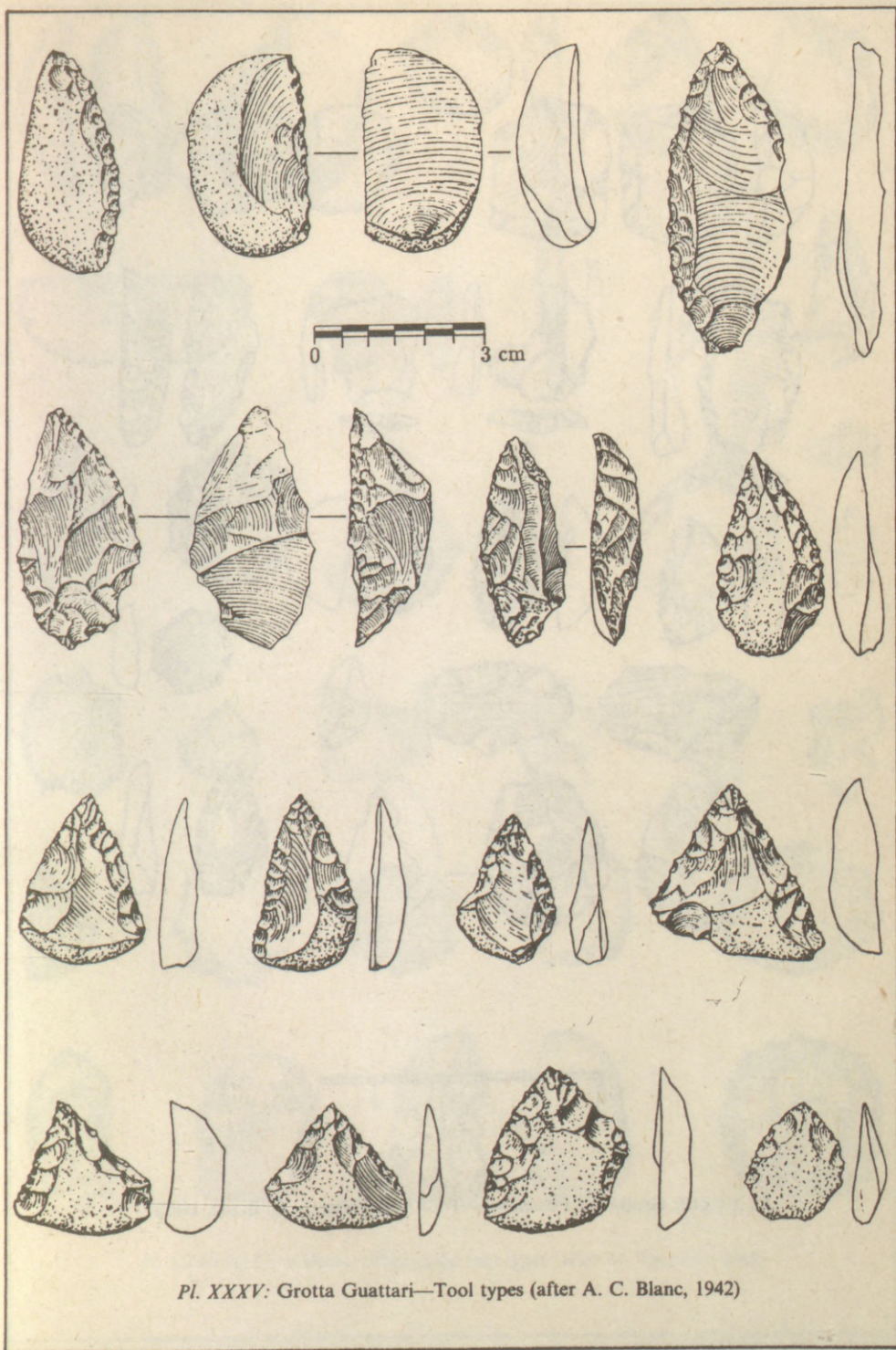
Pl. XXXII: Tata—Tol types (after L. Vértés, 1964: Figs 9–18)

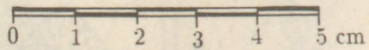
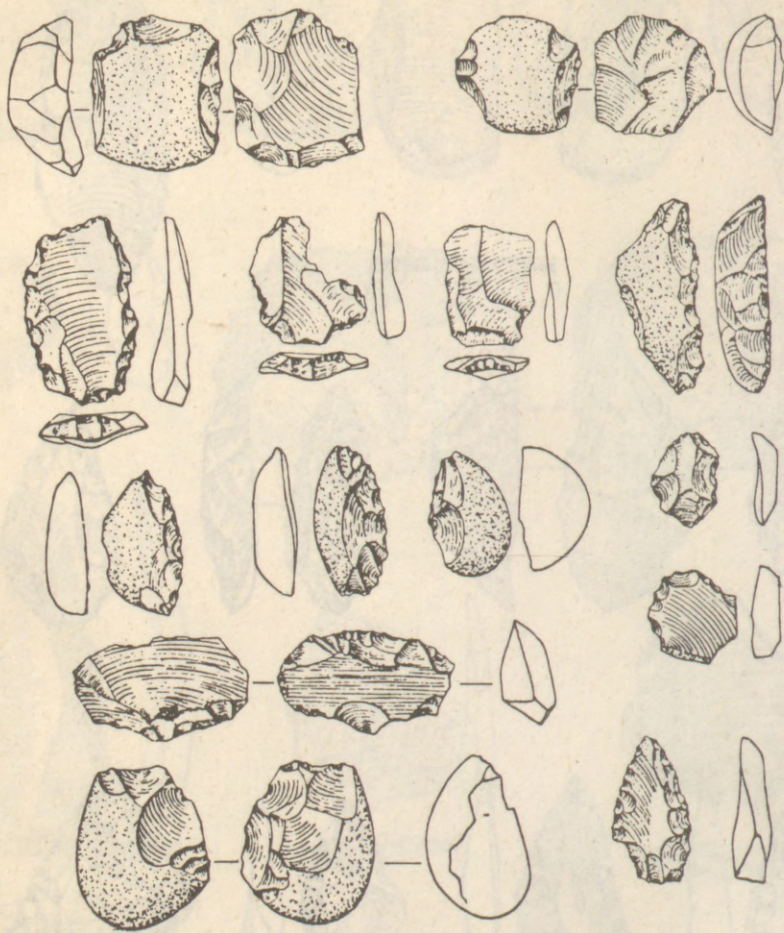


Pl. XXXIII: Tata—Tool types (after L. Vértés, 1964: Figs 21, 22, 24, 25, 27–30)

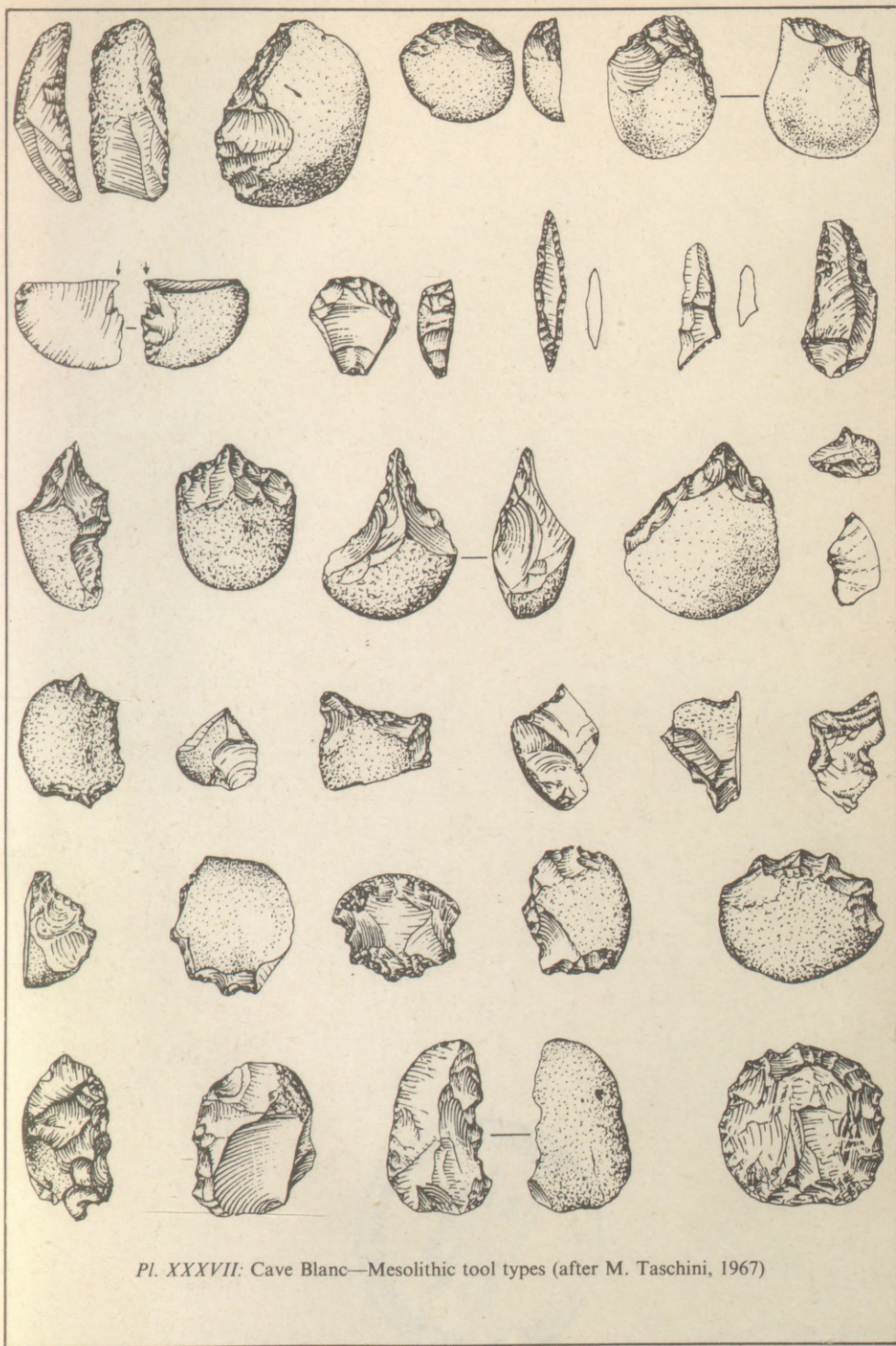


Pl. XXXIV: Grotta Guattari—Tool types (after A. C. Blanc, 1942)

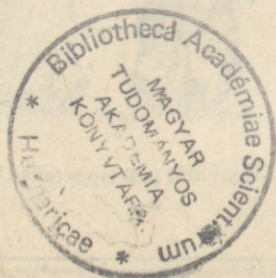


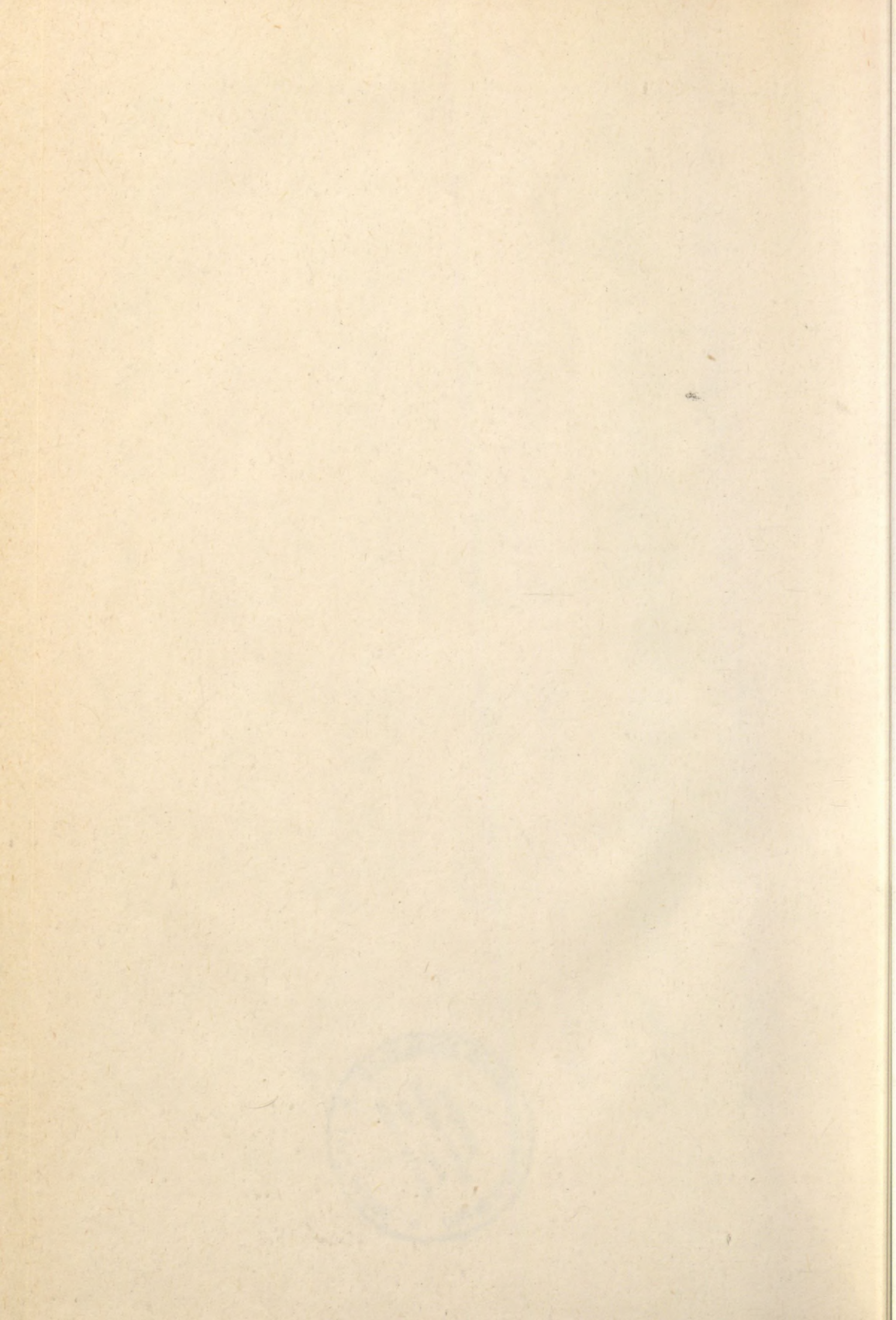


Pl. XXXVI. Grotta del Fossellone—Tool types (after A. C. Blanc, 1942)



Pl. XXXVII: Cave Blanc—Mesolithic tool types (after M. Taschini, 1967)





4555 (I)

This work is a unique synthesis of "Pebble Cultures", the oldest remains of civilization in Europe. The conclusions drawn from this study transcend the simple archaeological questions focusing on the origins of European culture and the agent of these achievements: Man.

The vertical development of European pebble industry and pebble sites is superbly outlined, based on the extensive literature on stratigraphic and archaeological data and the chronological and other viewpoints.

The highlight of the book is a novel look at the origins of the oldest European civilization.

Archaeologists, anthropologists, historians and anyone interested in this field will find this book a most comprehensive and worthwhile reading.



Akadémiai Kiadó, Budapest