„DIE AKTUELLEN FRAGEN DES MITTELPALÄOLITHIKUMS IN MITTELEUROPA"

„TOPICAL ISSUES OF THE RESEARCH OF MIDDLE PALAEOLITHIC PERIOD IN CENTRAL EUROPE"

TUDOMÁNYOS FÜZETEK 12.

Komárom-Esztergom Megyei Múzeumi Szervezet

TUDOMÁNYOS FÜZETEK 12.
KOMÁROM–ESZTERGOM MEGYEI MÚZEUMI SZERVEZET

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Tartalomjegyzék

Die Forschungsgeschichte von Tata-Porhanyóbánya

Julianna Kisné Cseh

Die dritte und bisher größte Freilegung der Tataer urzeitlichen Siedlung wurde in einer Zusammenarbeit des Ungarischen Nationalmuseums und des Kuny Domokos Museums unter der Leitung Viola Dobosi und Julianna Cseh geführt und 2001 beendet. Die Bearbeitung der Fundstoffe, die während der sechs Jahre langen Ausgrabungen zum Vorschein kamen, ist mit der Unterstüzung der Staatlichen Stiftung der Wissenschaftlichen Forschung (OTKA) im Gange. Die bisherigen Ergebnisse der Bearbeitung von verschiedenen Wissenschaftszweigen und die aufgeworfenen Fragen gaben den Anlaß zur Organisierung dieser Konferenz, zur Diskussion über die aktuellen Fragen der mittleren Steinzeit unserer größeren Region – das heißt Mitteleuropa – und zur Vorführung neuerer Ergebnisse. Ich möchte in meiner Abhandlung die Forschungsgeschichte des Fundortes kurz darstellen.

Der Fundort und seine geographische Lage

Der Fundort liegt neben dem Sportplatz des Eötvös Gymnasiums von Tata, in dicker Kalktuff unter dem Gymnasium, am östlichen Abhang des Kalvarienhügels.

Zur Darstellung der geologischen Verhältnisse zitieren wir aus der hervorragenden Arbeit Nándor Kochs, der die geologische Geschichte des Kalvarienhügels von Tata erstmals zusammenfaßte:

«Der aus älteren Bildungen aufgebaute Kalvarienhügel von Tata, welcher als eine abgerissene Scholle des Gerecsegebirges zu betrachen ist, liegt, allseits von jüngeren Bildungen umgeben, völlig isoliert da.

Von jüngeren Bildungen nimmt am Aufbaue desselben noch diluvialer Kalktuff teil, welcher die gegen den großen Teich abfellene E-Lehne in bedeutender Mächtigkeit (30-40) bedeckt.

Seine Entstehung verdankt der Kalktuff der Tätigkeit von diluvialen Quellen, die längst der NordNordwest-SüdSüdöst-lichen Verwerfung hervorgebrochen sein dürften. Die Mächtigkeit des Kalktuffes läßt vermuten, daß es sehr reiche Quellen sein mochten.

Er wird in einem Steinbruche zwischen dem katholischen Friedhof und dem Piaristengymnasium gewonnen.»[1]

Der Fundort wurde nach der Substanz der hier abgebauten Kalktuff genannt: die Ortsansässigen nannten und nennen bis heute auch Mürbgrube (porhanyóbánya) oder Steinstaubig (kőporos).

[1] Koch 1909, 17. und 303.

Die erste Berichte

Zuerst sollen wir die Angaben über die Geschichte der Steingrube kurz überblicken, weil die ersten Funde dank der hier laufenden Arbeit zum Vorschein kamen. Über die Erschließung der Steingruben – und so über die ersten Funde – besitzen wir keine genauen Angaben. Ihre Nützung ist gewiß nachweisbar in der späten Kupferzeit, als auf diesem Gebiet Feuerstein abgebaut wurde.[2] Wir haben keine gewißen Angaben über die frühere, römerzeitliche oder frühmittelalterliche Benutzung der Gruben. Die ersten Nachrichten über die schon im Mittelalter bestimmt benutzen Gruben stammen nach meinen Kentnissen aus 1535 und 1585, aus der Feder von dem Esztergomer Erzbischof Miklós Oláh und dem franzözischen Diplomat Jakab Bongars. Der Erzbischof berichtet über den ausgezeichneten roten Marmor des Berges, der südlich von der Burg liegt, nach der Meinung Jakab Bongars ist Tata *«wegen seinen Marmorgruben, Warm- und Kaltwasserquellen berühmt»*.[3] Es ist aber kein Originalmarmor sondern Kalkstein aus den Zeitalter Jura und Trias. Während der türkischen Kriegen wurden die Gruben benutzt, worauf neben den schon erwähnten Nachrichten die Bauarbeiten in der Burg und die zeitgenössischen Burggrundrisse hinweisen. Besonders wichtig sind die Darstellungen der Ungarischen Kronik des Kronikschreibers Wilhelm Dillich, des Kesseler Zeichners und Kupferstichers.[4] Auf seiner Zeichnung kommt zwischen den wichtigen topographischen Grundzügen der Burg auch der Marmorberg vor, auf weiteren Stiche erscheint als der Marmorberg, Marmerberg, Marmelberg, monte due sie caue marmi, monte douesi cauano li marmi, monte dove si cavano li marmi, monte di marmo, monte de donde se Saca el Marmo.[5] Wir können den Marmorberg mit dem Szent Ivan-Berg, mit dem heutigen Kalvarienberg, identifizieren. Wir können uns noch die Arbeit von Ortelius erwähnen, der sich in 1665 ebenfalls über den Hügel in der Nähe der Burg, wo rote und weiße Marmor abgebaut wird, berichtet.[6]

Nach den türkischen Kriegen wurden die Steingruben bis zur ersten Hälfte des 20 Jahrhunderts fortlaufend benutzt. Graf József Esterházy kaufte 1727 das Tataer Herrschaftsgut. Die Geschichte der Gruben in dem 18. Jahrhundert ist besser dokumentiert. Schon 1711 berichten die Quellen über den Bergbau in Tata. István Csiba erwähnt es 1714 und Mihály Bombardi 1718.[7] István Csiba (1673–1719), der Jesuitenpater und Nagyszombater Professor schrieb über die Gruben von Tata in seinem 1714 erschienenen Buch über die ungarischen Berge:[8] *«Und erstens – schrieb Casparus Ens darüber – in Ungarn südlich von der Donau, neben dem Marktflecken Tata … erhebt sich ein sehr hoher Berg, der wegen seiner weißen und roten Marmorsteingrube namhaft*

2 Dobosi 1983.

3 Szamota 1891, 163–182 und 527–528.

4 Kiss 1998, 4.

5 Kiss 1998, 31.

6 Ortelius 1665.; Gyulai 1888, 26.

7 Bombardi 1718, 69.

8 Csiba [1714] 1991, 126.

ist. Vor zwanzig und einigen Jahren wurde hier für die heilige Jungfaru eine Säule ausgeschnitten, die in Nagyszombat, vor der Jesuitenkirche der Bischof von Eger, György Fenessi, aufstellen laß.» Nach den türkischen Kriegen begann auf unserem Gebiet der Wiederaufbau und damit müssen wir mit der fortlaufenden Benutzung der Grube rechnen. Der Haupstuhlrichter István Nedeczky berichtet in seinem Rundschreiben von 1766 über Maurer- und Steinmetzmeister (KDM Hgy: Ktsz: 55.13.12).

Wir besitzen leider wenigere Angaben über die Kalktuffabbau, obwohl die Gruben ähnlich wie die Marmorgruben seit Mittelalter benutz worden waren.

Am Ende des 19. Jahrhunderts wurde der Geologe Ferencz Schafarzik von dem Königlichen Geologischen Institut mit der Zusammenstellung und ausfühlicher Beschreibung der auf ungarischem Gebiet tätigen Berggruben beauftragt. Das Geologische Institut schickte Rundschreiben an den Gemeinden und Komitaten, in den Angaben über die auf ihrem Gebiet tätigen Gruben und Steinproben. Er legte in seinem 1904 erschienenen Werk drei Kalktuffgruben – in Dunaalmás, Szomód und Tata – im Komitat Komárom dar. Wir können über die von Tata folgendes lesen.[9]

«Hellbrauner, porös-schwammiger, diluvialer Kalktuff aus der Grube von Graf József Miklós Esterházy, die am östlichen Rand der Stadt liegt und schon seit Menschengedächnis besteht. Die abgebauten Stücke – jährlich durschnittlich 1000 Kubikmeter – werden in kleinerer Grösse bei Bauarbeiten und Mauerungen benutzt.»

Wir können in allen Werken aus der zweiten Hälfte des 19. und dem Anfang des 20. Jahrhunderts mit geologischer Beschreibung von Tata und seiner Umgebung (Vértes, Gerecse) über die Kalvarienberg und die Kalktuffgrube lesen. So zum Beispiel in den Abhandlungen von Beudant,[10] Miksa Hantken (1821–1893),[11] Winkler,[12] Nándor Koch,[13] Ferenc Balogh,[14] János Staff,[15] Tivadar Kormos,[16] Imre Timkó,[17] Károly Komáromi,[18] Aurél Liffa[19] und Katalin Holló.[20] Wir können in diesen Arbeiten keine neuen Angaben über die Eröffnung der Grube finden aber einige Abhandlungen berichten über die hier gefundenen Pflanzen- und Tierüberresten.

Die erste Nachricht stammt doch nicht aus diesen Arbeiten. Das Sammeln der in Tata-Mürbgrube zum Vorschein gekommenen Fossilien und die Nachrichten über diese ist mit dem Namen Béla Dornyay (1887-1965) verbunden. Er als Lehrer der Erd- und Naturkunde, später Doktor der Geologie, war ein unermündlicher For-

[9] Schafarzik 1904, 151.
[10] Beudant 1822.
[11] Hantken 1861.; 1865.; 1871.
[12] Winkler 1833.
[13] Koch 1909.
[14] Balogh 1906.
[15] Staff 1906.
[16] Kormos 1906.
[17] Timkó 1907.
[18] Komáromi 1909.
[19] Liffa 1910.
[20] Holló 1935.

scher der Tataer Vergangenheit. Er beschäftigte sich neben der Geologie auch mit Archäologie, Geschichtswissenschaft, Literatur- und Kunstgeschichte. Viele seine Arbeiten erschienen in den Lokalzeitungen oder als Sonderadrücke. Er vermehrte ständig die Sammlung des Piaristenordenhauses mit neuen Funden, die später dank seiner Arbeit zu einer Regionalsammlung unter dem Name Tataer Museum zum Vorläufer des heutigen Museums wurde. Seine Arbeiten, Artikel, Abhandlungen und sein Nachlass (Briefe, Anmerkungen und Sonderdruck-Sammlungen) in Kuny Domokos Museum – weil er Grundforschungen machte – gehören bis heute zu grundlegenden Quellen der Lokalgeschichtsforschung.[21] Dornyay veröffentlichte in Verbindung mit dem Artikel Kálmán Tóth in Vasárnapi Újság[22] die Geschichte des ersten Berichtes über die in Kalktuffgrube gefundenen Funde.[23] Nach seiner Arbeit wurde offenbar, dass die Mürbgrube eine von den an frühesten bekannt gewordenen paläonthologischen Fundorten Ungarns ist. Aus der Beschreibung des englischen Reisenden Townson – und nicht des französischen Wissenschaftlers Beudant, der in 1818 Tata besuchte – stammt die erste Angabe über die fossilen Funde. Er besuchte in 1793 auf seiner Ungarnreise auch Tata. Hier war er Gast der Piaristen und bekam natürlich Informationen über die in der Nachbarschaft tätige Steingruben, darüber er folgendes schrieb:[24]

«In diesen Felsen wurden fossile Knochen gefunden. Mein Führer sagte mir, dass sie bei der Grabung auf einem acht-neun Fuß langen Elephantenzahn stoßen.»

Noch früher berichtet – der Jesuit und Naturforscher – János Grossinger in seinem 1794 erschienenen Werk über Tataer Marmor, der versteinerte Körper enthielt.[25] Mihály Tánárky berichtet vor Pál Kis schon 1814 über schrecklich großen Elephantengebeinen, die am 25 Oktober 1807. fünf Fuß unter dem Fingsand neben dem grossen See in Tata zum Vorschein kamen. Er erwähnt sieben Zähne, davon ein neun Fuss lang und sechs Zoll breit war, die sich aber später zerschmettert worden.[26] In Természettudományi Közlöny wurde auch über diese Nachricht 1895 berichtet.[27] János Szaiff (1807–1877) Piaristenlehrer schrieb in der ersten Bearbeitung der Geschichte von Tata über verkalkte Mammutknochen.[28]

Béla Dornyay fasste 1925 in seiner Abhandlung *«Tata-Tóváros hőforrásai és közgazdasági jövőjük»* das aufgedeckte Wissensgut über den Fundort zusammen.[29] Diese Arbeit ist eigentlich eine Kritik der gleichtiteligen Abhandlung von Henrik Horusitzky,[30] in der er die mit der Umgebung beschäftige Geologen (Koch, Liffa

[21] Kövesdi 2002.
[22] Tóth 1912.
[23] Dornyay 1912.
[24] Townson 1797.
[25] Grossinger 1794.
[26] Tánárky 1814, 96.
[27] Lengyel 1895, 441.
[28] Szaiff 1856.
[29] Dornyay 1925.
[30] Horusitzky 1923.

und Kormos) – weil sie die von ihm sammelten Angaben nicht kennen – bemängelt.[31] Wir müssen bemerken, dass Tivadar Kormos in seiner hervorragenen Monographie über die Resultate seiner Ausgrabung nur Pál Kiss zitiert und über die «Vorgeschichte» nur so viel schrieb:

«Der Kalktuffsteinbruch von Tata ist als Knochenfundort seit nahezu 100 Jahren bekannt.»[32]

In der Bibliothek des 1766 gegründeten Piaristengymnasiums von Tata war auch eine *«Tier- und ziemlich geordnete Mineral-Sammlung»* (Gimn. Ért. 1852). Selbs Béla Dornyay sammelte vor 1905 Mammutstoßzahn-fragmente in der noch betriebenen Grube und erwähnt die schon seit langen bewahrten Mammutzähne in der Hausbibliothek der Piaristen.[33]

Eine Reihe von Lokalgeschichtsforschern und Lehrern beschäftigte sich mit den Gruben und überwiegend mit der dort gefundenen botanischen Funden. Der wichtigste Forscher war Rudolf Gyulai (1848–1906) ein Benediktiner, Begründer und Sekretär des Geschichts- und archäologischen Vereins von Komitat und Stadt Komárom (Komáromvármegyei és Komárom Városi Történeti és Régészeti Egylet). Er begründete das Komitatsmuseum und war Veranstalter der ersten Ausstellung im Jahre 1889. Seit den 1880-er Jahren veröffentlichte er regelmäßig in den Lokalzeitungen wichtige Beiträge zur Ortsgeschichte. Er beschrieb 1887 den Kalvarienberg, als er an der Monographie über das Komitat Komárom gearbeitet hat:[34]

«In Tata, am Ufer des grossen Sees, in der Nähe der Marmorgruben zeigt sich ebenfalls in erheblicher Dicke der faserige, poröse Kalktuff; der entstand so, dass kohlensäuerhaltiger Kalk schlagte auf Pflanzenreste nieder und sie verkrustete deren. Die verkrusteten Pflanzenreste waren: Schilfrohr, Binse, kleinere Laubzweige, Blätter von Hagebuchen und Weide.»

Die erste Ausgrabung

Die erste archäologische Funde kamen im Februar 1909 zum Vorschein. Die Lokalzeitung, die in 1879 gegründete Tata-Tóvárosi Híradó, verfolgte mit stetiger Aufmerksamkeit das Schicksal des Fundplatzes und der Funde. In der Nummer von 20 Februar 1909 wurde unter dem Titel *Gefundene Antiquitäten (Talált régiségek)* folgendes berichtet: *«In dem Steinbruch hinter dem Piaristengymnasium stießen die vorige Woche dort arbeitenden Arbeiterhände auf einen interresanten Fund. Eine grössere Steinlage wurde zersprengt, als darin die Arbeiter die Knochen eines riesengrossen, in der Urzeit lebenden Mammuts entdeckten.»* Schon am 27. Februar erschien ein Artikel unter dem Titel Die Spuren des *«Urmenschen in Tata (Ősember nyomai Tatán)»*

[31] Dornyay 1925.

[32] Kormos 1912, 6.

[33] Dornyay 1925, 73.

[34] Gyulai 1893, 30.

aus der Feder Dornyay, der die Ergebnissen des ungarischen königlichen Geologen Tivadar Kormos veröffentlichte:[35] «... *in der sogenannten Mürbgrube, wo der diluviale Kalktuff seit Menschengedächnis für Bauziele abgebaut wird, fand er die unzweifelbare Beweise für den damaligen Aufenhalt des Urmenschen. Namentlich wurden von dem Urmensch benutzte Steinwerkzeuge (Messer, Kratzer usw.) mit grober Ausführung und Spuren von Feuerstellen und ferner auch von Feuer verkohlte Tierknochen, diese können nur von einem vernünftigen, intelligenten Wesen zumal von dem Mensch stammen.*» Er teilte im weiteren die Ergebnisse von Kormos, das Wesentliche der in Földtani Társulat am 17. Februar gehaltenen Vorlesung, sowie seine eigenen Forschungsergebnisse mit. Wir kennen das weitere Schicksal der ersten Funde aus der Lokalpresse: Graf Ferenc Esterházy bestimmte die Funde für das Komitatsmuseum und nach seinem Tod wurde sein Wunsch von der Gräfin erfüllt: «... *Der riesige Fund, aufbewahrt vor neugierigen Augen (und Händen) und gerettet für die Wissenschaft vom Verwalter Ágoston Darányi, wurde unter der Aufsicht des Sekretärs Gyula Alapi am vorigen Donnerstag in das Komitatsmuseum eingeliefert, wo man den besichtigen kann.*» (Tata-Tóvárosi Híradó 29. Mai 1909. Nr. 22, 3).

Der Fundstoff gelangte in die Sammlung des Jókai Közmívelődési- és Múzeum Egyesület, des damaligen Komitatsmuseums, und wurde ausgestellt. Diese Ausstellung und die Sammlung wurde 1935 unter der Leitung des Philosophiestudents György Zombory umdekoriert, der über die ausgestellten Objekte auch eine Bestandliste gemacht hat. Damals gehörten schon 331 Stücke zur paläontologischen Sammlung, die leider im Zweiten Weltkrieg fast vollständig zugrunde ging.[36]

Nach der Entdeckung der ersten Funde unterrichtete – wie wir schon früher auch erwähnten – Tivadar Kormos in seinem Vorbericht die Fachkreise[37] und auch die Lokalpresse berichtete fortlaufend die Öffentlichkeit. Ebenda wurden die Ergebnisse der ersten Ausgrabungssaison voröffentlicht:[38] «...*in dem Kalkstein, in etwa 8 m Tiefe von der Oberfläche ist eine – ungefähr 60 cm dicke – Sandader, worunter wieder massiver harter Kalkstein zum Vorschein kommt. Der meiste Teil der Knochen ist an der oberen Grenze der Sandschicht in den Kalkstein eingebettet, dessen an den Sand berührender unterer Grenze sowie in dem Sand zahlreiche primitive Steinwerkzeuge Typ. Chelles, gebrannte Knochen, Holzkohlstücke – Küchenabfall – gefunden wurden ...*» – später änderte sich die Zusammensetzung der Kulturschicht auf Löß, den damals wegen des schlechten Wetters nicht beobachtet werden konnte.[39] Er reihte den Fundort in seinem Bericht über der Ausgrabung des vorigen Jahres in 1910 aufgrund der Fauna in das obere Pleistocaen ein und setzte die gefundenen Steinwerkzeuge in der Mitte des Paläolithikums.[40] Er fasste die Ergebnisse von zwei Ausgrabungs-

35 Dornyay 1909, 1–2.

36 Binder–Csütörtöky 1986, 113-115.

37 Kormos 1909, 61–62.

38 Kormos 1909a, 149–151. und Tata-Tóvárosi Híradó 24. Juli. 1909, 2.

39 Kormos 1912, 6.

40 Kormos 1910, 207.

saisons (Mai –Juli 1909 und März–April 1910) in einer – seine Zeit vorangehenden – Veröffentlichung zusammen.[41]

Die Zusammenfassung der Ausgrabungsresultate ist folgendes:

«Meine zweimaligen Sammelarbeiten ergaben ein vollkommen zufriedenstellendes Resultat. Das, was ich am eifrigsten suchte: menschliche Knochen habe ich zwar nicht gefunden, ich konnte jedoch die Anwesenheit des Menschen der älteren Steinzeit unumstößlich feststellen, u. zw. In Gesellschaft einer höchst interressanten Fauna und unter derartigen geologischen Verhältnissen, dank welchen dieser Fund – wie wir im Laufe der weiteren Ausführungen sehen werden – einen außenordentlich hohen Wert besitzt, ja sogar fast einzig dasteht.»[42]

Die Rahmen meiner Abhandlung machen eine ausführliche Besprechung der Monographie nicht möglich und daher führe ich nur die Resultate – ich berufe wobei grundlegend auf die Originalgedanken des Verfassers – kurz vor.

Über die zwischen Kalktuffblöcke geschlossene Kulturschicht:

«... daß diese Lößschicht während einer trockenen Periode, auf äolischen Weg entstanden ist, als in der Tätigkeit der Thermalquellen an dieser Stelle eine Pause eingetreten war. Später setzte dann die Tätigkeit der Thermen von neuem ein und überdeckte im Laufe der Zeiten die dünne Lößschicht abermals mit einer mächtigen Kalktufflage.»[43]

Bis Erreichung der Kulturschicht und zur Erschließung wurde 100 Kubikmeter Kalktuff abgebaut.

«Als wir mit dem Abbau weiter gegen Osten vorschritten, wurde die Lößschicht immer dicker und erreichte an einzelnen Stellen sogar eine Mächtigkeit von 80-90 centimeter. Unterhalb des oberen Teiles der nordwestlichen steilen Steinbruchwand und des sich davon nach Südost dahinziehenden Kalktuffblockes waren im Löß die Spuren eines Feuerherdes zu beobachten.

Hier war die oberflächliche Schicht des Lößes (8-10 cm) rotgebrannt und enthielt sehr viele Holzkohlenfragmente.

Im Umkreis der Feuerherd-Spuren, welche zumeist unmittelbar unterhalb des Kalktuffes zu beobachten waren, lagen sehr viele Steinwerkzeuge und Feuersteinsplitter umher, während aus einer größeren Tiefe gut bearbeitete Stücke kaum zum Vorschein kamen.

In den untersten Schichten des über dem Löß lagernden Kalktuffes, aber nur dort allein, war eine Unmasse von Knochen, zumeist von Mammut und Rhinoceros vorhanden, u. zw. wie aus Fig. 6. klar ersichtlich, zumeist in liegender Position.

Es ist sehr wichtig zu wissen, daß die Knochen zum Teil derart gelagert waren, daß ihre kleinere Hälfte noch im Löß eingebettet lag, während die größere Hälfte schon vom Kalktuff umgeben war. Ebenfalls in der untersten Lage der oberen Kalktuffschicht lagen viele Feuersteinsplitter und angebrannte Knochenfragmente umher, welche mit den Kalktuff verwachsen das Bild eines wahrhaftigen ‹Kjökkenmödding› zeigte.»[44]

[41] Kormos 1912.

[42] Kormos 1912, 4.

[43] Kormos 1912, 12.

[44] Kormos 1912, 14–15.

Er stellte über den Fundstoff folgendes fest:

«... hatte der Urmensch hier, ... seine Werkzeuge zumeist aus fluviatilen Geröllen hergestellt. ... Die zahllosen zerbrochenen Gerölle, die zu tausenden umherliegenden Gesteinsabfälle und retouchirten Splitter («Absplissׅ») sprechen dafür, daß sich der Urmensch mit der Mehrzahl der Kieselsteine versucht hat, zumeist ohne Erfolg.

Es kann also festgestellt werden, daß der Urmensch hier eine regelrechte und beständige Werkstätte besaß, wo nicht allein seine fertigen Gerätschaften, sondern auch die beiseite geworfenen mißlungenen Stücke und unbearbeitete, abgesprungene Abfälle beisammen liegen.»

«Die Mehrzahl der im Steinbruch gesammelten Knochen stammt vom Mamut, u. zw. zumeist von jugendlichen Tieren her, ein Zeichnen dafür, daß dieses Tier zu jener Zeit hier eines der gewöhnlichsten gewesen und als solches die Hauptnahrung des Urmenschen lieferte».[45]

Nach der Darlegung der Ausgrabung wurden die zoologische Resultate und die Paläolithindustrie von Tata vorgestellt. Er vergleichte die Tataer Funde mit Krapina, mit den Höhlen in Bükk-Gebirge und anderen ungarischen Funde sowie mit den Fundorten Weimar-Taubach-Ehringsdorf. Schießlich folgte die Zusammenfassung der Resultate.

Ich lege die zoologische Resultate auf dieser Abbildung dar. Wir müssen aber beachten, daß der meiste Teil der Knochen Fragmente war.

«Auch diese waren im feuchten Material zumeist derart verwittert, daß ich außer einige Zähnen, kleineren Kieferfragmenten und sonstigen kleineren Knochen nichts retten konnte.» [46]

Hier kamen erstmals in Ungarn Überreste von pleistozänen Spalax – zwei Unterkieferfragmente (rechts- und linksseitig) mit je drei Molaren und mehrere Schneidezahn-Fragmente – zum Vorschein, ebenfalls wichtig ist die Anwesenheit von Ochotona Pusillus Pall., dieses typischen Steppentieres in der Tataer Paläolithsiedlung.

Kormos macht bei der Darlegung der Wirbeltierfauna, welche aus dem Kalktuff zum Vorschein kam, uns darauf wieder aufmerksam:

«In Anbetracht dessen, daß ich die Knochen ausschließlich in der untersten Lage der Kalktuffschichten, unmittelbar oberhalb der Lößschicht gefunden habe, ferner des Umstandes, daß manche Knochen zur Hälfte im Löß, zur Hälfte aber im Kalktuff eingebettet lagen, erleidet es keinen Zweifel, daß sämtliche Knochen, welche aus dem Kalktuff zum Vorschein kamen, zur Zeit einer Pause in der Quellentätigkeit auf der Lößschicht als damaliger Oberfläche im Umkreis der Ansiedlung des Urmenschen umherlagen. Es erleidet demzufolge keinen Zweifel, daß sowohl die im Löß, als auch die im Kalktuff gefundenen Wirbeltierreste geologisch gleich alt sind.» [47]

[45] Kormos 1912, 18.

[46] Kormos 1912, 19.

[47] Kormos 1912, 25.

Er hat über die Wirbeltierfaunan zusammenfassend folgende festgestellt:

«Die Fauna, welche die paläolitischen Ansiedlung von Tata begleitet, ist wie wir sehen, ziemlich mannigfaltig. Von den fünfzehn nachgewiesenen Wirbeltierarten (vierzehn Säugetiere, ein Vogel) sind fünf, und zwar: Felis spelea, Magaceros giganteus, Bison priscus, Rhinoceros antiquitatis und Elephas primigenius vollkommen ausgestorben, während eins: Ochotona Pusillus heute in Mitteleuropa nicht mehr lebt, um die übrigen, welche in der Umgegend von Tata schon längst nicht mehr vorkommen (Canis lupus, Ursus arctos, Tetrao tetrix), garnicht zu erwähnen.» [48]

Tivadar Kormos legte ausführlich die Weichtierfauna (es kamen ausschließlich kontinentale Schnekenarten zum Vorschein) auch dar, darüber ich nur die Zusammenfassung mitteilen möchte:

«Die Kalktuffschichten von Tata enthalten auch Relikten (Neritina Prevostiana, Belgrandia? Tataensis), welche darauf hinweisen, daß die Thermalquellen ihre Tätigkeit in der Umgebung von Tata bereits während des Pliozäns begonnen haben.» [49]

Bei der Darlegung der Tataer Industrie reihte die in Kulturschichten gefundenen Werkzeuge (der Großteil dieser hier zum Vorschein kam) nach Form aber nicht nach Bestimmung in 12 Gruppen ein, die Folgende sind:

a) breite Spitzen
b) schmale Spitzen
c) Pfeilspitzen
d) Spitzen von entwickelterem Typus
e) massive Spitzen
f) Beil
g) Klingen
h) Kratzer-Klinge
i) Hochkratzer
j) bogenförmiger Kratzer
k) gewöhnliche Kratzer
l) Mikrolithe

Der Verfasser legte ausführlich die verschiedene Typen dar, die ich mit Hilfe von Zeichnungen vorstelle. Von den mehreren tausend Funden, die bei der Ausgrabung zum Vorschein kamen, waren ungefähr 200 Stücke bearbeitet. Er beschrieb zusammenfassend die Tataer Industrie auf folgender Weise:

«Trotzdem die Industrie von Tata wenig endgültige Typen aufzuweisen vermag, ist dennoch ein auf zwei Grundformen gerichtetes Bestreben deutlich zu erkennen. Die eine ist die mehr oder minder dreieckige, massive Spitze, die andere der viereck- (trapez-) förmige Kratzer. Neben diesen zwei vorherrschenden Formen, welche im Allgemeinen durch die einseitige Bearbeitung gekennzeichnet sind, ist die Anzahl der sonstigen Formen eine

[48] Kormos 1912, 23.

[49] Kormos 1912, 66.

verschwindene. Von der Spitzen wurden die größeren vielleicht in der Hand gehalten, während die kleineren als Lanzen- und Pfeilspitzen dienen konnten. Die größtenteils sorgfältig ausgearbeiteten Kratzer sind trotz ihrer Kleinheit charakteristisch und lassen die mir gegenüber wiederholt geäußerte Ansicht Herrn Dr. Obermaiers, wonach die Industrie von Tata einen Moustérien-Character verrät, begründet erscheinen.»

Ein-zwei Stück (zum Beispiel die Kratzer Nr. 26–27) zeugt von der Aurignacien, aber die charakteristische aurignacien-retus ist nicht genügend vertreten und die einseitig bearbeiteten Kratzer (17 Stücke) zeugen von Mousterien. Kormos reiht die Tataer Industrie zu diesem letztern.

«Das Material der Steinwerkzeuge ist zumeist ein farbiger Feuerstein, Hernstein oder Jaspis, welchen der Urmensch zum Teil aus den Geröllen des Tataer Tales (Által-ér), zum Teil aber am Kalvarienberg und aus den feuersteinführenden Schichten der unterhalb des Ordenhauses der Piaristen auftretenden Liaskalksteine zusammengetragen hat. Die Feuersteine enthalten in den meisten Fällen mit Chalzedon ausgefüllte Radiolarien und häufig dünne Chalzedonadern. Untergeordnet diente auch Quarzit, Lidith, Stomolith und Kalkstein als Material der Steinwerkzeuge, welches fast ausnahmlos aus zerbrochenen Geröllen verschaft wurde.»[50]

Neben den Steinwerkzeuge kamen einige Knochenwerkzeuge zum Vorschein. Wir können das Zeitalter der Lößschicht nach der Weichtier- und der nicht zuletzt auf den Steppencharakter hinweisenen Wirbeltierfauna (Spalax, Citellus, Ochotona) in irgendeinen Interglazial-Periode setzen.

«Diese Fauna scheint älter zu sein, als die in den Höhlen des Bükk-Gebirges in neuerer Zeit entdeckte Steppenfauna und ist ihr Alter höchstwahrscheinlich auf die II. Interglazialperiode zu verlegen. Angenommen es würden blos zwei glaziale Perioden unterschneiden, so wäre das Alter der Fauna von Tata in irgend einen späteren Abschnitt der einzigen Interglazial-Periode einzuteilen.»[51]

Kormos führte seine Forschungen in 1913 weiter, als auf der nordwestlichen Seite der Grube befindliche Kalktuffblöcke vollständig abgetragen wurden (MÁFI Évkönyv XX. Köt. 1. füz., 11. Abb. 4.). Er drang bei der Suche der zwischen den Kalktuff gekeilten Lößschicht tiefer als zwei Meter unter die Grubenwand.[52] Das Ergebnis seiner Forschung war neben mehreren hundert Splitter, Kieselsteine und Abfertigungsabfall ungefähr 15-20 Stück hervorragen bearbeitete, charakteristische Paläolithwerkzeuge. Er gab diese letztere an Jenő Hillebrand für eine Untersuchung. Er stellte über ihren Zeitalter folgendes fest: *«Einige Spuren, besonders das Bruchstück einer in 1913 gefundenen primitiven lorbeerblattförmigen Spitze, so scheint es, bestätigen am Ende die Auffassung derjenigen, die die Steinindustrie von Tata zu den Erzeugnisse des von Moustierien jüngerer Aurignacienkulturs reihen.»*[53]

[50] Kormos 1912, 51–52.

[51] Kormos 1912, 65.

[52] Kormos 1913.

[53] Kormos 1913, 525–527., Abb. 15–16.

Tivadar Kormos (1881-1946) war ein international anerkannte Paläontologe. Mit dem Geologe Ottókár Kadić und dem Antropologe Jenő Hillebrand (1884–1950) gehörte er zu jener Forschunggeneration, derer wir den Beginn der ersten großen Ausgrabungsarbeiten, die methodologische Begründung der heimischen Paläolithforschung und die ersten heimischen mit Altsteinzeit beschäftigende Monographien danken. Das Állami Földtani Intézet/Staatliche Geologische Institut war der Leiter und erste finanzielle Unterstützer der damaligen Forschungen.[54] Bei ihrer Entdeckung war die Siedlung von Tata mit der Szeleta- und Krapina-Höhle die dritte altsteinzeitliche Siedlung in Ungarn.

Dank der genauen Berichte Tivadar Kormos gelangte der Fundort von Tata in den Vordergrund des heimischen und internationallen Interresses. Es besteht keine Möglichkeit für die ausführliche Vorführung dieser. Von den schon gennanten heimischen Forschern erwähnt Jenő Hillebrand in seiner zusammenfassenden Abhandlung (1919) als einzigen Moustérien-Fundort in Ungarn.[55] Er reihte in 1935 anhand der Tataer Steppenfauna und weiterhin wegen der Palaeolittypen aus der unteren Schicht der Kiskevély-Höhle (ein Werkzeug von Tataer Charakter zusammen mit einem typischen Protosolutréen Werkzeug) zusammen mit J. Bayer[56] zum protosolutréen Kultur ein.[57]

Der hervorragene Forscher Henry Breuil reihte bei der Beschreibung der ungarischen Paleolithindustrie zuerst der Tataer Industrie typologisch ebenfalls in Protosolutréin, später in obere Moustérien ein, die Parallelen von einigen Stücke fand er zwischen den Werkzeugen aus der Gudenus-Höhle und aus La Quina.[58]

Miklós Gábori wies auf die Verbindungen der Werkzeuge von Tata mit Solutréen hin.[59]

Pál Ferenc Sinka beschäftigte sich mit Tata[60] und wir dürfen das Werk des Paläonthologen Kálmán Lambrecht (1889–1936) auch nicht Vergessen, der allerdings keine archäologische Arbeit leistete, aber er schrieb das erste vervolkstümliche Buch über die Urmenschen.[61] In diesem beschrieb Tivadar Kormos die Siedlung von Tata.[62]

Die nächste Ausgrabung wurde in 1958 unter der Leitung László Vértes gemacht. Dank der Sammeltätigkeit von zwei Lehrern des Tataer Gymnasiums, Viktor Budó und István Skoflek, kam der Ausgrabungsort von Kormos zum Vorschein. Die zwei

[54] Vértes 1965, 93.
[55] Hillebrand 1919.
[56] Bayer 1913, 403.
[57] Hillebrand 1934–1935.; Hillebrand 1935.
[58] Breuil 1944, 125.
[59] Gábori 1953, 52.
[60] Sinka 1926, 52.
[61] Lambrecht 1931.
[62] Kormos 1931, 339–349.

Lehrer sammelten mit ihren Schülern Blätterabdrücke dort und so fanden auch die alsteinzeitliche Siedlung.

Die neuen Ergebnisse der Ausgrabung wurden von einer Arbeitsgemeinschaft unter der Leitung László Vértes bearbeitet und in einer Monographie publiziert.[63] Es besteht keine Möglichkeit für die Besprechung dieser gut bekannten Monographie, es ist aber auch nicht nötig, weil die Ergebnisse seit ihrer Erscheinung sowohl in heimische als auch in die internationale wissenschaftliche Forschung aufgenommen wurden.

In meiner Abhandlung strebte ich nicht nur nach der Vorführung der enggenommenen Forschungsarbeit und ihrer Resultate, sondern wollte ich die in Archiven, in Museen aufbewahrte und noch unaufgedeckte oder schon vergessene Quellenmaterial und die Ergebnisse der Lokalgeschichtsforschung betont darlegen. Mein erstes Ziel war einige von der internationallen Forschung wenig bekannte Kapitel der ungarischen Wissenschaftsgeschichte bekannt zu machen.

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[63] VÉRTES 1964.

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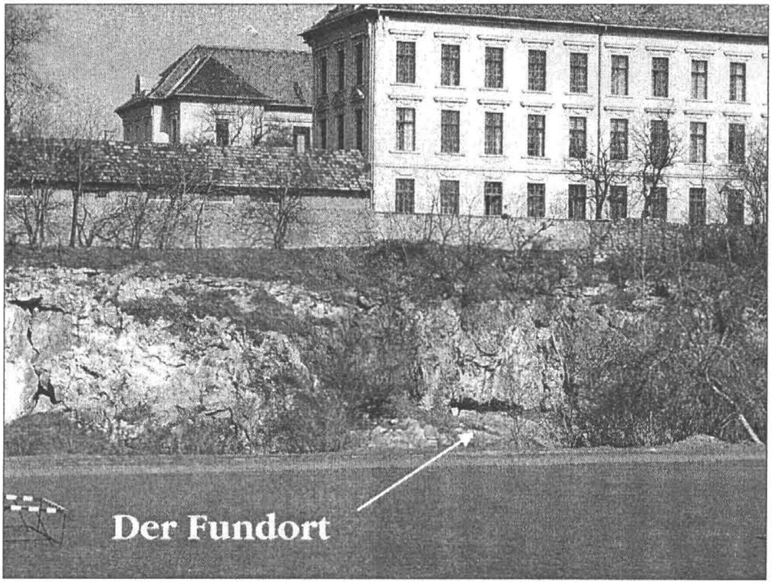
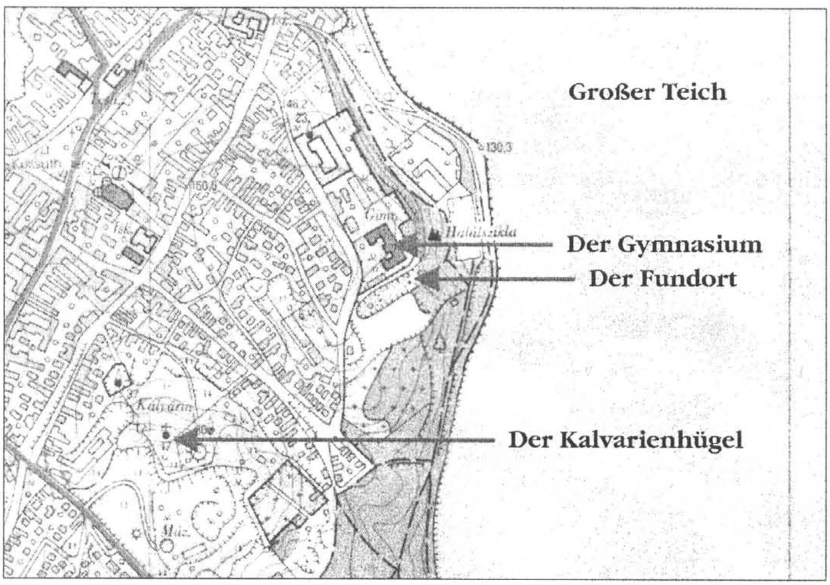
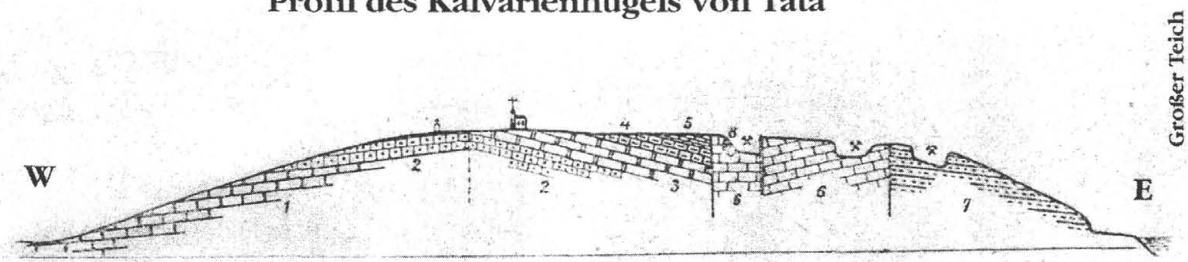

Der Fundort


Großer Teich
Der Gymnasium
Der Fundort
Der Kalvarienhügel

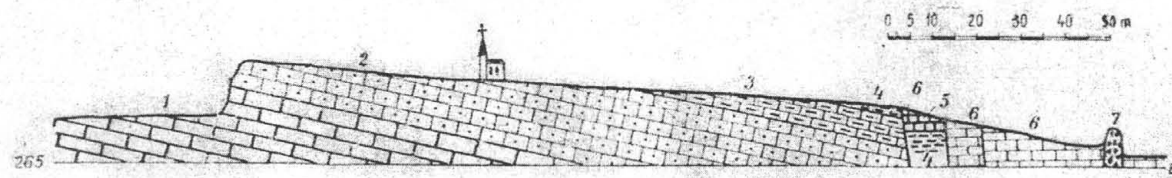
Tafel 1.

Tafel 2.

Profil des Kalvarienhügels von Tata



Nach Koch, Nándor



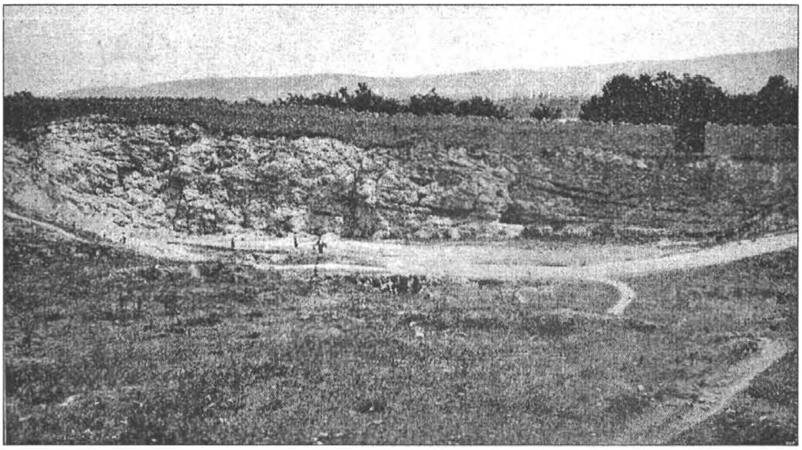
Nach Fülöp, József

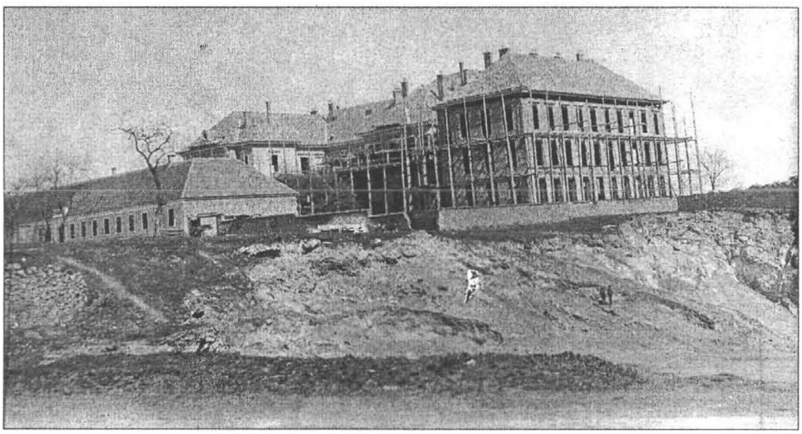
1. Dachsteinkalk, 2-6. Kalkstein, 7. Kalktuff

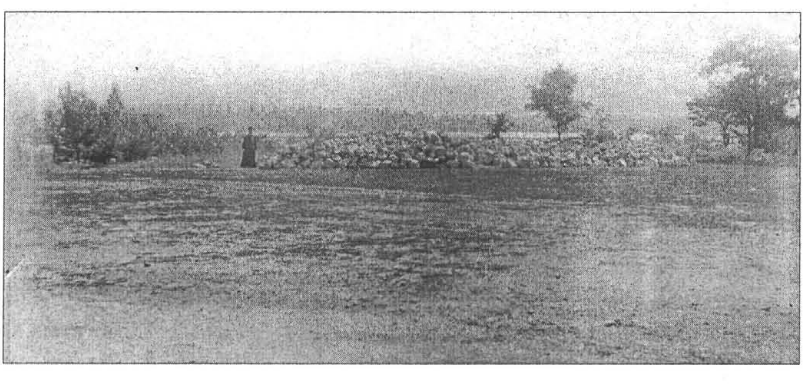

"Der Marmor berg"
CONTERFACTVR DER VOESTVNG TOTTIS WIE DIE VON DEN CHRISTEN IST EROBERT WORDEN ANNO 15 97


"D. Mormer berg"
DOTIS

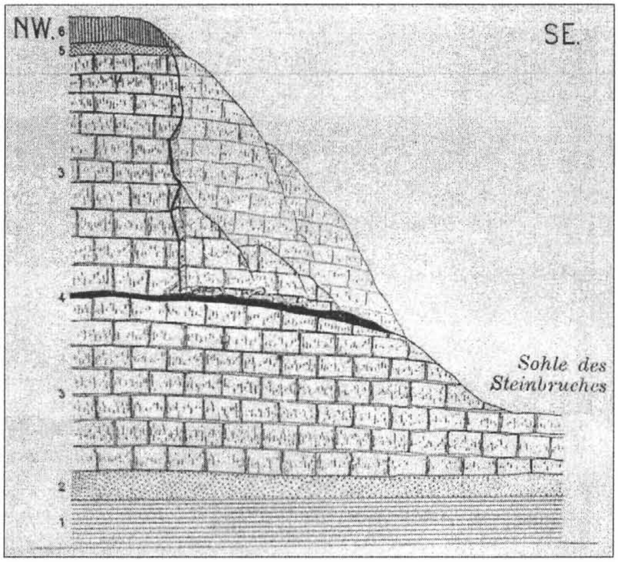
Tafel 3.

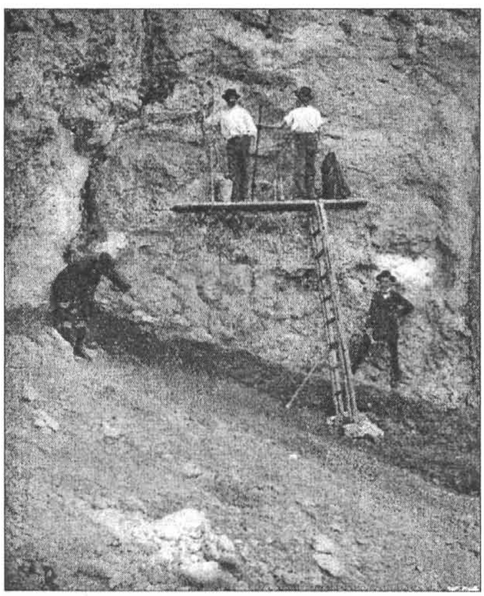






Tafel 4.
Ansicht des zur Domäne von Tata gehörigen Kalktuffsteinbruches vom Kálvária-Hügel betrachtet 2-3 Nach Dornyay Béla

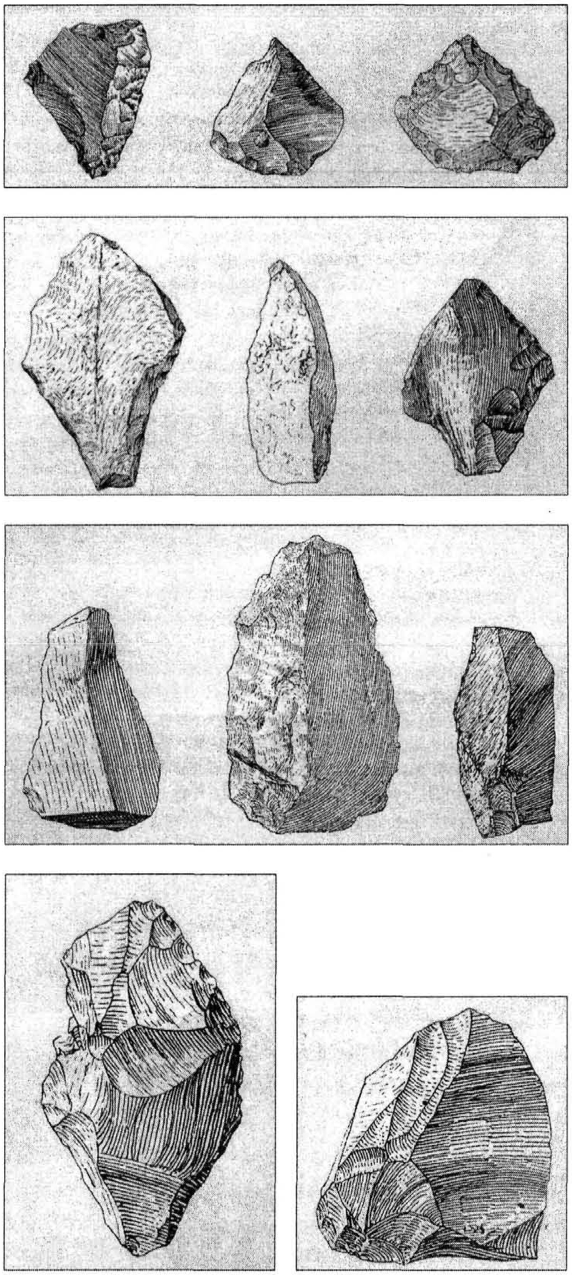




Tafel 5.

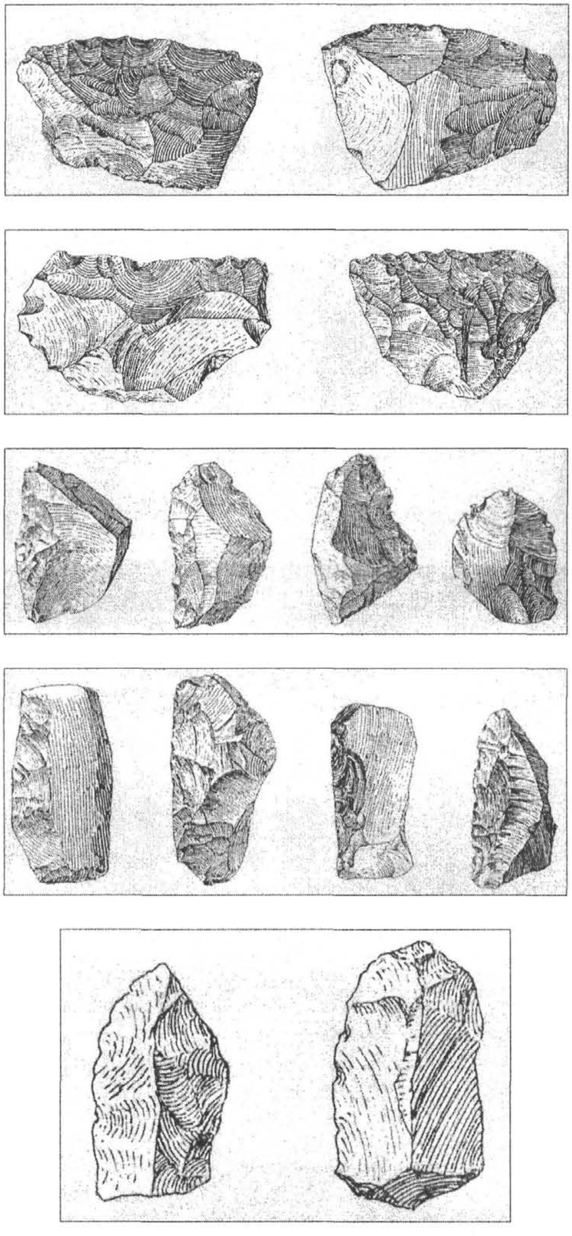
1. Das Profil bei Tata (1. präpleistozäne Schichten 2. pleistozäner Sand 3. Kalktuff 4. Lößschicht zwischen dem Kalktuff 5. sandiger Kalktuffschutt mit Schnecken 6. Alluvium) (nach KORMOS 1912)

2. Der Lagerungsverhältnisse nach dem Abbau der im Vordergrund befindlichen kleineren Kalktuffblöcke (nach KORMOS 1912)

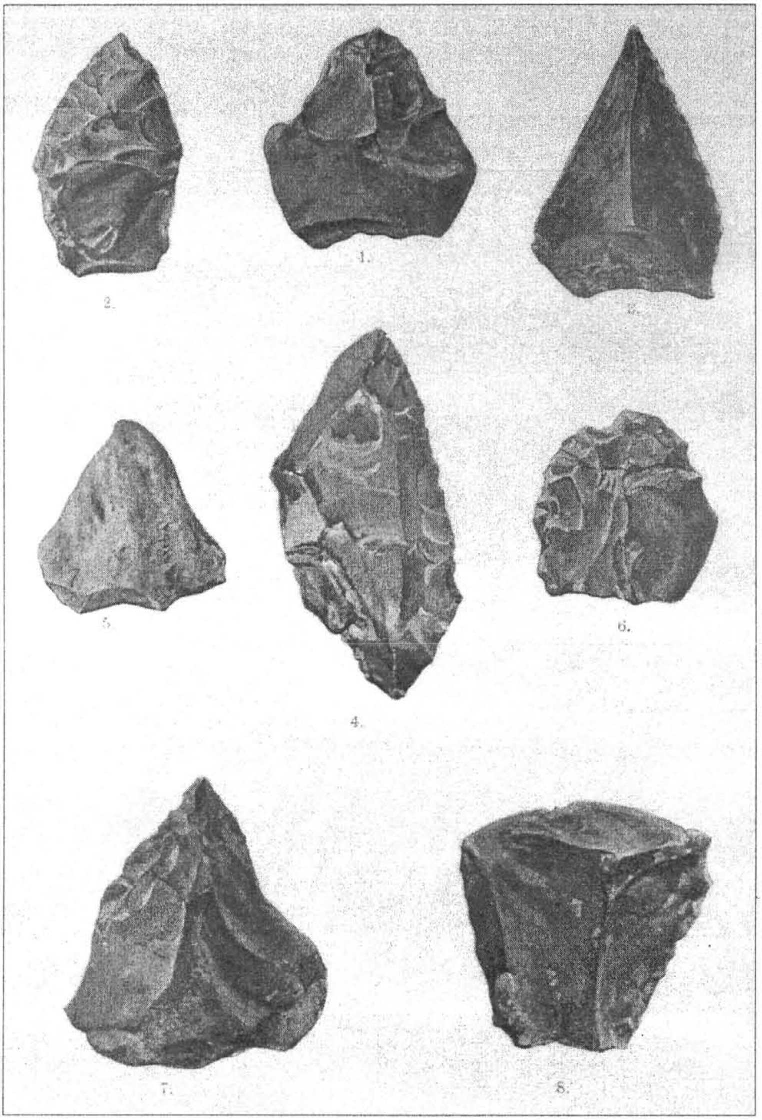


Tafel 6.

1. Breite Spitzen 2. Pfeilspitzen und schmale Spitze 3. Spitze von höher entwickeltem Typus 4. Klingen und Kratzerkinge 5. Hochkratzer (nach KORMOS 1912)

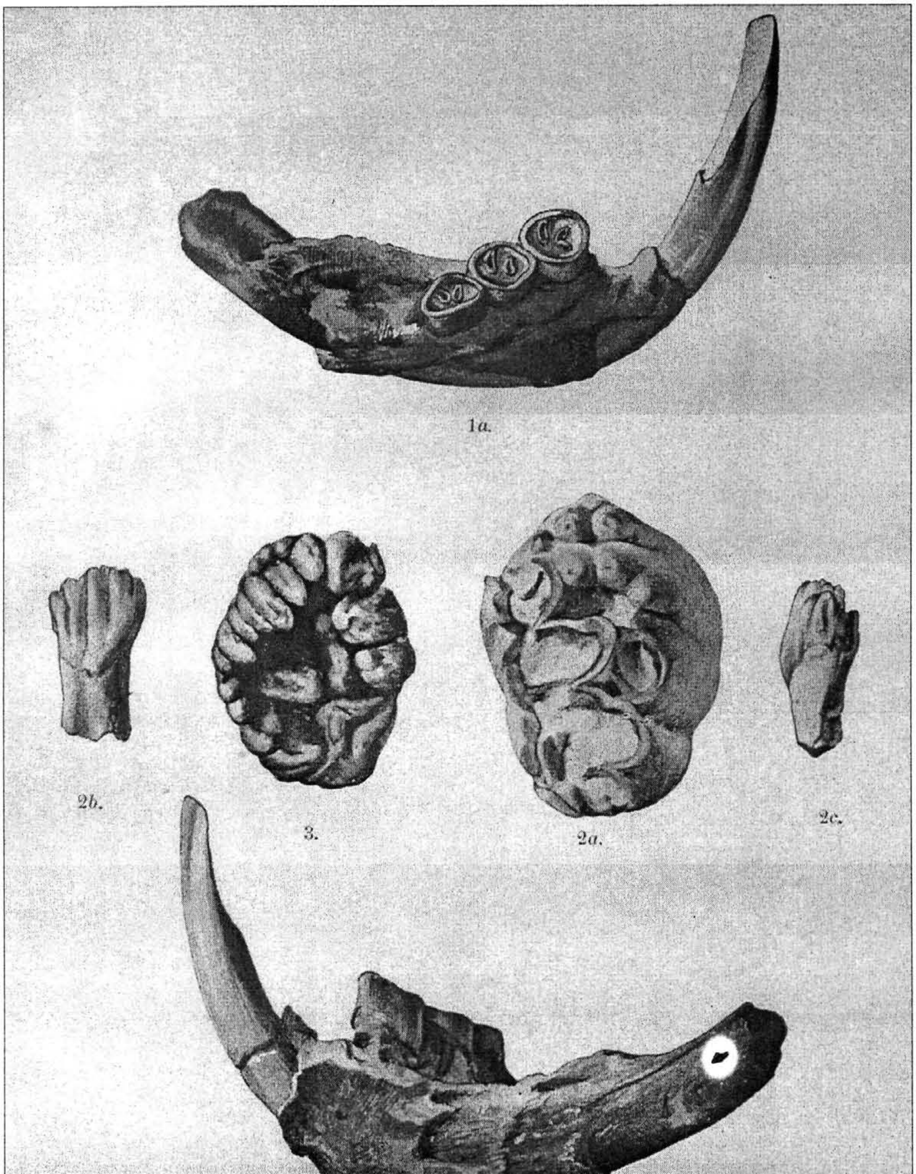


Tafel 7.
1-4. Kratzer 5. Mikrolithe (nach KORMOS 1912)

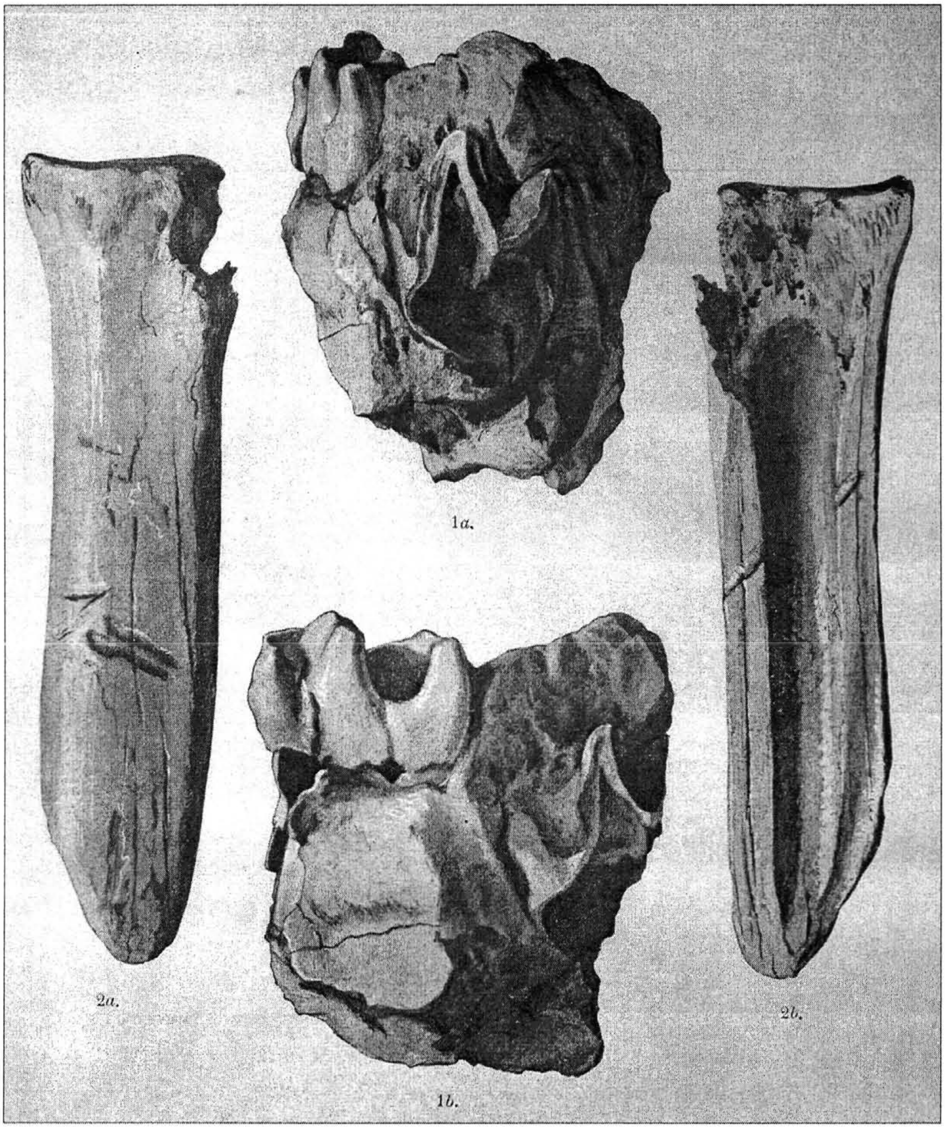


Tafel 8.

1. Breite Spitze aus grünlichgrauem Feuerstein 2. Mandelförmige Spitze mit beiderseitigen Retouchen aus Jaspis 3. Atypische, massive Spitze (zufällige Lanzenspitzen-Form) aus Feuerstein 4. Kratzer aus rotem von Chalzedonadern durchzogenen Jaspis (Mousterien-Typus) 5. Atypische, scharfrandige Spitze aus buntem, von Chalzedonadern durchzogenen Jaspis 6. Hochkratzer aus fleischrotem Jaspis (Aurignacien-Typus) 7. Breite Spitze aus grauem Hornstein (Mousterien-Typus) 8. Trapezförmiges Beil (?) aus grauem Horustein (nach KORMOS 1912)



Tafel 9.
1a – 1b. Spalax (Mesospalax) sp. ? 2a – 2b. Elephas primigenius Blumb
3. Elephas primigenius Blumb (nach KORMOS 1912)



Tafel 10.
1a-b. Rhinoceros antiquitatis Blumb 2a-b. Cervus (sp. ?) (nach Kormos 1912)

Sedimentology, mineralogy, lake evolution and chronology of the Quaternary Tata thermal lacustrine travertine

Sándor Kele – László Korpás – Péter Kovács-Pálffy – Miklós Lantos

Abstract

In the area of Tata town (Hungary) there are several Quaternary travertine outcrops of which the Porhanyó-Quarry is the best exploited one. The principal goal of our work was to define the depositional environment of the Tata travertine. Former archaeological studies focused on the reconstruction of the Middle Paleolithic Mousterian culture of the site. We conducted petrographical and microfacies studies together with paleomagnetic and XRD measurements for paleoenvironmental and chronological evaluations.

The travertine of the Porhanyó-Quarry can be divided to vertically six units. Algal and other phytoclastic and phytohermal grainstone, boundstone and floatstone are considered to be the dominant microfacies of travertines. On the wall of the quarry and NE from the Quarry, next to the Öreg-lake carbonate vents and cones can be found and these forms prove former spring activites on the bottom of an erstwhile shallow lake. The lake, fed by thermal springs could have formed in a siliciclastic floodplain or delta system. The three main lacustrine phases of the lake evolution were interrupted first by a palaeosoil formation and flooding event, followed up by fluvial-eolian event and finally finished by eolian sedimentation. The lacustrine phases represent intensive spring activity generating relatively high water levels, while the fluvial to eolian phases are related to be reduced spring activity with water level drops. The upwelling thermal water brought quartz grains with the thermal water from the Pannon siliciclastic bedrock to the surface. These grains are preversed in the centre of the carbonate vents. Due to the intensive spring activity many carbonate vents were preserved in the quarry. The different facies (vent, cascade, pond) migrated during the evolution of the travertine complex due to changes in morphology and flow direction.

Keywords: Porhanyó Quarry, travertine, lacustrine deposition, mineralogy, chronology, paleoclimatology.

Introduction (and geological background)

During the Late Miocene and Holocene intensive spring activity characterized the W-Gerecse Mts. and as a result of this in the surroundings of Tata many local travertine deposits were formed (Fig. 1).[1]

The Porhanyó-Quarry (Fig. 2) is situated in the neighbourhood of the Eötvös Secondary School (Tata), on the west side of the Öreg-lake, and was named after its loose, friable sediment. The quarry became famous from its archaeological finds. The limestone occuring in the quarry deposited from the parents of the springs, which once fed the Fényes- and Cseke-lake (Tata). The karst-springs discharged from Mesozoic carbonates on the alluvium of the Által-creek, on the II/a—and sometimes on the II/b—terraces (Népkert-springs).[2] The freshwater limestones deposited from the Fényes-springs on the alluvium of the Által-creek together with limestones occuring on the west-side and east-side of the Öreg-lake (on the II/a terrace). The rocks are porous, friable and dissected by mud- and sand-layers. The layers are drab, pale yellow and their thickness is 1-2 m. The freshwater limestones located on the II/b terrace of the Által-creek belong to the marsh-pool facies type but comprise also tetaratas, which indicate smooth-slope facies. Similar travertines can be found on the eastern part of the Öreg-lake until the Cseke-lake (in the area of Tata town). The layers settled here comprising tetaratas deposited from the *"Angolkert-springs"* (Népkert-springs) when the springwater flew into the Által-creek that was located at a deeper position.[3]

After Scheuer and Schweitzer and Pécsi the travertines of the Porhanyó-quarry were deposited on the terrace II/a and II/b of the Által-creek as a tetarata-pool system.[4] The height of this terrace is 146 m asl. and it is 15-20 m above the present valley floor.[5] According to Pécsi (1959) the formation of this terrace level took place around the end of the penultimate (Riss) or the beginning of last (würm) glaciation. The terrace is covered by the T2 travertine horizon of 5-8 m thickness.[6]

The first palynological investigation of Tata-Porhanyóbánya was carried out in 1958. A 19 m long core was drilled into the travertine, the samples were analyzed at every 20 cm[7] and 19 pollen taxa were identified. In May 2003 new pollen analytical research started at the locality.

[1] Schafarzik 1904.; Dobosi 2003, 205–214.; Lenkei 1943, 115–117.; Horusitzky 1923.; Schréter 1951, 111–150.; Vértes et al. 1964.; Scheuer–Schweitzer 1974, 113–134.; ScheueR–Schweitzer 1988, 131.

[2] Scheuer–Schweitzer 1988, 131.

[3] Scheuer–Schweitzer 1988, 131.

[4] Scheuer–Schweitzer 1988, 131.; Pécsi 1959, 346.

[5] Ruszkiczay-Rüdriger 2003.

[6] Schweitzer–Scheuer 1995, 163–186.

[7] Járai-Komlódi 1964, 67–77.

A Paleolithic settlement was found in one of the terrace-pools belonging to the II/b terrace and numerous small tools and bone-remnant were excavated.[8] More than 2000 tools and rich natural historical evidence was found here. The Paleolithic people *(Homo sapiens neanderthalensis)* settled in the spring-pools when the pools were temporarily dried out.[9] The quarry which was operating since the bronze age is now out of function, but due to the former explorations and quarrying the wall is well exposed. The so-called *"culture-layer"* was explored horizontal approximately 15-20 m length and its thickness is around 1 m. The detailed study of the *"culture-layer"* was made by Végh and Viczián, Vértes, Kretzoi and Vértes and Ruszkiczay-Rüdriger.[10]

Description of the Porhanyó-quarry

The Porhanyó-Quarry's NE-SW section (Fig. 3) exposes the freshwater limestone in 100 m length and in 15 m thickness. The bedrock of the limestone is Pannonian sand and clay. Numerous carbonate vents, cones, tetaratas and cascades can be distinguished in the section and out of the section, next to the Öreg-lake (Fig. 4). During field investigations connections between the carbonate vents and the other morphological forms more revealed. The vents are often intergrowned along the setion and in some cases they are morphologically similar to the cascade forms.

Algal and other phytoclastic and phytohermal grainstone, boundstone and floatstone are considered to be the dominant microfacies of Tata travertines (Fig. 5). The 15 m thick lacustrine travertine can be divided to six units (Fig. 3). Unit 1 (14.7–12.4 m) consists of massive, thickbedded phytoclastic travertine with some gastropods, and covered by a sharp discontinuity surface, parallel to the bedding. Unit 2 (12.4–11.8 m) comprises the archaeological *"culture layer"* and is build up by a 30-40 cm thick palaesoil horizon at the bottom. This sandy clay is rich in bones, in Palaeolithic human tools, artefacts and show fragments of charcoal. The palaeosoil horizon is covered by siliciclastic fluvial channel deposits with a N-S direction that could have deposited from a rapidly flowing water. A new discontinuity surface separates the next unit, a bedded phytoclastic and gastropods bearing travertines (Unit 3 11.8–4.5 m) from the *"culture layer"*. Unit 3 is built up from 20-60 cm thick, layered limestone that contains bones ordered in a N-S direction together with gastropods and plants. Unit 4 is a soft, laminated, phytoclastic travertine terminated by a new discontinuity surface, which covers the vents and cones. Unit 4 is covered by a loose clastic travertine-bearing horizon of Unit 5 (2.5–1.0 m), which is imbedded in fluvial-eolian sand. Eolian sand of Unit 6 (1.0–0.0 m) terminates the section.

8 Kormos 1912.; Vértes 1964.; Dobosi 2003, 205–214.

9 Dobosi 2003, 205–214.

10 Végh–Viczián 1964, 129–131.; Vértes 1964.; Kretzoi–Vértes 1964, 251–256.; Ruszkiczay-Rüdriger 2003.

In the Tata freshwater limestone (and also in the Budakalász freshwater limestone),[11] Characea algae and Ostracods occur[12] indicating shallow-lake environment. The vertebrata fauna of the Tata freshwater limestone was described by Kormos and Kretzoi[13] while at Budakalász Jánossy[14] and at the Buda-Vár-hegy Mottl and Krolopp et al.[15] made similar investigations. During the initial period of the lake evolution the climate was warm and humid, but later it changed gradually to a cold, continental desert at the termination of the lake evolution.[16] Krolopp and Korpás[17] also have drawn a similar conclusion by studying the Buda-Vár-hegy freshwater limestone. Using modern analogies and studying the fossil flora, Pavletic[18] postulated a temperate (20-25 °C) deposition environment for the Tata travertine.

Sampling and analytical methods

Eighteen samples were collected from one vertical section for petrographic evaluation (Fig. 3). Additionally we sampled the most typical carbonate formes (7 samples.; Fig. 6). Eight samples were taken from one undetermined form (Fig. 7) which can be either carbonate vent or cascade.

Petrographic and microfacies analyses on thin sections were performed at the Hungarian Academy of Sciences, Institute for Geochemical Research. Detailed XRD studies were conducted on bulk samples and on insoluble residue collected in the vertical section and on samples collected from the palaeosoil horizon. The analyses and the interpretation of the results was performed by P. Kovács-Pálffy and I. Baráth (MAFI). The dissolution of the limestones was made with acetic acid (30%) at the Geological Institute of Hungary by I. Partényi and F. Hózer. The detailed description of the method is given in the paper of Kovács-Pálffy and Földvári.[19]

Paleomagnetic measurements from one vertical section (including samples from the palaeosoil horizon) were also used to determine the timing of travertine formation. The analyses and the interpretation of the results was performed by M. Lantos at the Geological Institute of Hungary. The detailed description of the method is given in the paper of Lantos.[20]

[11] Kele et al. 2003, 161 – 175.

[12] Diebel–Pietzeniuk 1990, 145–162.

[13] Kormos 1912.; Kretzoi 1964, 105–126.

[14] Jánossy 1961, 63–74.

[15] Mottl 1943, 285–292.; Krolopp et al. 1976, 17–78.

[16] Kretzoi 1964, 105–126.; Korpás et al. 2003, 81–105.

[17] Krolopp 1961, 146.; Krolopp et al. 1976, 17–78.; Korpás et al. 2003, 81–105.; 2004.

[18] Pavletic 1964, 47–49.

[19] Kovács-Pálffy–Földvári 2004.

[20] Lantos et al. 2004, 227–236.

Mineralogy of the Tata travertine

Stable isotope studies have been used to characterize the genesis of travertines since the 1950s.[21] Systematic mineralogical and stable isotope analyses on Hungarian travertine occurrences have not been carried out yet. The first mineralogical and stable isotope geochemical studies were made by Rózsavölgyi, Mihályi-Lányi and Opauszky on the Tata freshwater limestone.[22]

On the base of XRD analyses the samples collected along the vertical section of the Porhanyó-Quarry are composed of pure, magnesium-free calcite (94-98%). Insoluble residues of samples collected from units 1–4 contain a few siliciclastic grains (0.53%) whereas unit 5 contains more quartz grains (2.29%). The palaeosoil of the culture-layer (2nd unit) contains a small amount (4%) of dolomite Quartz, feldspar and rare muscovite represent the scarce extraclast. XRD measurements on insoluble residues indicate the presence of quartz, plagioclase, K-feldspar, muscovite, illite, chlorite, montmorillonite. Additional traces of kaolinite, amfibole, magnetite, maghemite, hematite, goethite, gyps and pyrite were detected. XRD analyses on the palaeosoil horizon indicated the presence of quartz, calcite, dolomite, muscovite, chlorite, plagioclase and K-feldspar as well as traces of montmorillonite, illite and traces of amfibole, hematite, pyrite and gypsum. The fluvial eolian sand units (5th and 6th units) show extremely high values of detrial minerals.

Chronology of the Tata travertine

Age determinations performed so far on the Tata limestone were based on radiogenic (^{14}C, Th/U, ESR) methods, paleontology, archaeology and paleomagnetic measurements. The ^{14}C measurements was performed by de Vries and de Waard[23] in the culture-layer yielding 33,6 ± 1,1 ky and 55 ± 2,5 ky above the culture-layer. Th/U age determinations on travertine localities at Tata, Dunaalmás, Vértesszőlős and Buda-Vár-hegy travertines[24] resulted in an estimated age of 100 ky.[25] On the basis of palaeontological data, the formation of travertine complex took place at the end of the last interglacial, and the fauna belongs to the Subalyuk biozone.[26] Archaeological studies[27] suggested Middle palaeolithic (~100 ky) age for the travertine, while the indefinite radiometric methods resulted in ages ranging between 33.6 to 10 Ky.

[21] Craig 1953, 53–92.

[22] Rózsavölgyi 1964, 31–36.; Mihályi-Lányi 1964, 37–42.; Opauszky et al. 1964, 19–29.

[23] Vries–Waard 1964, 35–36.

[24] Pécsi 1973, 109–119.; Henning et al. 1983.; Scheuer–Schweitzer 1988, 131.; Osmond 1990, 545.; Oakley 1990, 543–544.; Cherdintsev–Kazachewski 1990, 547.; Schwarz–Latham 1990, 549–552.

[25] Schwarz–Skoflek 1982, 590–591.

[26] Kretzoi 1964, 105–126.; Jánossy 1979, 207.

[27] Vértes et al. 1964.; Dobosi 2003, 205–214.

Systematic paleomagnetic sampling and magnetostratigraphic studies[28] of the Buda-Vár-hegy, Budakalász, Vértesszőlős, Tata, Les-hegy, Dunaalmás and Süttő travertine occurences led to the conclusion that two main periods of travertine formation occured (Fig. 8). The older one belongs to the Matuyama-chron around the c2 anomaly (Dunaalmás, Süttő, Les-hegy). The younger one may have occured in the Matuyama-Brunhes, starting at about the Jaramillo chron and ending at the reverse anomaly in the middle of the Brunhes chron (Buda-Vár-hegy, Budakalász, Vértesszőlős, Tata). A systematic palaeomagnetic log of the Tata travertine has given an uniform normal polarity record for the entire travertine section (Fig. 3), including the "*culture layer*" (Fig. 9). It seems plausible to correlate this normal polarity record with certain parts of the Brunhes.[29]

Carbonate vents, terraces, cascades

The horizontal units of the Porhanyó-Quarry are often interrupted by carbonate vents, cones and other morphological forms which were formed due to the former intensive spring activity. The microscopic photos of samples taken from the centre of the carbonate vents show clastic quartz grains cemented in the freshwater limestone (Fig. 10). These grains derived from the Pannonian siliciclastic bedrock and come to the surface with the discharging springwater and cemented in the carbonates precipitating simultaneously (Fig. 11). The clastic fabric is characteristic to the centre of the carbonate vents and the size and frequency of the quartz grains decrease with increasing distance from the spring orifice. The presence of clastic grains indicate the intensity and the discharge of the ancient spring activity. The vents are spatially connected to each other, to the cascades and to the tetaratas. The different facies (vent, cascade, pond) migrated during the evolution of the travertine complex due to changes in morphology and flow direction.

Conclusions

The travertine of the Porhanyó-Quarry of Tata can be divided to six horizontal units. The travertines can be sedimentologically classified as algal and other phytoclastic and phytohermal grainstone, boundstone and floatstone microfacies types. The lake in which the travertine was deposited was fed by thermal springs discharging on a siliciclastic floodplain or delta system. Three main lacustrine phases of the lake evolution can be distinguished (Fig. 12). Travertine formation was interrupted first by a palaeosoil formation and flooding event, followed by a fluvial-eolian event and

[28] LANTOS et al. 2000.; KORPÁS et al. 2003, 81–105.

[29] LANTOS et al. 2004, 227–236.

finally finished by eolian sedimentation. The lacustrine phases represent intensive spring activity generating relatively high water levels during the formation of the 3rd and 4th unit, while the fluvial to eolian phases are related to reduced spring activity with water level drops. Based on the different age determination methods and former studies the age of Tata travertine is approximately 100ky. According to the XRD analyses the Tata travertine are composed of pure, magnesium-free calcite.

On the basis of the field observations and thin section examinations numerous carbonate vents and cascades can be distinguished in the quarry, which were formed because of the former intensive spring activity. The vents are connected to each other, to the cascades and to the tetaratas. The different facies (vent, cascade, pond) migrated during the evolution of the travertine complex due to changes in morphology and flow direction.

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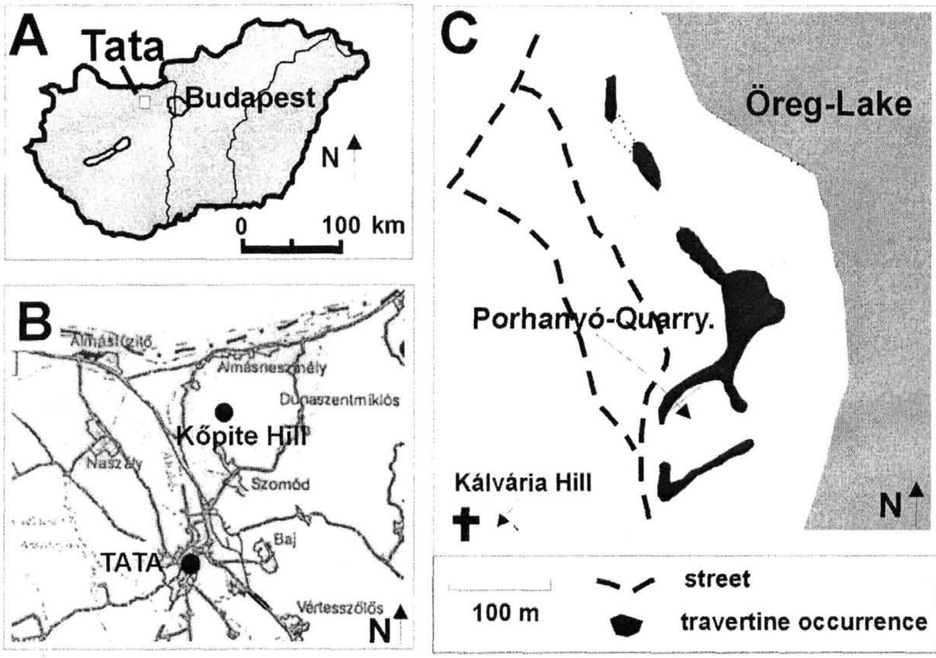
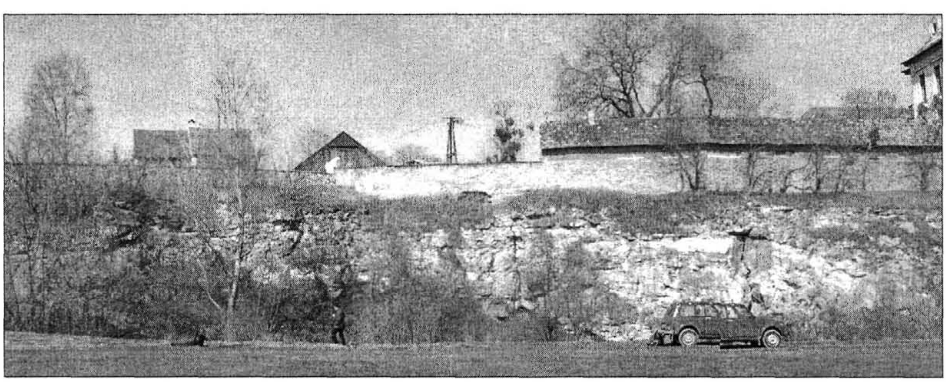
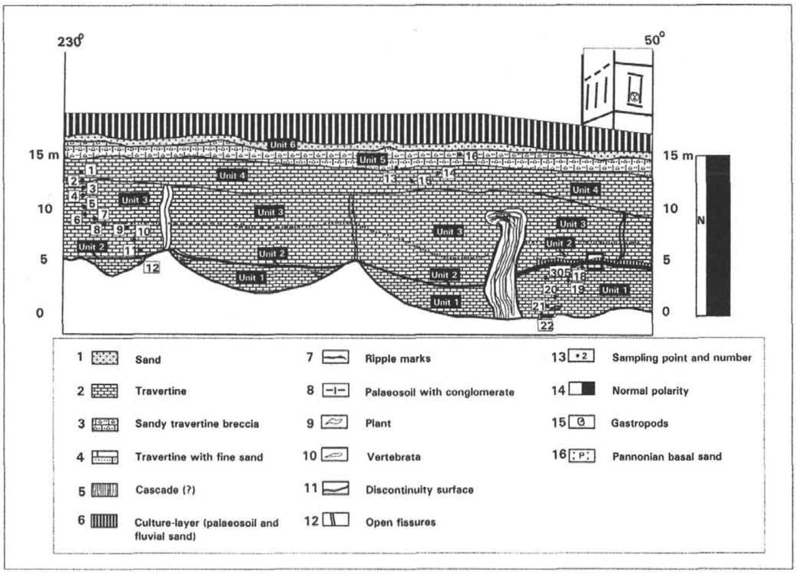


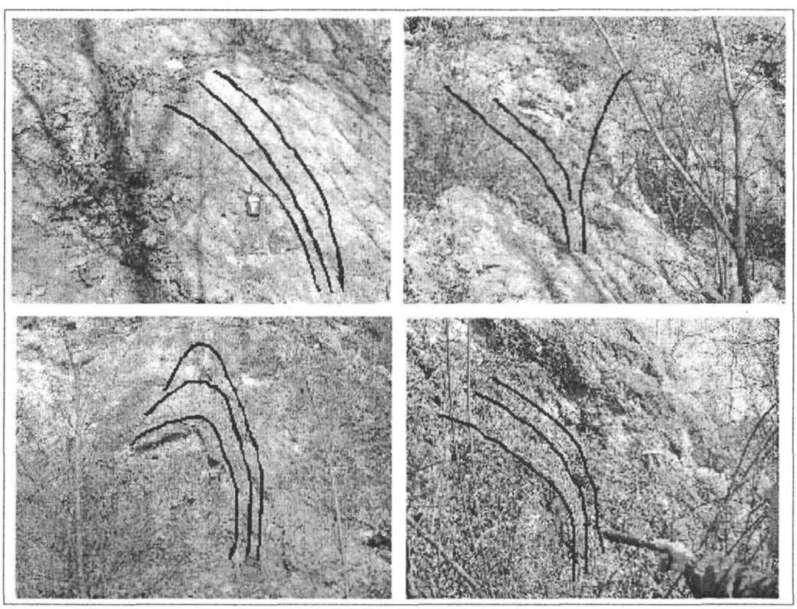
1. The travertine occurrences at the Öreg-Lake (Tata) (modified after the geologic map of Gyalog 2003) and location of the Kőpite-Hill (travertine cone?)



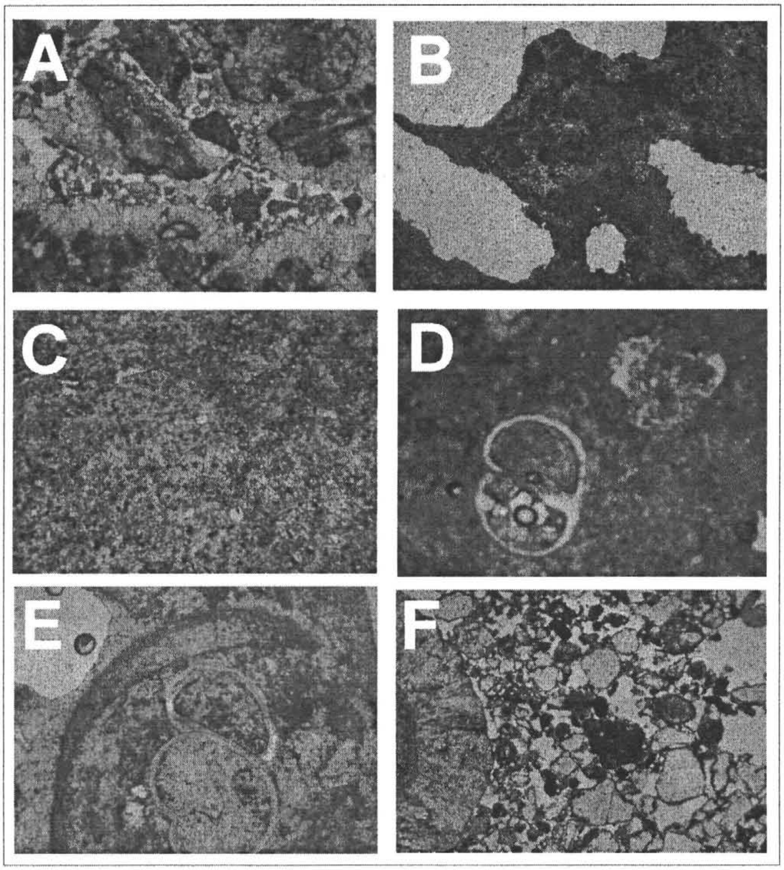
2. The panorama picture of the Tata Porhanyó-Quarry situated below the Eötvös Secondary School



3. The characteristic section of the travertine in the Porhanyó-Quarry with the sampling points



4. Numerous carbonate vents were preserved in the Quarry



5. The most important thin section photographs of the characteristic microfacies types and micromorphological features of the Tata travertine occuring in the Porhanyó-quarry (with special regard to the samples deriving from the palaeosoil horizon and from the alluvial facies). Plane-paralell light

A: Massiv, phytoclastic travertine, phytoclastic grainstone (floatstone) from the upper part of the first unit. In these travertines (besides the plant fragments) angular quartz and detrital components are also abundant in the microfactures

B: Siliciclastic fluvial-channel deposit: fluvial gravel, sandy clay

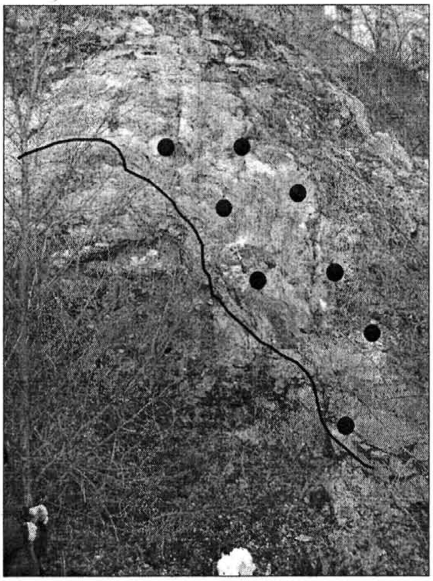
C: Peloidal wackestone have also been observed in the quarry. This wackestone is characterized by small peloids and micrite aggregates

D: Thin bedded, laminated phytoclastic travertine with gastropods are the typical rock type from the unit 3. These travertines were deposited in a shallow lake environment

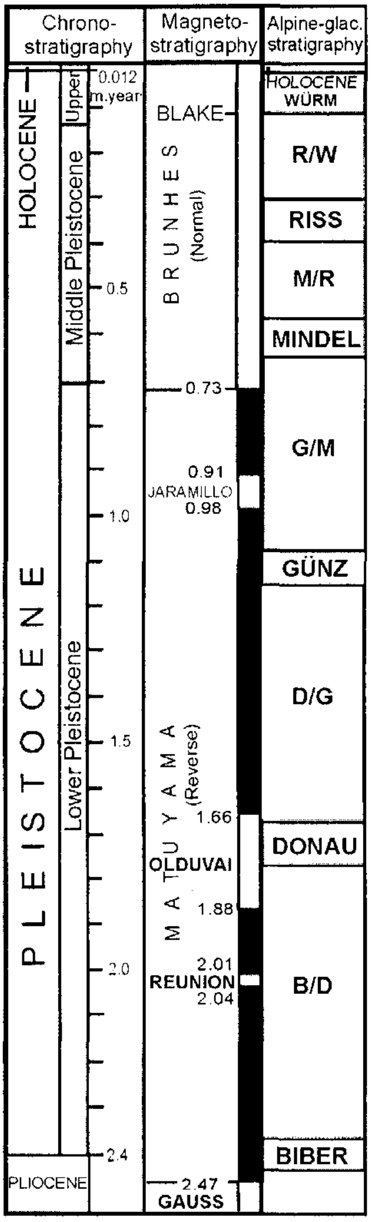
E: Laminated, bioclastic travertine with abundant gastropods, bivalve shells, intraclasts (unit 4). Bioclastic grainstone and packstone are the most common microfacies type in this unit

F: Loose clastic travertine-bearing sediment which is imbedded in fluvial-eolian sand (unit 5)

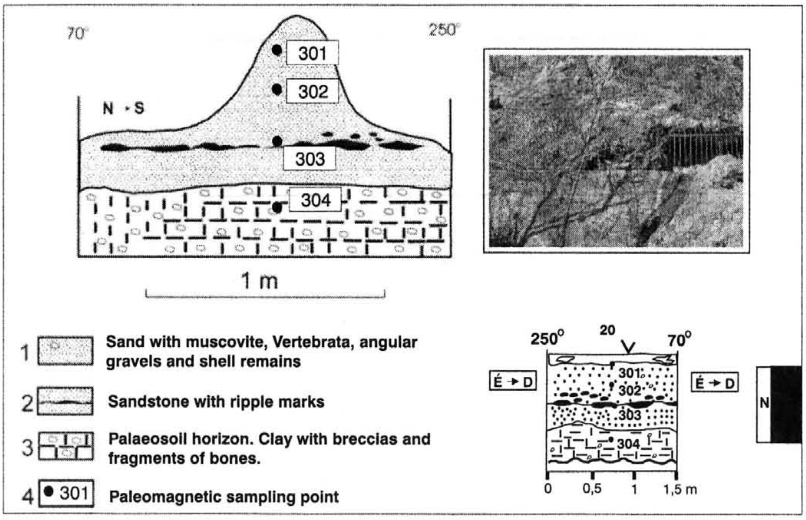
6. Picture of a carbonate cone situated out of the vertical section



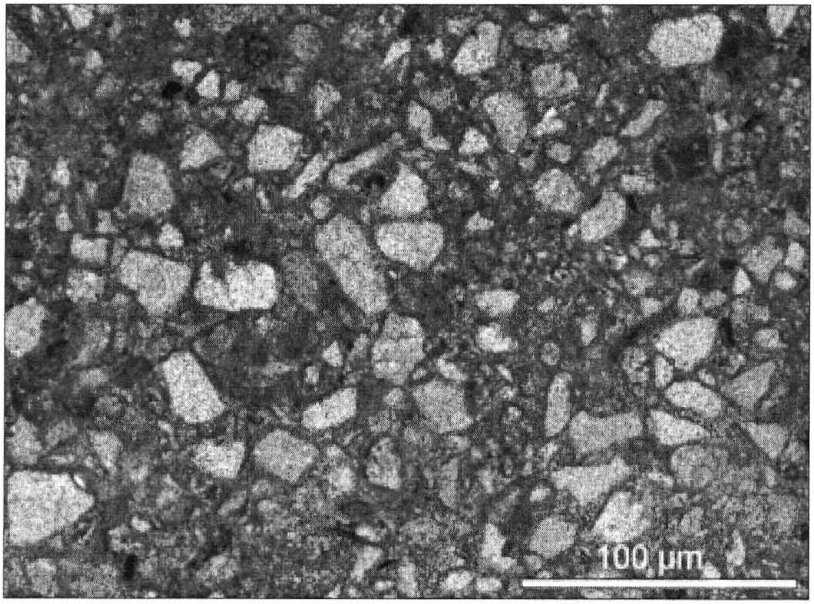
7. Picture of one morphologically undetermined form which can be either carbonate vent or cascade. The samping points are also indicated on the photo



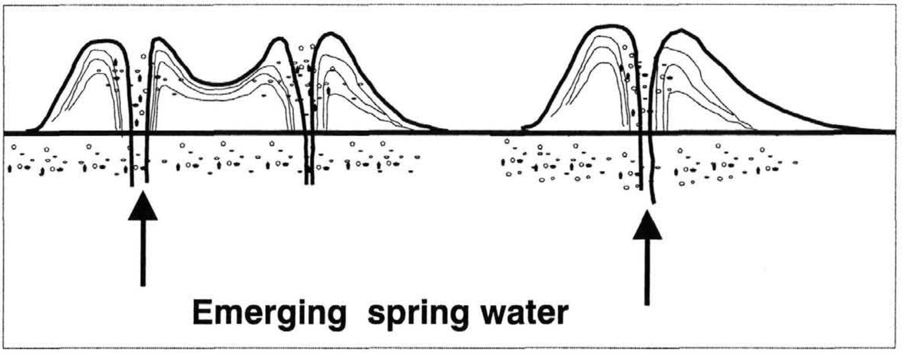
8. Stratigraphy of Pleistocene formations
(modified after Jámbor 1993 and Berggren et al. 1985)



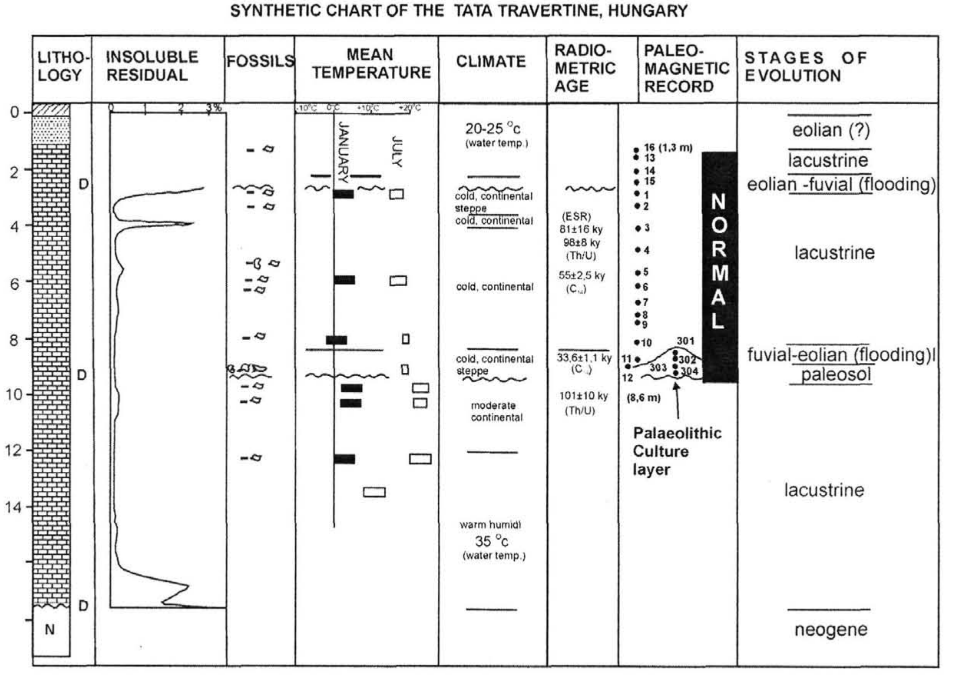
9. The section and photo of the palaeosoil layer with the sampling points and with the paleomagnetic polarity



10. Thin section photographs of a sample rich in quartz grains taken from a carbonate vent (Plane-paralell light)



11. Sketch of the carbonate vents (with quartz grains deriving from the Pannon siliciclastic bedrock) occuring in the quarry



12. Synthetic chart ot Tata freshwater limestone (chronology and palaeoenvironmental relation)

The use of nummulitic chert in the Middle Palaeolithic in Hungary

András Markó – Miklós Kázmér

Introduction

Nummulites are unicellular organisms (foraminifers), typical for the Palaeogene shallow marine carbonate rocks in the Carpathian Basin. They are often present in rock-forming quantity in the Middle Eocene to lowermost Oligocene sediments of Transdanubian Central Range of Hungary and in southern Slovakia. Uncommon occurrences of *Nummulites-bearing* rocks are in Lower Miocene and younger conglomerates, which yield nummulitic chert pebbles of various colours (grey, brown or yellow), with striated and usually black cortex. Time, place and mode of silicification is an open question for the time being, since the siliceous variety of the rock is unknown from primary geological outcrops.

Some types of the pebbles can be distinguished easily macroscopically, but the majority of the pieces is covered by thick patina layer, that's why the original colour and texture of the stone cannot be observed. The pebbles generally consist of chalcedony, rarely opal and quartz; sometimes, when the rock is not completely silicified (e. g. the piece from Opatovská Nová Ves) primary quartz is also present in considerable quantity. During our recent studies several kinds of *Nummulites (N. millecaput, 'N. striatus' and 'N. perforatus')*, and other foraminifer genera *(Discocyclina, Asterigerina, Assilina)*, a boring sponge *(Entobia)* were identified as well as remains of annelids *(Rotularia spirulea, Ditrupa)*, molluscs, corals, *Crinoidea, Bryozoa*, echinoids and algae.[1]

The presence of nummulitic chert was first reported from Ipolytarnóc,[2] later from the gravel pits westward from Budapest (Budafok, Biatorbágy, Etyek),[3] from the Pest plain (Rákosszentmihály, Csömör, Fót, Mogyoród) and from Nógrád.[4] After the World War II it was found at several points in the Ipoly/Ipel' valley in Slovakia (Slovenské Ďarmoty, Dolinka, Ipel'ské Predmostie, Nenince).[5] Geological age

[1] Lajos Bartkó and M. Vaňová identified different Nummulitic species *(Nummulites millecaput, N. irregulris* var. *regulata*, and *N. millecaput millecaput, N. anomalus, N. chauvannesi)* and other foraminifer remains *(Assilina, Discocyclina, Globigerina); Ostrea, Crinoidea*, algae and Molluscs were also found – Bartkó 1939.; Mišík 1969, 127.

[2] Szabó 1879. Recently this locality was discovered again: Bartkó 1985, 30., 59., 11. ábra.

[3] Schafarzik 1928, 10.; Jaskó 1939, 122–123.

[4] Bartkó 1939, 58.

[5] Mišík 1969, 127.; 1975, 99–101.

of the gravel formations varies from the Lower Miocene (Ipolytarnóc: *Eggenburgian*, Slovenské Ďarmoty: *Egerian/Aquitanian*) through Middle Miocene (Rákosszentmihály) to the Pleistocene and Holocene (in the Pest Plain, and in the Ipoly/Ipel' valley). Recently some outcrops were found in the Pest Plain (Délegyháza, Dunavarsány) and in the Cserhát Mountains (Debercsény-Mogyorós, Vanyarc – Makói oldal).

In archaeological context the use of the raw material was first identified in the case of the *Charentian* site near Érd[6] and on the surface sites lying in the Ipoly/Ipel' valley (Malá Čalomija, Bátorová, Opatovská Nová Ves and Kiarov II.).[7] On the Early Palaeolithic site of Vértesszőlős and on the *Mousterian* site of Tata nummulitic limestone pebbles were used for tool-producing.[8] During the intense field surveys in the territory of the Cserhát Mountains and the revision of some older assemblages several sites have been identified where the raw material was used. Some of them dates to the *Aurignacian* (Acsa-Rovnya), *Gravettian* (Püspökhatvan-Takács-hegy, Galgagyörk-Kelemen-földek, Csővár-Arany-hegy), and *Epigravettian* period (*Pebble Gravettian* or *Ságvárian* after V. Dobosi:[9] Szob). The assemblage from Hont-Vár-hegy was interpreted as Epipalaeolithic, while a core of Neolithic character came into light near Nógrádsipek. Several sites from the outskirts of Vanyarc, Bér, Galgagyörk, Kálló, Erdőtarcsa and Cserhátsurány has no proper dating for the time being. Finally a depot find have to be mentioned from the territory of the Bronze Age fortified settlement of Dunaföldvár. The pieces of this later assemblage were examined by petrographical methods (thin sectioning) too (Map 1.).[10]

1.

In the followings the use of the nummulitic chert in the MP will be discussed (Table 1.). Two types of archaeological industries used the pebble raw material in great quantity. The *Charentian* site of Érd was investigated in 1963–1964[11]. The ratio of the nummulitic chert is 4,61% among the tools. They are mainly side scrapers (20 pieces), raclettes (3), couteau a dos (4), choppers and chopping tools (4), two pseudo-Levallois points and a burin.

Artefacts made of nummulitic chert came into light exclusively from the upper culture bearing layer. The uppermost level *a* was the most important, where 9 side-scrapers, two chopping tools, a retouched flake, a worked pebble and a burin (14 pieces altogether) came into light. Level *b* yielded an atypical chisel, 3 *couteau à dos* (one of

6 Dienes 1968.

7 Bárta–Petrovský-Šichman 1962, 300., 304–306.; Mišík 1969, 127–129., Abb. 1.; 1979, 9.; Bárta 1979, 9.

8 Végh–Viczián 1964, 129.; Vargha-Máthé 1990, 287.

9 Dobosi 1994.

10 Biró 2000, 242–243.; Biró–Dobosi–Schléder 2000: Litotheca 1416.

11 Gábori-Csánk 1968. The petrographical study links to the name of István Dienes. – For further data about this site see the study of Zsolt Mester in this volume.

them is atypical), a raclette, an atypical chopper and a retouched flake. From level k a single simple side-scraper on flake, from level k an angular side scraper and a *couteau à dos* were found.

2.

The other industry with pebble working tradition originates from the *Kiskevély Cave*, in the Pilis Mountains, near Csobánka. It was the first cave site in Hungary, where systematic excavation was taken (Antal Koch, 1868), however archaeological material was collected only during the excavations of Jenő Hillebrand, in 1912–1914. In the fourth, brownish, clayey geological layer he exposed a fireplace containing a great quantity of burned bones and chipped stone artefacts. For the first time Hillebrand mentioned exclusively unifacial tools, analogous to the *Mousterian* site of Tata, later he classified the assemblage as *'Praesolutréen'* or *'Protosolutréen'* because of the only one leaf shaped implement, similar to the tools from the Jankovich cave, which was found *above* the level of the hearth.[12]

After World War II László Vértes placed the age of the reddish brown layer into an interstadial period, probably to a humid phase of the W1 (e. g. Early Würm) or to first half of the W1/2 (e. g. Interpleniglacial). He suggested that the leaf shaped scraper came into light from a distinct layer dating to the end of the W1/2 interstadial or the beginning (tundra phase) of the W2 stadial, and that it has nothing to do with the assemblage similar to the Tata-type Middle Palaeolithic industry.[13] V. Gábori-Csánk placed both assemblages into the same, partly washed out layer; she identified the *Mousterian* finds by the lower culture layer of Érd and placed chronologically to the beginning of the *Altwürm*.[14]

Based on the palaeontological data the age of the brownish layer was taken to the Subalyuk faunal phase (Lower Würm), together with the Middle Palaeolithic pebble using industry from the Diósgyőr-Tapolca cave (I/3–4, II/3–5. layers),[15] Lambrecht Kálmán cave (IIIrd, yellow layer), Érd-Parkváros and Tata-Porhanyó and finally with the upper layer complex of the Subalyuk cave.[16]

In the collection of the Hungarian National Museum artefacts of Middle Palaeolithic type (*Jankovichian* and *Mousterian*) were made of quartzite, hydrothermal and radiolarite pebbles and nummulitic chert. During the inventorising these later ones were identified as *Magdalenian* and *Mousterian*. A double side-scraper, or raclette

12 Hillebrand 1935, 15–16.

13 Vértes 1958.; 1959, 98–102.; 1965, 111–112.; Vértes 1964, 216.

14 Gábori-Csánk 1993, 32–36.

15 For recent data from this site and the age of the lowermost culture bearing layer see: Ringer–Moncel 2002, and in this volume.

16 Jánossy 1979, 129., 136–137.; Vörös 2000, 188–189.

were considered later as *Jankovichian*,[17] a double side scraper on pebble slice[18] and a fragment of a slice scraper,[19] two pebble slices, a fragment of a slice, seven flakes and two pebble fragments with flake scars[20] were made of nummulitic flint.

The pieces under consideration were made of the same type of Nummulitic chert of greyish colour and blackish pebble cortex containing *Nummulites* (mainly *'N. striatus'*), rarely Discocyclina, and red algae remains. Macroscopically similar type of raw material was identified in Érd and on the *Ságvárian* site of Szob.

Another raw material, also used in the cave contains only fragments of fossils (algae or foraminifers) and wears traces of sand-coloured, porous cortex. A double convergent side-scraper, a raclette, a simple side scraper and the leaf shaped scraper were made of this raw material. All of them has been ordered into the *Jankovichian*.[21]

3.

One of the most interesting site of the Middle Palaeolithic bifacial industries is lying near Hont,[22] in the Ipoly/Ipel' valley. After some field surveys a sound excavation was taken on the site in 1969 by M. Gábori. The find assemblage is unpublished and it was certainly mixed with other surface collections both of Middle Palaeolithic type and more recent periods. That is why the pieces without typological significance cannot date precisely, however the majority of the artefacts are from the Middle Palaeolithic period. M. Gábori compared the excavated assemblage to Razdrojovice (Moravia). Basing on the presence of Volgograd (Sukhaja Metchetka) type bifacial knife the site can be dated to the Early Würm, respectively.

Among the raw materials Szeletian felsitic porphyry, radiolarite, obsidian, 'Northern' flint, local and Mátra-type limnic quartzite and Nummulitic chert was used.[23]

During surface collections fragments of slices, some flakes and blades, flake-like blades and raw material fragments with scars were found. One type of the nummulitic chert used in the assemblage is similar to the Kiskevély pieces, it contains *N. 'striatus'* and *Discocyclina* remains. Another one, of yellowish colour with thick red weathered layer and bad quality containing also *N. 'striatus'* is known from Szob also. The brown pebble with brown, smooth cortex and without patina is known from

17 Inv. nr: 108/914.34. – Vértes 1958, 130., XXI. T.; Gábori-Csánk 1993, 139.: pl. X. 4.; Dobosi–Vörös 1994, 19.

18 Inv. nr: Pb. 825a. (179) – Gábori-Csánk 1993, 140.: pl. XI, 6.; Dobosi–Vörös 1994, 20.

19 Inv. n: Pb. 825c – Dobosi–Vörös 1994, 20.

20 Inv. n.: Pb. 824, 825, Pb. 825b (26), 826 and 827 – Gábori-Csánk 1993, 140.: pl. XI. 8., 12.; Dobosi–Vörös 1994, 20.

21 Inv. n: Pb. 481, 483, 484, 914. – Vértes 1958, 129., XXXI. t. 2, 4.; Gábori-Csánk 1993, 139.: pl. XI. 2., 4.; Dobosi–Vörös 1994, 19.

22 Gábori 1976, 1982.

23 Dobosi–Simán 2000, Table II.

Hont only. It seems to be a hopeful separating sign, that beside the general species, other foraminifers *(Assilina)*, annelids *(Rotularia spirulea)*, *Crinoidea*, *Bryozoa* and red algae remains also occur.

4.

One of the newly discovered sites in Cserhát Hills is near Legénd. At this place almost hundred finds were collected by now, made of mainly limnic quartzite, a kind of hydrothermal pebble, felsitic porphyry, quartzite, radiolarite and 'northern' flint. What makes this site worth to mention are the tools (12 pieces): side scrapers, leaf shaped scrapers, bifacial knifes and short end scrapers made of limnic quartzite and felsitic porphyry. Five pieces were made of nummulitic flint: an irregular, pyramidal core, two fragmentary segments a flake and a chip. This raw material is similar to the geological pieces, which could be collected in the vicinity of Debercsény. This pebble raw material is covered by thick patina layer and contains *N. 'striatus'*, *Assilina*, *Discocyclina*, *Crinoidea* also.

Preliminary conclusions

1.

Nummulitic chert is a special raw material, which was used for a long time, but only in a relatively small quantity. In the Middle Palaeolithic pebble working industries it was certainly used in Érd and in the Kiskevély cave. Another type of Middle Palaeolithic industries with leaf shaped implements beside the only one chopping-tool of Hont yielded flakes and raw material fragment by now. The use of the raw material in the *Jankovichian* assemblage and even the presence of this industry in the Kiskevély cave is an open question for the time being. In the later periods in the pebble working Upper Palaeolithic industries (Szob) and even in the Neolithic and Bronze Age the raw material was also known.

2.

The primary geological source of the nummulitic chert is not known yet and the overhelming majority of the archaeological implements wear pebble cortex too. One may conclude, that all the finds of Nummulitic chert were made of pebble raw material even in the absence of pebble cortex.

3.

The geological sources of the pebbles are situated on the territory lying southward from the Ipoly valley.[24] In the future pebble formations with nummulitic chert may be detected in the Middle part of the Great Hungarian Plain, in the environs of Dunaföldvár, which is the southernmost occurrence of the raw material in archaeological context. The connection between the macroscopic types and the fossil remains is not clear for the time being and the question of provenance can not be answered as yet, because the majority of the pebbles were found on archaeological sites. However, the greyish-brow pebbles from the Cserhát Mountains and the brown pebbles from the environs of Hont (from the Middle Palaeolithic site and from the 'Epipaleolithic' site of Hont – Várhegy) contain very similar fossil remains, but the patina formation is at different degree. The yellow pebble with red weathered surface, used on the archaeological sites of Hont and Szob, may have been collected from the alluvia of the Ipoly/Ipel' river. Finally the grey variety of good quality, with black pebble cortex, similar to the Krumlovský les (Kromauer Wald) chert was extensively used, but the provenance is unknown.

Further studies by petrographical methods (thin sections) may answer the above mentioned questions.

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[24] Recently some Lower Palaeolithic sites were found in Italy where a kind of silicified Nummulitic limestone pebble was used as raw material (Isernia La Pineta in Central Italy and Ca'Belvedere di Monte Poggiolo in Emilia Romgnana: Longo et al. 1997, 580–583.; Peretto et al. 1998, 357–361. The petrographical and geochemical investigations were carried out by Massimo Sozzi and Sergio Vannucci.). However the foraminifer remains from these samples are only microscopic dimensions and were not identified taxonomically.

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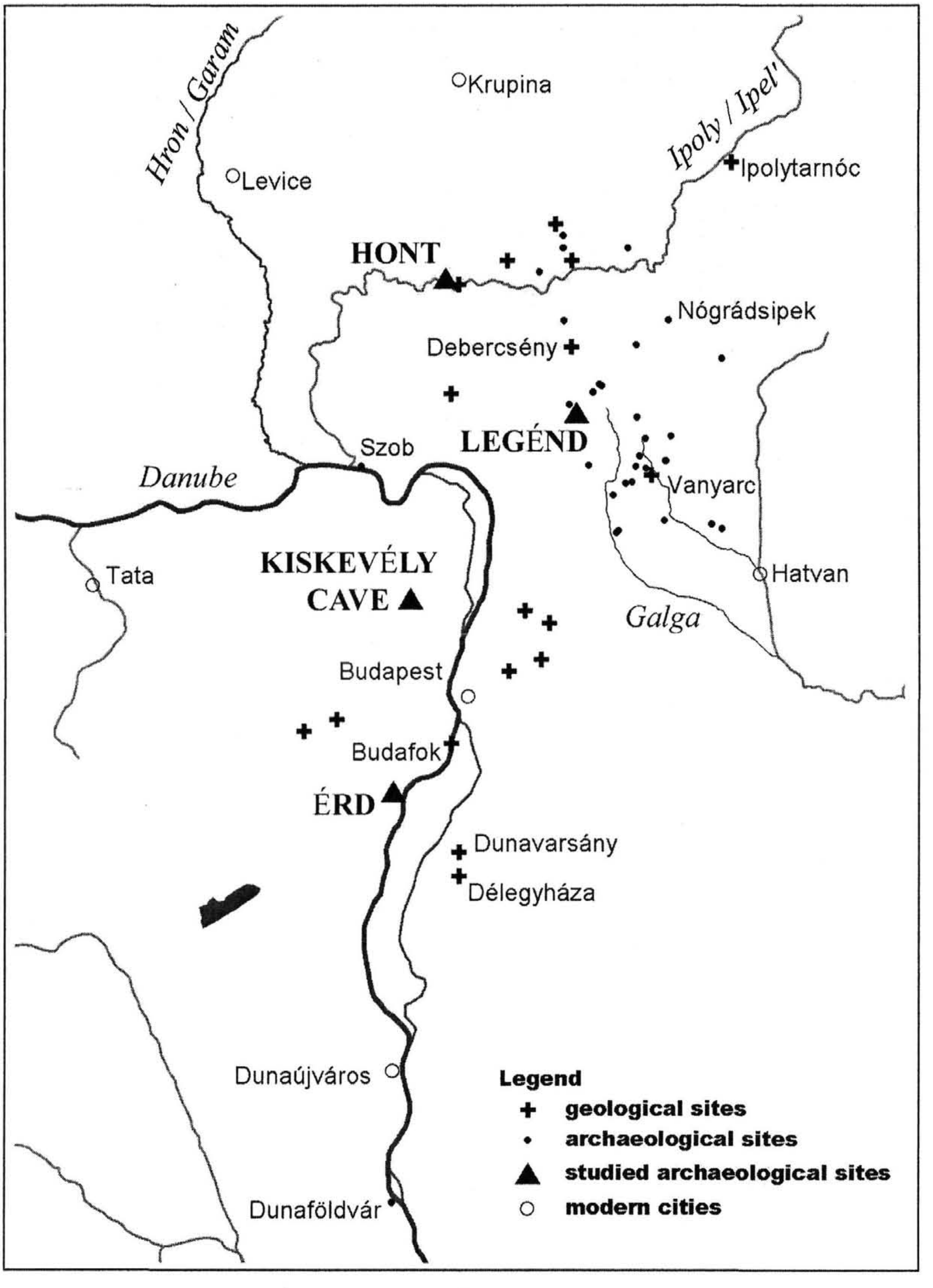
Archaeological site	Inventory number	*N. millecaput*	*'N. striatus'*	*Nummulites*	*Discocyclina*	*Asterigerina*	*Assilina*	*Rotularia spirulea*	*Entobia*	*Peneroplis?*	small *Gastropoda*	*Mollusca*	rhodoid	red algae	algae	*Ditrupa*	*Bryozoa*	*Crinoidea*	bioclast	?
Érd	12															+				
Érd		+																+		
Érd														+						
Érd			+																	
Érd	855											+								
Érd			+																	
Érd	602													+						
Érd	620			+																
Érd	583			+																
Érd										+										
Érd	253			+																
Érd	74		+																	
Érd	5			+	+															
Kiskevély Cave	Pb. 825/b		+																	
Kiskevély Cave	Pb. 825/c																			
Kiskevély Cave	Pb. 825/a		+																	
Kiskevély Cave	Pb. 825																			+
Kiskevély Cave	Pb. 481																			+
Kiskevély Cave	Pb. 483																			+
Kiskevély Cave	Pb. 824		+																	
Kiskevély Cave	Pb. 827		+		+								+							
Kiskevély Cave	105/1914.34				+															

Archaeological site	Inventory number	*N. millecaput*	*'N. striatus'*	*Nummulites*	*Discocyclina*	*Asterigerina*	*Assilina*	*Rotularia spirulea*	*Entobia*	*Peneroplis?*	small *Gastropoda*	*Mollusca*	rhodoid	red algae	algae	*Ditrupa*	*Bryozoa*	*Crinoidea*	bioclast	?
Hont	Pb. 99/165		+										+		+					
Hont	Pb. 99/176		+																	
Hont	Pb. 99/190		+		+	+			+			+								
Hont	Pb. 99/196		+																	
Hont	Pb. 99/197		+																	
Hont	Pb. 99/198		+																	
Hont	Pb. 99/212		+																	
Hont	Pb. 99/213		+				+						+							
Hont	Pb. 99/215		+		+															
Hont	Pb. 99/242		+					+									+	+		
Hont	Pb. 99/264																		+	
Hont	Pb. 99/270		+		+															
Hont	Pb. 99/328				+															
Hont	Pb. 99/342														+					
Hont	Pb. 2003/84		+				+				+									
Legénd			+		+		+											+		
Legénd				+																

Table 1. Identified fossil remains of the studied artefacts



Map. 1. Distribution of the nummulitic flint on archaeological sites and geological outcrops

Pebble tools from Tata-Porhanyó

Viola T. Dobosi

Owing to the accurate and luckily preserved documentation, the history of the prehistoric site at Tata Porhanyóbánya can be followed from the start of the excavations in 1906. The three major excavation campaigns (Tivadar Kormos, László Vértes, Viola Dobosi and Julianna Cseh) and the intermittent collection of sporadic finds (especially István Skoflek) can be associated most probably with the same settlement unit of the site (the lime tuff basin). The site is an irregular basin of a northwest–south-east orientation measuring 14-15 m along the longer axis. An unevenly cemented pillar connects the underlying and the overlying solid lime tuffs and divides the basin into two asymmetrical parts. Tata was a limited occupation area enclosed from all sides even though it was actually an open-air site. If we accept the idea that lime tuff evolution resulted in identical structures within the same carstic and terrace system even at spots that are 6 km apart, we can compare this site with the settlement features of the Lower Palaeolithic site of Vértesszőlős. The extension, ground surface and the height of the walls of the two basins, which developed in two chronologically distant periods (Mindel and Riss/Würm), significantly surpass the measurements of the basins that are being built at present (e.g. Egerszalók, Szalajka valley). It is certain that series of basins flanked the rims of the terraces along the Általér and a number of these basins proved to have been inhabited at Vértesszőlős, while no authentic data attest to the same at Tata. It means that although the relics of the basins can be identified at several places yet the traces of human settlements are as yet missing. Perhaps the archaeological material, which was collected in different regions of the large quarry and classified as stray finds, should be considered to have come from the original provenance. The walls of the basins were of various heights at Vértesszőlős. At least one side of the basin at site I, the wall was higher than 2 m, while it was barely 1 m at site III and at Tata. Diversions in the temperature and precipitation in the two geological periods can explain the difference in the length and the intensity of lime tuff deposition. All the excavations and authentic collections can be associated with the same basin: the part of the quarry that lied the closest to the secondary school and where there was no extraction. Beside the finds collected from undetermined locations, the material collected from the collapsed walls of the lime tuff basin was also considered as stray finds. The baulk that László Vértes had left at the site was strongly damaged by the fluctuation of the temperature and the rummaging of "treasure hunters".

It is significant to note from the respect of the interpretation of the archaeological phenomena that only a surface of 1 square metre was found at the time of the last excavation campaign, which corresponded to the criteria of a culture-bearing layer in a conventional archaeological sense. The finds did not come from a horizontal settlement layer, they could be associated with a sediment of a vertical dimension.

Tata-Porhanyóbánya is the richest Palaeolithic site in Hungary. The number of the catalogued items is 25 590.

The years of the excavations, the names of the excavators and the collectors and the inventory numbers and the item numbers are the followings:

Year of the excavations	*excavator/ collector*	*year/mark of inventory*	*items*
1909–1910	T. Kormos	Pb 266–391	126
1958	L. Vértes	Pb 58/	9734*
1959	L. Vértes	Pb 59/	1496*
1958–1959	L. Vértes	Pb 82/	351
1960–1970	I. Skoflek	Pb 82/	68
1994	I. Homola	Pb 96/	43
1995	Cseh–Dobosi	Pb 96/	927
1996	*Cseh–Dobosi*	*Pb 97/*	2256
	Cseh–Dobosi	*Pb 98/*	2199
1997	Cseh–Dobosi	Pb 99/	3058
1998	Cseh–Dobosi	Pb 2000/	3096
1999	Cseh–Dobosi	Pb 2000/	967
2000	Cseh–Dobosi	Pb 2001/	870
2001	Cseh–Dobosi	Pb 2003/	399

In the years of cataloguing marked by, * László Vértes determined the quantity of the flakes by weight. The detailed analysis of the many kilograms of flakes catalogued in a single inventory unit according by excavation units has not yet been completed.

Two groups of finds were selected to represent the tools: László Vértes analysed in details and published the finds of the excavation seasons 1958 and 1959.[1] With the adaptations of his data and their comparison with the results of the most successful year of the last excavation period (directed by V. Dobosi and J. Cseh), we can draw the generally valid picture of the Tata industry.

[1] Vértes 1964.

Type groups	*Types*	VÉRTES *excavation 1958–1959*	DOBOSI – CSEH *excavation 1996*	*Items total*	*percent*
	hand axe	9	1	10	0,56
	chopper	46	13	59	3,29
	chopping tool	28	4	32	1,79
Lower Palaeolithic Total				91	5,08
	scraper unifacial	776	90	866	48,35
	scraper bifacial	75	12	87	4,86
	scraper angular	78	17	95	5,30
	scraper pointed	36	6	42	2,35
	scraper multiple	45	8	53	2,96
	tata-scraper	136		136	7,59
	notched-denticulate	42		42	2,35
Scrapers total				1321	73,76
	point	54	4	58	3,24
Middle Palaeolithic Total				1379	77,00
	end-scraper rabot	64	10	74	4,13
	burin-chisel	109	48	157	8,77
	borer	58	7	65	3,63
	truncated		5	5	0,28
	combined		10	10	0,56
Upper Palaeolithic Total				311	17,36
	standard tools	*1556*	235	*1791*	*100,00*
	segment		36	36	
	slice		203	203	
	geometrically broken		54	54	
	blade-like	88	59	147	
	non-standard tools	*88*	352		
	flake	113 inv. Units	3822	3935	
	levallois flake	34		34	
	core	64	17	81	

Typological spectra of the two main excavation seasons

The differentiation between standard and non-standard tools was finally determined at the analysis and typological determination of the pebble industry of the Lower Palaeolithic site of Vértesszőlős.[2]

The standard category contains the tools that can be fit into the conventional archaeological typology. After the flake had been removed from the raw material (nodule or core) or after the pebble had been split, a working edge was created in the same way and on the same place, which had an identical function. Thus the tools form large series and the diversions in the parameters of the objects of the same category are insignificant. It is not simply a semantic question if some of the independent tool *types* distinguished in the typological system by morphological traits can really significantly be differentiated, if the place, number and relationship of the working edges are important from the respect of the producer of the tools or if the only aim was that the tool should be suitable for the designated function. The high proportion of non-standard tools makes this problem even more emphatic in the case of pebble cultures. The more than 50 types in Vértes' list of the Lower Palaeolithic industry of Vértesszőlős probably did not actually mean so many tool types.

Non-standard tools: (usually) pebbles split to regular geometric shapes without further elaboration. The working edge was the ad hoc working edge offered by the natural edge or point created by splitting. The proof of the pre-meditated and conscious production is the place of the occurrence: the culture-bearing layer, the undisturbed archaeological feature that evidences long-range human settlement with all its criteria (typical tools, waste of tool production, the scattered remains of the butchered pray animals, and, in lucky cases, the spots of hearths with charcoal and burnt bones), and the large series of objects produced with identical methods.

Dobosi–Cseh excavation 1996	Item number	percent
Standard tools	235	5,31
Geometric tools	293	6,62
Blade-like flakes, cores, pebble-fragments, debris	3898	88,07
Total	4426	100,00

Excavation material from 1996

Regarding the traditional types of the standard tools we find that the extremely high proportion of the Middle Palaeolithic types as compared to the Lower and Upper Palaeolithic types unilaterally determines the cultural and chronological position of the site.

The differentiation of the group of choppers and chopping-tools among the Lower Palaeolithic tools is important because they offer a possibility to compare the mate-

[2] Vértes 1990.

rial with the Lower Palaeolithic finds of Vértesszőlős. These types, the proportion of pebble tools, the measurements of the artefacts and the identical/similar settlement patterns affiliate the two sites with a Central European cultural entity understood in a broad sense that encompasses wide chronological frames yet it can be definitely outlined.

The determinant pebble products of the pebble industries are the half and quarter pebbles, which were often split with geometrical exactitude, and the orange-slice and bread-slice shaped flakes coming from further segmentation (Fig. 1, 4–9). These last two groups are functionally identical with the blades (or flake blanks). They are the blanks of tools, or adhoc tools where the natural surface of cleavage facing the cortical back provided the working edge. More than half of the tools preserved pebble cortex in the Tata material on a larger or a smaller surface.

The application of the "wechselseitege gleichgerichtete Kantenbearbeitung" on a few tools led to the differentiation of the "hand-axe" type (Fig. 2, 1.), which is contradictory in itself in the case of objects measuring 30-40 mm, even though they appear to be perfect hand-axes in a miniature form.

The proportion of scrapers is especially high (74%) in the middle palaeolithic material. They were made with reduction technique as well as on blanks (Fig. 3.).

The working edge could be simple: the shape was straight, convex, concave or lobed. Tools on which a notch created with a single blow are grouped among the scrapers. They could be used for the smoothing of cylindrical objects having the same radius as the arch of the notch.

At double scrapers the convergent working edges can meet at 90 or more degrees (angular) or at an acute angle. The difference between points and pointed scrapers is subjective. Beside tools having straight edges running symmetrically at an acute angle to a narrowing point and having a very flat lateral retouching, most of the tools of this group are asymmetrical along the longitudinal axis and have a short and widening proximal end. Although we often cannot tell what practical purpose the scrapers in the length group between 30 and 40 mm could serve (however perfect they appear to be), they were even less suitable for the function of a weapon or a projectile point despite the morphological perfection.

László Vértes called the bifacially elaborated scrapers on foliate, fine flat flakes scraper-knives.

From the mathematical-statistic analysis of the metric data of the type Vértes arrived to the conclusion that the differentiation was justified and its function was different from that of the classical scrapers.

Series containing a couple of items can be differentiated among the scrapers, which are very diverse in shapes and execution. These series show a nearly perfect morphological matching with the types named after classical sites. The convergence in this case can only be morphological and/or functional. The communities that produced a given type or tool shape according to their own needs lived in drastically different environments and in significant distances from each other both in a chronological and in a topographic sense. Neither lineage nor kinship ties can be supposed between them.

The Subalyuk scraper is characteristic of the lower culture-bearing layer (developed Mousterian) of the eponymous Subalyuk cave. The archetype is a right-angled triangular scraper measuring 50-60 mm. The more-or-less straight cutting edge was made on the hypotenuse of the massive flake. The Tata version is half the size.

The Yabrudian is a tool assemblage measuring 10-12 cm in length in average according to A. Rust's classical monograph. The Yabrud scraper is a right-angled double scraper prepared on the wide and flat Clactonian flake. The Tata version is hardly one-third of this size.

About 8% of the scrapers in Vértes' Tata publications is composed of the so-called Tata-scrapers. It is a basically regular slice scraper with an arched edge and as such it is the characteristic type of all the industries that used lemon slices as blanks (Fig. 2, 6–8). The type is not unique in itself nor is it so profoundly characteristic of a site that this term could be justified. It is actually an evident derivation of a chopping-tool. The evaluation of the arched cutting edge made with bifacial chopper retouching is subjective. It can be either a fine chopping tool or a coarse scraper.

The shape or the execution of the tools of the Upper Palaeolithic type group is near to or even reaches the technical level that can be expected or that generally appears in younger settlements. The working edges of the end-scrapers were prepared with fan-shaped retouching. The burins are usually not independent tools, they appear combined with various scrapers at either terminal of the flakes.

Another Upper Palaeolithic trait is the oblique truncation of the distal end of flakes with a single blow, which probably substituted the retouched truncation.

Blade-like flakes often appear among the flakes (Fig. 3, 1–2). Their technical parameters are close to those of classical blades. This could be regarded as the early appearance of one of the significant elements of the technique, while numerous other elements match the cultural level or they are even archaic. Similarly to bifacial elaboration, the elongated, narrow flakes cannot be associated with the genetic forerunners, the contemporary contacts or the possible descendants of the culture/industry. They are the results of a refined and standardised technology that evolved to an extremely high level. The pebble raw material, which according to Vértes "*...the blow executed on the smooth pebble surface... leads to the detachment of "premeditated" flakes just like when a prepared Levallois core is used*"[3] could support this trend.

The mammoth tooth lamella, which is carefully and uniformly polished on the edges and polished on the surfaces attests to developed manual skills. We will not discuss its spiritual significance, which can be estimated only from forced ethnographic analogues, nevertheless, the quality of the execution is obvious.

M-H. Moncel made the detailed analysis of the pebble working technology (see her article in this volume). The general description can be summed up in the followings. The elaboration method is varied and extremely fine on silex raw material, while the quartzite tools are coarser. It means that the coarser execution was not caused by an inferior skill, it came from the coarse, granulous structure of the raw material.

[3] Vértes 1965, 108.

Bifacial elaboration reaches nearly 40% in Tata. Bifacial elaboration could be applied only on the edges or on entire surfaces. This could be the reason why research was likely to affiliate the industry of the site to the Hungarian Middle and Upper Palaeolithic industries characterised by bifacial elaboration.

From among the retouch types, the classical Middle Palaeolithic (around 60 degrees) stepped and surface retouches are the most frequent.[4] The above-mentioned WGK is characteristic of the archaic types. Lateral retouch is characteristic of the occasional edge retouching of flakes, while fan-shaped retouch appears on end-scrapers.

Most of the flakes that were suitable for further elaboration were turned into tools, or at least they were retouched on a short stretch. The largest number (although not the most significant in its bulk) of finds contains the waste of reducing production technology from all the raw material types.

Vértes made experiments with probability calculations at the elaboration of the finds in 1958–59. The scrapers and the scraper-knives build standard groups of finds, which can be well determined in themselves. "*The statistical difference demonstrated between the two groups of finds certainly implies differences in planning, production and function.*"[5]

The greatest controversy of the archaeological material of Tata appears in the measurements. The average measurement of the typologically perfect items does not surpass 30 mm. It is a veritable micro-industry. I would not even dare to suggest a function for a 22 mm long scraper. Although it could be the stone inlay of a composite tool by its trapezoid shape, this conclusion seems to be far-fetched.

After the elaboration of about the half of the tools, the technical parameters of the Tata industry can be described in the followings:

Standardisation is pronounced in every metric feature. The average measurement is 30-31 mm. The proportion of the length and the width of the tools is 65%. Owing to the pebble raw material and the flake-technology, the industry is definitely stout.

László Vértes' technological experiments have proved that a blow on the rounded surface of a pebble led to similar results as flaking from a Levallois core. L. Vértes found that this could be one of the primary reasons why this special raw material had been chosen.[6]

In the preliminary evaluation, we analysed only a small portion of the recovered finds. The particular data can be modified yet the basic trends and regularities are valid for the entire industry.

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[4] Vértes 1965, 108.
[5] Vértes 1965, 108.
[6] Vértes 1965, 108.

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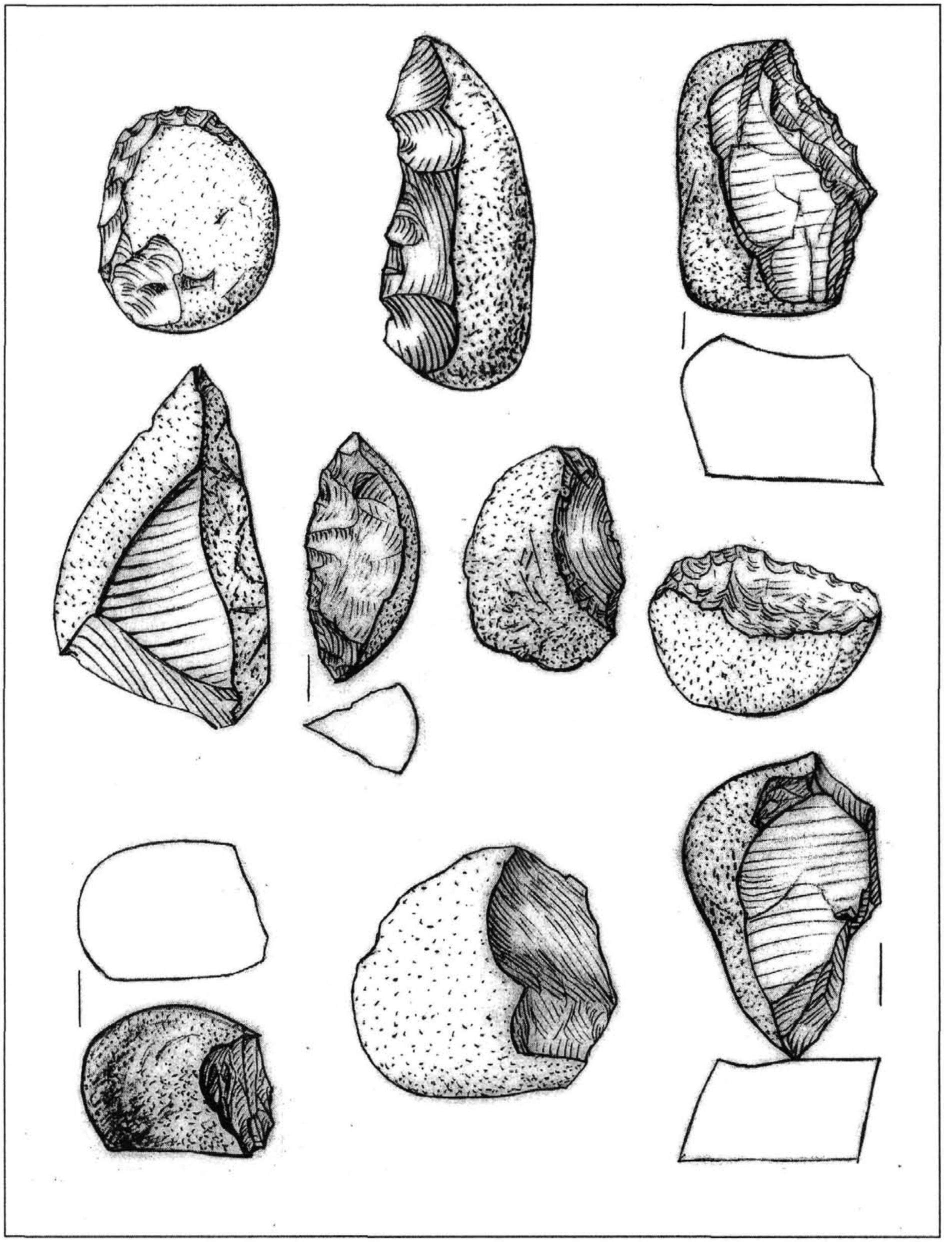

Fig. 1. Geometrically broken pebbles, slices, segments, scrapers on slices (1:1,4)

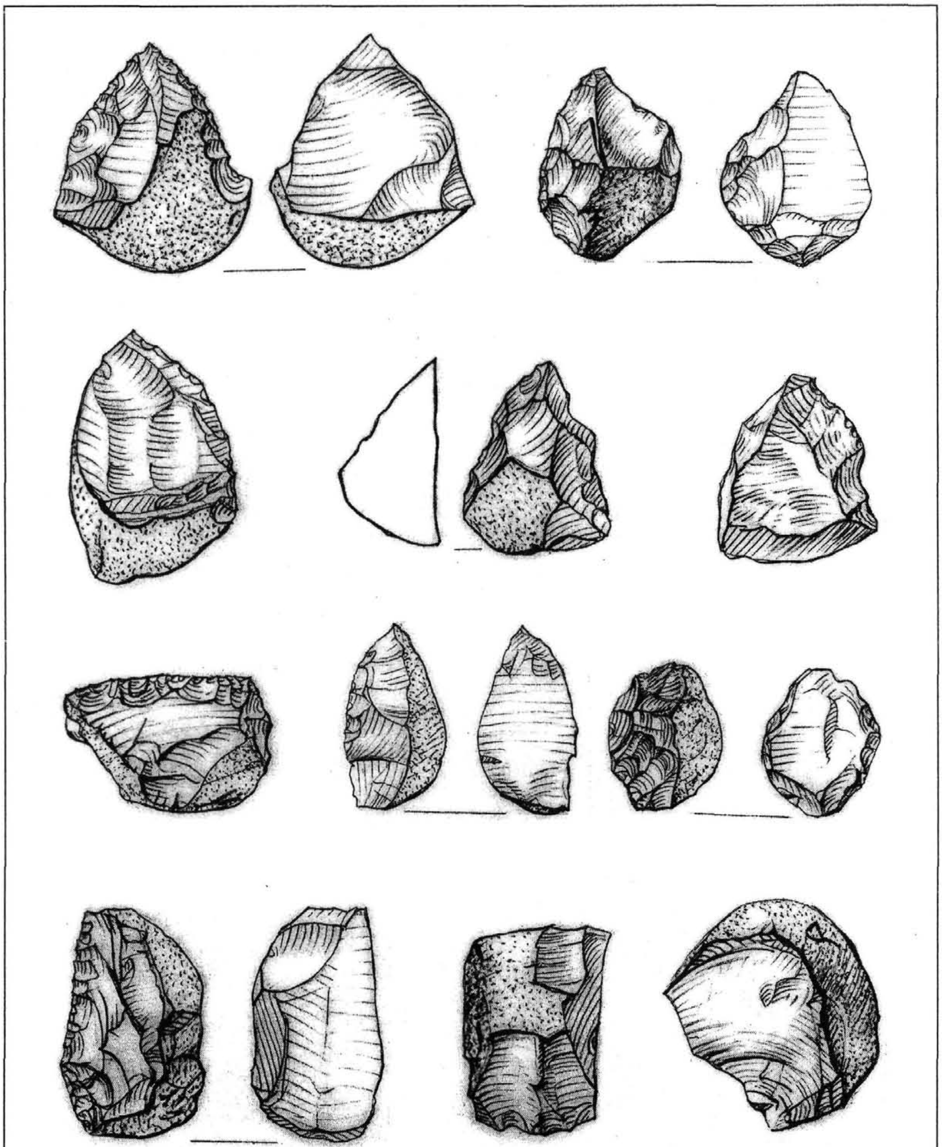

Fig. 2. Pseudo-hand axes, side scrapers on slices and flakes (1:1,4)

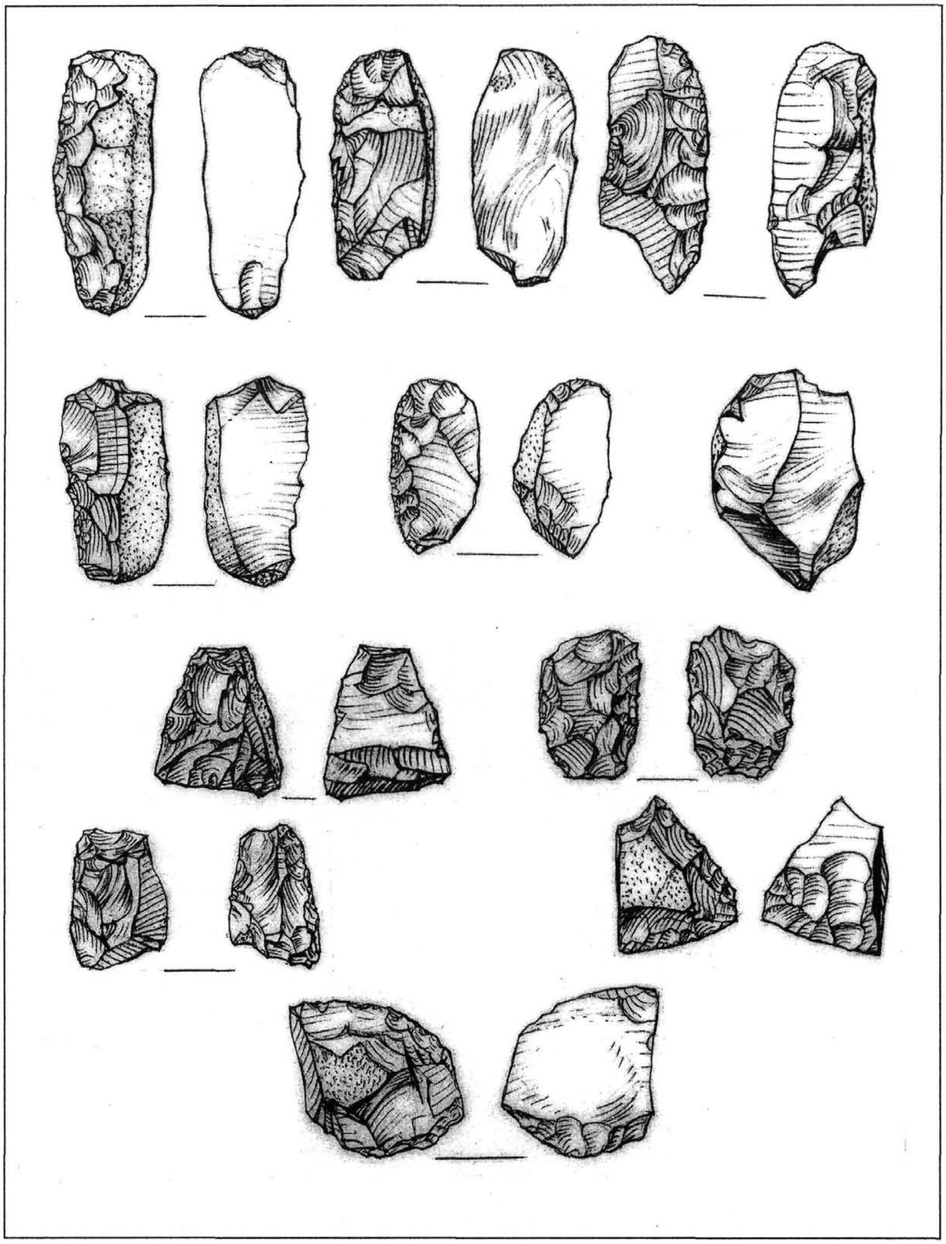

Fig. 3. Bifacially retuched side scrapers, knives, blade-like tools (1:1,4)

Tata-Porhanyóbánya: the raw material of the stone artefacts

KATALIN T. BIRÓ

Introduction

It is well known to the participants of the present meeting that Tata is one of the classical Palaeolithic sites, the earliest investigated open-air settlement and at the time of its discovery, the oldest Hungarian Palaeolithic site: its archaeological research dating back almost to a hundred years.

Many problems concerning the Tata site are being raised here on the occasion of the new investigations. As the excavations were finished only last year and the amount of the new material is quite abundant we are only at the beginning of the evaluation not to speak of the revision of former results. This is especially true for raw material studies.

Published evidence on the raw material of the Tata stone tools

The former students of the Tata Palaeolithic settlement were, starting from Tivadar Kormos, the first excavator and generations of specialists to come, without exception, endowed with firm scientific background and strong connection to geosciences.

Therefore it was natural to include the petroarchaeological information available on the stone tools.

Kormos 1912

Kormos (1912) noted the followings:

"Az ősember itt... jobbára folyókavicsból készítette szerszámait. E kavicsokat talán nagyobb távolságról (a Dunából?) hordta össze s ezért az anyagot megbecsülte"[1]. That is, the tools were made of pebbles, collected probably from a longer distance, maybe the Danube. He also noted the presence, apart from tools, that of fabrication debris found in thousands.

In the description of the individual tools of outstanding typological merit,[2] he listed the followings:

1 KORMOS 1912, 14.

2 KORMOS 1912, 35-44., Items 1–50.

Types	*flint*	*quartzite*	*horn-stone*	*lydite*	*stomolite (hornfels)*	*jasper*	*lime-stone*	*silex*
a	5	2	2	1	1	1		
b	1	2						
c	1	1					1	
d	1					1		
e	2							
f			1					
g	2				1			
h		1						
i	1					1		
j						1		
k	8		1		1	3		1
l	4	1						
total	25	7	4	1	3	7	1	1

Table 1.
Key to Table 1:
types separated by Kormos: *a:* wide points; *b:* narrow points; *c:* arrow-heads; *d:* points of more developed [sic] types; *e:* massive points; *f:* axe; *g:* blades; *h:* end-scraper on blade; *i:* high end-scraper; *j:* arched scraper; *k:* general scraper; *l:* microlithes.

It should be noted, that he presented, following a very modern concept, which is unfortunately not practised by most of the technical publications in our days, the selected pieces on colour prints. This is essential in the study of rock types and very useful for petroarchaeological assessment.

He commented on the bulk composition the following:

"A kőszerszámok anyaga túlnyomó részben színes tűzkő, szarukő és jáspis, amelyet az ősember részben a tatai völgy (Által-ér) kavicsaiból, részint pedig a Kálvária-hegyen és a Kegyesrend háza alatt fellépő liászmészkövek tűzköves rétegeiből gyűjtött össze. A tűzkövek legtöbb esetben chalcedonnal kitöltött radioláriákat és gyakran vékony kalcedonereket tartalmaznak. Alárendelt mennyiségben kvarcit, lidit, stomolit és mészkő is szerepelnek a kőszerszámok anyagaként...".

That is, the raw material of the tools is mainly coloured flint, hornstone and jasper collected from the pebbles of the Által-ér, the Kálvária-hill (Tata) and under the building of the Piarist order. He noted the presence of Radiolaria in the *"flint"* with chalcedony matrix. According to Kormos, quartzite, lydite, stomolite (hornfels) and limestone were also present in subordinate quantities among the stone tools, also collected from pebbles. He did not find any hammerstones.

The *"jasper"* of Kormos can be clearly identified as red, reddish brown radiolarite, as well as most of his *"flint"*—he himself stressed the presence of Radiolaria in them.

"Quartzite" and *"lydite"* was located by subsequent analyses as well. Limestone must be local. The questionable sorts of raw material is hornstone (is it really hornstone? perhaps Buda hornstone, lying rather far but certainly available and known to be used by Middle Palaeolithic people of Érd,[3] even claimed to be quarried in the Middle Palaeolithic period.[4] Stomolite (hornfels) needs petrographical checking; possible geological source can be in the Velence Mts.

Végh–Viczián 1964

In the 1964 monograph by Vértes et al.,[5] partly we have some petroarchaeological statements of Vértes as well as the special petrographical analysis by Anna Végh and István Viczián.

The authors summarised the raw materials differentiated by Kormos. Analysed macroscopically the ca. 150 kg debris from the excavations of Vértes (1958–59). Selected about 100 samples for further analysis, made altogether 18 thin sections.

They separated about 20 kinds of raw materials, mainly silex and its varieties. There were other rocks of various genetical origin (magmatic, sedimentary and metamorphic) identified. The terminology used by Végh and Viczián for silex included *"Feuerstein"* (used for Jurassic and Cretaceous silices) and *"Hornstein"* (used for Triassic and Palaeozoic silices).

They separated two main groups among the Tata raw materials:
a: flint and hornstone of the neighbouring region
b: other raw materials *"aus dem Kieselkomplex"* (meaning, from the pebble complex).

They specifically mention (classified under a,) *"flint"* of Jurassic age, from Tata-Kálvária-hill and other localities of the *"Vértes and Gerecse"*), in fact, Gerecse Mts., from Agostyán-Tűzköveshegy, Piszke and Lábatlan, from the Dogger and Malm layers. This is, by all means, identical with radiolarite, known from current research as the most important local raw material used in Transdanubia. On the photo table (Abb. 1.,1–2.) they use the name *"Radiolaritfeuerstein"* and the photo is clearly about radiolarite. Also the recent investigations on the Tata raw materials (see later) testify a clear dominance—both from pebble and block of radiolarite among the raw material of the artefacts. They also note,[6] that no traces of mining could be spotted. This statement, however, changed with the discovery of numerous *"flint mines"* of radiolarite all over Transdanubia,[7] notably and specifically the one on the Tata-Kálvária hill, just over the site in the territory of the Geological Park.[8] They did not dwell more on

[3] Dienes In Gábori-Csánk 1968.

[4] Gábori-Csánk 1989.

[5] Vértes Et. Al. 1964.

[6] Végh–Viczián 1964, 131.

[7] See Catalogue Of Flint Mines, Bácskay And Biró In Lech 1995.

[8] Fülöp 1973.

"*hornstone*", however it would be interesting to see if they spotted any of the Triassic hornstone (of Buda hornstone?) or not.

Classified under "*other raw materials*", they listed limestone, sandstone, quartzporphyr. I think they use the word Kiesel (silex) meaning pebble, referring to Kieselkomplexes several times, mentioning that a large part of the pieces came probably not from the Danube but the Helvetian complex (of what?) and from the drift of the Slovakian rivers, e. g. Vág (Vah). They also mention a possible place of origin in the foothill pebble complexes of the Gerecse and Vértes Mts.

The Nummulitic limestone pebble and the silicified wood encountered are supposed to come from a Pliocene-Helvetian (pebble?) layer. More stone types mentioned without hint at the place of origin is tuffite and sericitic siliceous schist, gneiss and quartzite pebbles. They claimed that the petrographical characteristics of these are fairly uniform and they are to be located in any pebble complex.

In the photographic evidence, they are presenting—apart from the radiolarite—a fine-grained cryptocrystalline silicite as flint with a vein of chalcedony-fairly general texture for fine-grained siliceous rocks (Abb. 1., 3–4.), a silicified intermediary tuffite (Abb. 1., 5.). Theoretically, this rock occurs closest to the site in the Visegrád and Pilis Mts., but can be found in the Slovakian pebble drift of some rivers, e.g., Garam (Hron). The last preparatum presented on photo is a nummulitic limestone presented on Abb. 1., 6.

The approach and treatment of the material can be considered modern in those days; however, the documentation published is not enough to identify what they were actually working on. It is especially painful not to know about their "*Quartzporphyrkiesel*" which may or may not be identical with the popular raw material of the Bükk Mts., about 300 km to the East of Tata across the Danube and the nummulitic limestone (silicified or not?), both of them subjects of current research (Markó et al. in press, A. Markó in this volume).

The archaeological analysis of Vértes in the same monograph did not add much to the petroarchaeological aspects. His interest is partly typological, partly technical and statistical. He sometimes noted the presence of quartzite vs. silex at the specific tool types. In the case of retouchers (hammerstones), he mentioned the preferential use of limestone. On table D,[9] he made a brief summary on the raw material composition by piece and percent, he published also in the Handbook.[10]

D (Rohmaterial):

1 (Kiesel)	1207 St.	58,6%
2 (Silex)	673 "	32,7%
3 (Quartzit)	150 "	7,2%
4 (Knochen)	23 "	(–)
5 (Sonstiges Gestein)	28 "	1,4%

9 Végh–Viczián 1964, 176.

10 Vértes 1965.

Vértes 1965

In the Handbook of Hungarian Palaeolithic and Mesolithic period,[11] the following summary data were published:[12] more than 2000 finished tools and ca. 150 kg fabrication debris was collected (including the material collected by Kormos, the number of tools were about 2500 pieces). Most of the archaeological material was made on pebbles (about. 59%). Though seams of silex are known in the neighbouring Mesozoic limestones, the Palaeoanthropus of Tata preferred silex pebbles of Tertiary terraces.

Vértes concluded that the preferential use of pebbles can be explained by technological advantages, i. e., hitting on the smooth pebble cortex can result in the production of *"planned"* flakes like a Levallois core with prepared platform. He mentioned also an *"amulet"* made of Nummulites perforatus with two incised lines on the surface.

Listing the natural historical data on the site, he laconically mentioned[13] 1207 pebbles, block silex 673 pieces, quartzite 150 pieces, others 28 pieces.

Other pieces of information in technical literature with consequences on the interpretation of Tata raw materials

There are also other pieces of information, not directly relevant to the Tata-Porhanyó raw material that have a consequence on the petroarchaeological cognisance of the site.

First of all, the discovery and excavation of the Tata radiolarite quarry. The known period of utilisation of the quarry is Copper Age (3810+65 BP, and shards of the Baden culture)[14] the site is open to public in the framework of the Geological Park. There is no indication of Middle Palaeolithic quarrying here, however it is not to be excluded. Some *"flint mines"* in Hungary were claimed the exist in the Middle Palaeolithic, notably the hornstone quarry at Budapest-Farkasrét.[15]

The other question of considerable relevance to our problem is the provenance of the Vértesszőlős stone tools. Vértesszőlős lies very close to the Tata-Porhanyóbánya site, within 10 km of each other, and both sites utilised pebbles, silex and quartzite.

11 Vértes 1965.

12 Vértes 1965, 107.

13 Vértes 1965, 372.

14 Fülöp 1980, 551.

15 Gábori-Csánk 1989.

The petroarchaeological survey of the site[16] separated the following rock types in the Vértesszőlős industry:

Sedimentary rocks

1. Radiolarites (jasper, opal, flint chert):
2. Lydites
3. Spongiolites (brecciated and calcareous radiolarite, lydite and spongiolite)
4. Marl
5. Limestone

Metamorphic rocks

The author claimed that all the collected types could be located in the Pleistocene terraces of the Általér. She mentioned specifically the Tata-Akasztóhegy pebble quarry as possible source of lydite.

It is clear that the raw material basis of Tata and Vértesszőlős were close to each other if not identical. Surveying for one implies the same for the other.

New investigations on the raw material

Knowing what we know of Tata, after the work of colleagues with suitable calling and expertise, why do we have to investigate the Tata raw material any more?

First of all we have the large number of new finds at hand. Are they the same, are they different? How do they relate to the material known previously?

Second, in the meantime Hungarian petroarchaeological research has made important advances. We know much better the prehistoric raw material stock and have more data on raw material acquisition in general.

Third, we still miss a piece-by-piece identification of the raw material. All petrographic experts mentioned in their publication bulk results and the investigations, in a way, levigate in the air. Even the thin sections mentioned by Végh and Viczián[17] are not to be located any more. There are four old thin sections preserved in the Lithotheca collection of the HNM (L 97/305) we suspect to come from the Porhanyó site, but do not know for sure (Plates 1–2.). I have made new microphotos on the thin section slides preserved in the HNM Lithotheca collection. Two of them comprise radiolarites, one quartzite and one spongiolite.

Clearly, it is necessary to extend petroarchaeological studies to the new evidence as well as revise the former results.

What has been done already? In fact, not much compared to the quantity of finds. I have investigated altogether 208 pieces of the 1996 campaign by macroscopic inspection. Two groups emerge very clearly, as for all who had done anything on the Tata material at all: quartzite (98 pieces total, 47% of n = 208) and silex (101 pieces total, 49% of n=208). The rest (9 pieces, 4%) comprises limestone and calcareous sandstone.

16 Varga-Máthé 1990.

17 Végh–Viczián 1964.

Silex is made up of radiolarite (6 macroscopic type groups selected), spongiolite (= Lower Jurassic chert?) and many other uncertain categories, most of them probably also radiolarite (Table 1).

The gravel origin of the pieces (silex pebbles preferentially used) make the problem more complex. Both quartzite and silex artefacts have pebble cortex on part of their surface. Quartzite tend to have more (68% of total pieces have cortex on the surface of 20% on average each), while it is clearly less frequent on silex (36% of total pieces have cortex on the surface of 23% of the corticated pieces). Most of the silex bearing cortex could only be classified to *"uncertain"* silices, and the ratio of cortex on them is rather high (over 30%) (Table 2). It can show that part of the silex tools were made of blocks in primary, or at least, not gravel deposit, sources. Another explanation can be that the technology for the silex tools comprised a more complex *"chaine operatoire"* and therefor the cortex appears only at the exterior decortication flakes.

Instead of conclusions...

At this stage, it is clearly too early for conclusions. Less than 2% of the total material has been studied. We can, however, formulate the questions more clearly.

First—can we locate the collecting spot(s) for Tata? Do the raw materials selected for tool-making come, all from secondary sources? What is the geological, primary origin of the individual raw material groups?

And, the big question for me—were the seemingly Bakony origin raw materials (Szentgál radiolarite, Úrkút-Eplény radiolarite, Spongiolite) local, did they have—probably eroded—outcrops in the Gerecse–Vértes mountain system? Or, did the rivers of the Early Pleistocene transport them? (from where). Also, with availability of special radiolarite types around Tata we may reconsider some statements concerning the prehistoric trade as well.

The actual state of art can be summarised in the form of two maps. On the first one (Map 1.), the exploitation of local (pebble) resources is indicated as suggested by previous studies. On the second map (Map 2.), I am suggesting other possible contact areas on the basis of published petroarchaeological data and my own observations. A more convincing answer to these problems is expected from the ongoing petroarchaeological studies.

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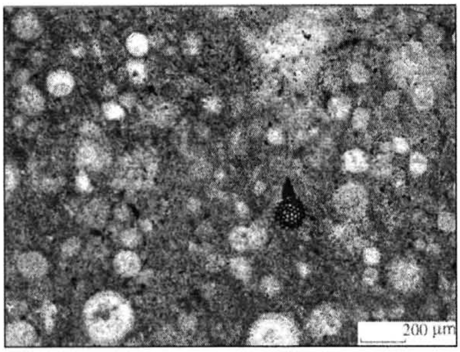
Raw material type group		*AveLength*	*AveWidth*	*AveHeight*	*Σ"weight" (~ g)*	*Ave"weight" (~ g)*	*Total no. of pieces*
9	Szentgál radiolarite	15, 7	14,3	5,3	6,9	2,3	3
909	Szentgál radiolarite?	20,75	13,9	6,1	23,4	2,9	8
910	Úrkút-Eplény radiolarite?	18	11,5	5		0	2
11	Hárskút radiolarite	28	18	7	7,6	3,8	2
911	Hárskút radiolarite?	16	10,5	6,5	8,7	4,3	2
12	Tata type radiolarite	19,4	12,1	4,3	8,3	1,1	7
13	reddish brown Transdanubian radiolarite	22,7	19,5	9	50,1	7,1	7
15	other Transdanubian radiolarite	15,5	11,5	4	1,5	0,7	2
915	other Transdanubian radiolarite ?	21,8	18	9,5	79,3	5,2	15
19	Gerecse radiolarite	17,3	16	5,7	4,5	1,5	3
919	Gerecse radiolarite?	23,25	20,2	12,2	29	7,2	4
928	Bakony Lower Jurassic chert (spongiolite)?	24	18,7	11,3		0	3
53	quartzite	27,2	21	10,3	813,9	8,3	97
953	quartzite?	19	11	9	1,9	1,8	1
999	others (silex, limestone)	29,4	22,7	11,5	2289,1	44	52
total		25,9	20	9,8	3324,3	15,9	208

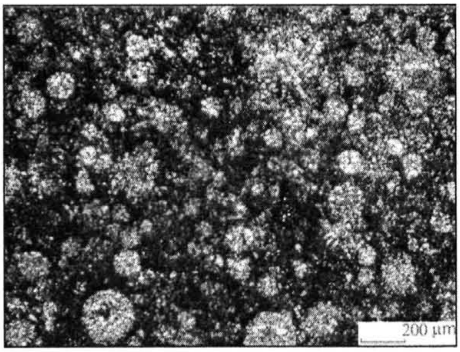
Table 1.

Raw material type group	*Total nr. of pieces*	*AveCortex% (total)*	*pieces with cortex*	*AveCortex % (pieces with cortex)*
9 Szentgál radiolarite	3	0	0	0
909 Szentgál radiolarite?	8	6,25	1	50
910 Úrkút-Eplény radiolarite?	2	0	0	0
11 Hárskút radiolarite	2	7,5	1	15
911 Hárskút radiolarite?	2	7,5	1	15
12 Tata type radiolarite	7	5,71	1	40
13 reddish brown Transdanubian radiolarite	7	8,57	2	30
15 other Transdanubian radiolarite	2	0	0	0
915 other Transdanubian radiolarite ?	15	11,33	7	24,29
19 Gerecse radiolarite	3	0	0	0
919 Gerecse radiolarite?	4	11,25	3	15
928 Bakony Lower Jurassic chert (spongiolite)?	3	0	0	0
53 quartzite	97	13,7	66	20,14
953 quartzite?	1	15	1	15
999 others (silex, limestone)	52	11,48	19	31,42
total	208	11,23	102	22,9

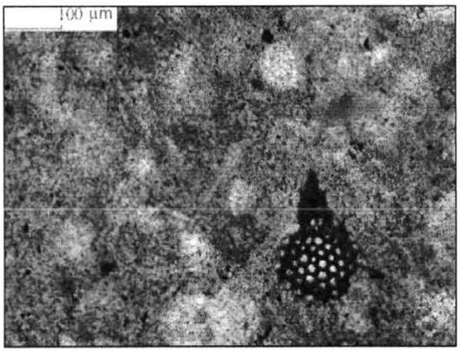
Table 2.



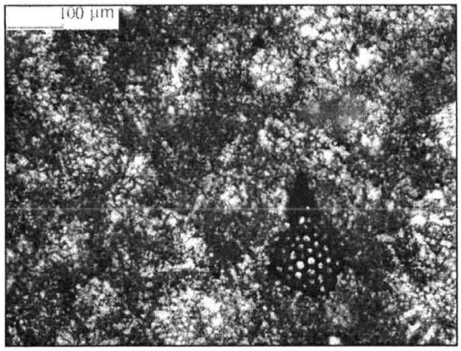
1. Radiolarite (1) thin section, 1N 4x objective



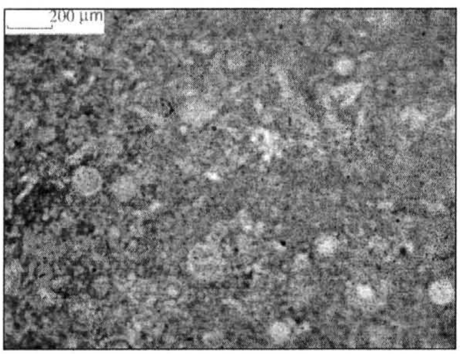
2. Radiolarite (1) thin section, XN 4x objective



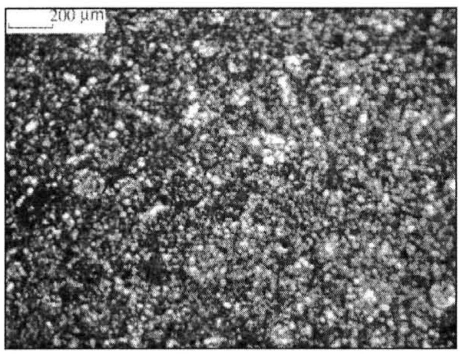
3. Radiolarite (1) thin section, XN 10x objective



4. Radiolarite (1) thin section, XN 10x objective

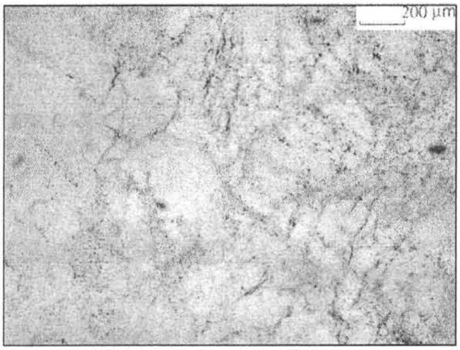


5. Radiolarite (2) thin section, 1N 4x objective

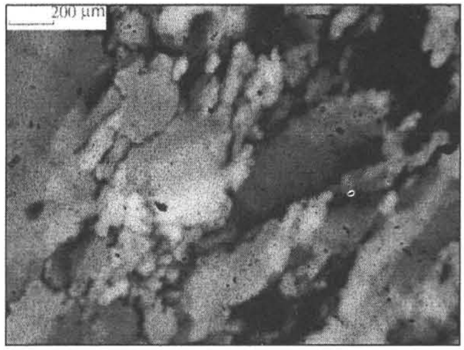


6. Radiolarite (2) thin section, XN 4x objective

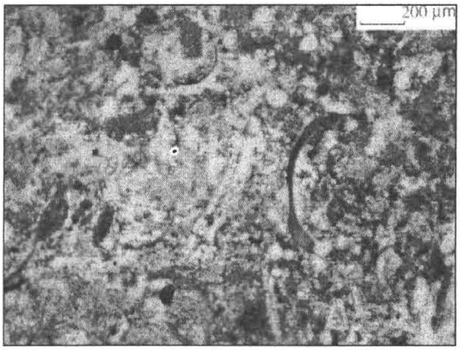
Plate 1.
Thin sections from Tata-Porhanyó in the Lithotheca collection of the HNM (L 97/305)



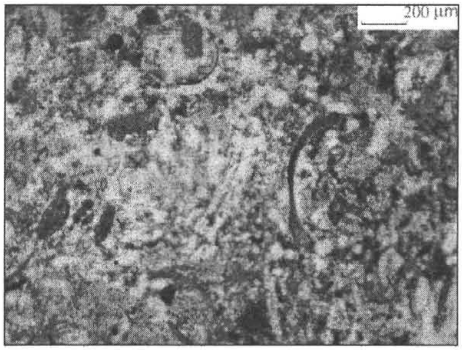
1. Quartzite thin section,
1N 4x objective



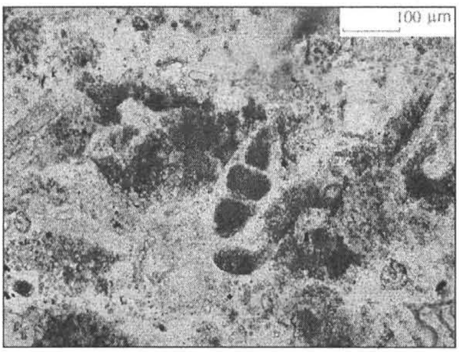
2. Quartzite thin section,
XN 4x objective



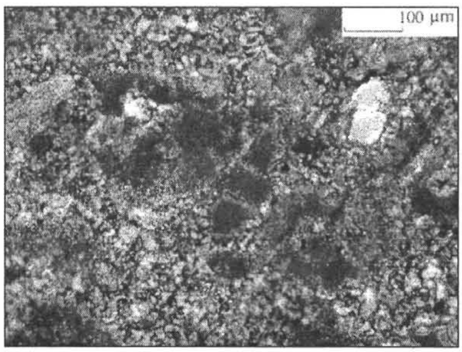
3. Spongiolite thin section,
1N 4x objective with sponge spicules



4. Spongiolite thin section,
XN 4x objective with sponge spicules

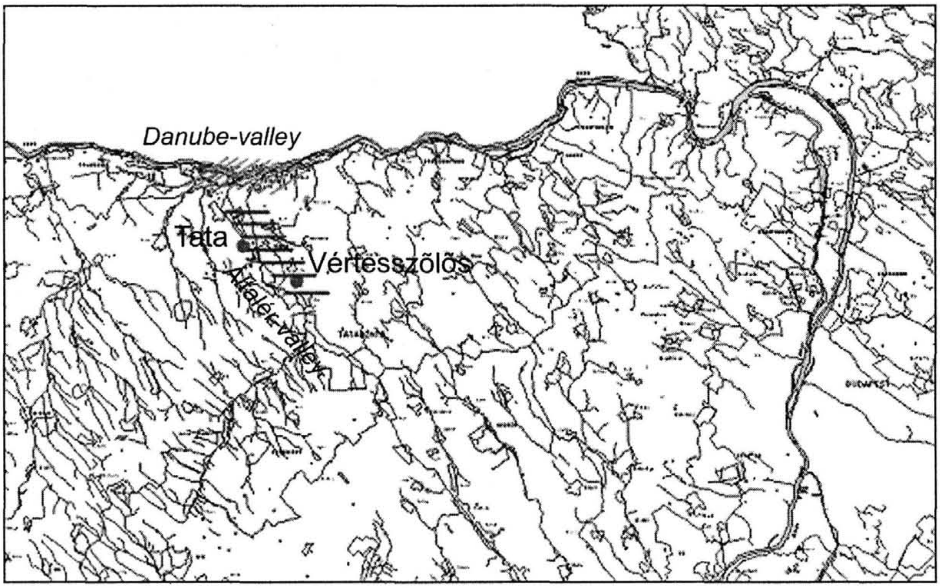


5. Spongiolite thin section,
1N 10x objective with sponge spicules and Foraminifera

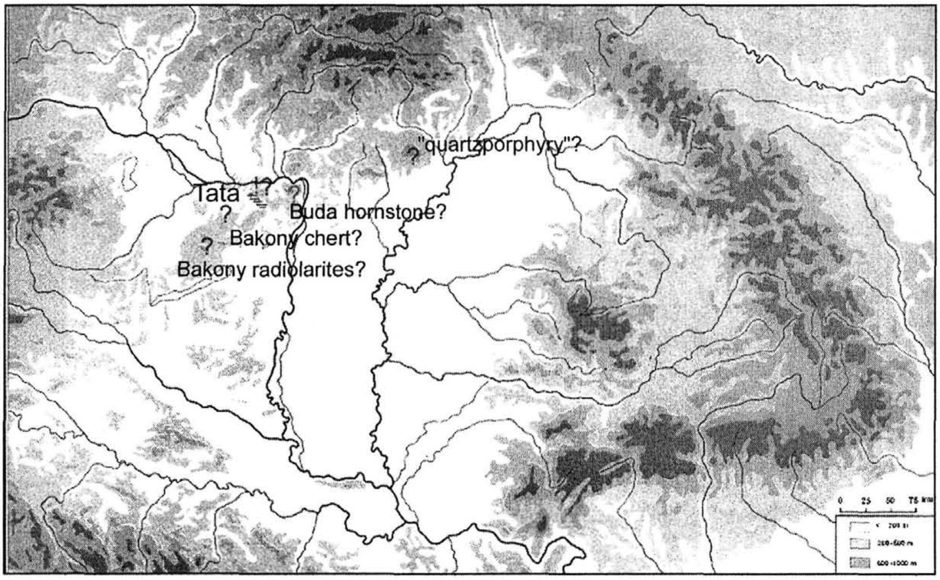


6. Spongiolite thin section,
XN 10x objective with sponge spicules and Foraminifera

Plate 2.
Thin sections from Tata-Porhanyó in the Lithotheca collection of the HNM (L 97/305)



Map 1.
Possible collecting spots from secondary deposits (river pebbles) around Tata



Map 2.
Possible origin, primary or secondary, for the raw material types identified in the Tata lithic material

Tata (Hungary), Kůlna (Czech Republic), Taubach and Weimar (Germany): a uniform Early Upper Pleistocene microlithic world (OIS 5)?

Marie-Hélène Moncel

Abstract

Microlithic assemblages are present in Central Europe. Some of them dated from the OIS 9, but mostly they belong to the OIS 5 and the beginning of the OIS 4. They are also often associated with travertins (springs). The environment of the human occupations was frequently temperate. The bone remains (evidence of anthropic marks) show that large mammals have been hunted or scavenged (Bovids, Horses, Cervids, Rhinoceros, Elephants). The lithic assemblages linked to these bone remains are composed of numerous artefacts which have a very small size (20-30 mm for the flakes and the cores). The raw material acquisition took place around the site (flint, radiolarit, quartz, quartzite), except for some rare stones which have been collected in a long distance area (for example in Kůlna 11).

The technological study of four of these lithic assemblages (Tata, Kůlna 11, Taubach and Weimar) brings new observations on the debitage and the processing system used by humans. The technological behaviour is largely similar at these sites and it concern small pebbles or blocks, for the most quadrangular with flat faces. Most of the cores have two flaking surfaces, one of them carrying sometimes cortical patches. The removals are centripetal or unipolar. Some cores use the quadrangular shape of the pebbles, each face is a flaking surface for one or two removals. Evidence of bipolar technique does not exist. A great variability is observed among the cores, but most of them belong to a single processing system. Actually, this variability depends on the pebble shape, but also on stages in the processing system. The debitage on each core could have stopped at different moments of the processing system.

This common technological behaviour could indicate a specific and wide spread tradition over Central Europe including some local trends. It is difficult actually to imagine that the debitage of small flakes is only linked to the activities which took place in these locations. The activities could explain some characteristics for example the numerous small points in Tata. Nevertheless, the environment does not seem to explain the small pebble collecting.

The technological behaviour of the Neanderthals and the microlithic assemblages over time

Very small artefacts (less than 30 mm long) are usually associated in mind with the Mesolithic. Nevertheless, these kinds of products are already described from Oldowan assemblages, and every assemblage yields a part of voluntary small blanks.[1] Consequently, small flakes belong to the human tool kit regardless of the period.[2] What is more striking is when all the artefacts of an assemblage measure less than 30 mm, including the cores and the pebble tools.

In several assemblages in Europe and the Near East, there are more or less small flakes. But these flakes are never retouched. At some sites, especially in Central and Eastern Europe, the small size caracterize all the assemblage, both flakes and pebble tools.[3]

Because of the small size of the artefacts, and consequently, of this "extra-ordinary" status, the analysis of microlithic assemblages is a way to examine which parts are traditions, activities and raw material influences in the aspects of an assemblage. Are they explained by a lack of large rock blocks in the environment? Do they record a specific tradition in regard to the raw material types and the technical behaviour? Is there a relation to the activities which took place in the site?

Several sites in Central Europe yielded microlithic assemblages (fig. 1.). Most of them are dated to the OIS 5e (Eemian) or to the beginning of the last glacial period, frequently associated with travertine deposits. These microlithic assemblages, located in the same geographical area (small plains and basins within Central Europe), are present, for example in Taubach, Weimar and Stuttgart-Bad Cannstatt in Germany; Předmostí II and Kůlna (level 11) in Czech Republic, Hallena Street in Poland, and in the Carpathian basin, Gánovce, Bojnice III and Hôrka in Slovakia, Tata in Hungary.[4]

The scarce human remains, brain cast in Gánovce and teeth in Taubach, show that these industries were made by Neanderthals.[5]

Actually, this phenomenon is frequent in both time and space (table I.). Microlithic industries exist in old periods, even if they remain rare, in Central Europe (Vértesszőlős, Bilzingsleben, Trzebnica)[6] the easternmost part of Eastern Europe, Central Asia and the Near East.[7] Some of these sites, for example in Bilzingsleben (Germany) and Vértesszőlős (Hungary), are also located in travertine.

1 Carbonell et al. 1995.; Texier 1995.; Berthelet 2001.

2 Goren-Inbar 1988.; Carbonell et al. 1995.

3 Taschini 1979.; Goren-Inbar 1988.; Papaconstantinou 1989.; Bietti–Grimaldi 1996.; Golovanova et al. 1998.

4 Vértes et al. 1964.; Gábori-Csánk 1968.; Sibrava et al. 1969.; Valoch 1967., 1977., 1984, 1996a–b.; Wagner 1982.; Banesz 1990., 1991.; Wagner 1992.; Kaminska et al. 1993.; Kovanda et al. 1995.; Dobosi 2000.; Wísniewski 2001.

5 Lozek 1954.; Prozek 1958.; Valoch 1996a.

Because of the highest frequency of such assemblages during the last interglacial, beginning around 125 Ky, D. Collins in 1969 and K. Valoch in 1977 suggested to create a cultural group in Central Europe named Taubachian (after Taubach in Germany),[8] to focus on the variability of these numerous assemblages dating for most of them to the OIS 5 and 4 (more than 40 listed sites). Although the different cultural names, used by researchers, such as Kiik-Koba Micromousterian, Micoquian Micromousterian or Pontinian in Italy, are often based on tool types or on geographical areas, technological analysis brings evidence of various traditions inside these microlithic assemblages, perhaps related to regional trends.[9]

The term "Taubachian" does not seem to describe the best way all the microlithic assemblages, dated to the OIS 5 and OIS 4, in this part of Europe and cannot be employed to designate a single lithic entity. The Taubach assemblage is not the best example of a microlithic assemblage.[10] However, largely described by K. Valoch by the excavations from Kůlna in the Czech Republic, the microlithic industries gather some common characteristics as the use of small pebbles of various rocks, contributing to a microlithic assemblage, the "non-Levallois" technology in most cases, the average size of the flakes of 3 cm or less, a lot of broken flakes.[11] The flat retouch is also lacking, as well as the bifacial tools. Side-scrapers, denticulates and notches are prevalent, associated with micro-choppers. Bones often show numerous retouches of compressors.[12]

These assemblages are often related to hot water springs (but also to caves and river banks), and the animal remains especially belong to one or two large herbivores (bovines, horses), associated with smaller animals in some cases. Among the fauna, there are also remains of large mammals such as elephants and rhinoceros. In some assemblages, these species are quite numerous, for example, Cervus elaphus, Dicerorhinus mercki (70% young) and Bison priscus in Taubach in a mixed forest context (110-116,000 BP by U/Th);[13] Dicerorhinus mercki and Elephas antiquus in Gánovce.[14] In Tata, the Mammoth is the dominant species.

Different hypothesis could explain these assemblages. Thus, do these assemblages represent distinctions in lithic traditions, differences in subsistence strategies or a large influence of the available raw materials?

6 Burdukiewicz et al. 1979., 1994.; Mania 1988.; Mania et al. 1980.; Dobosi 1983a., 1988., 2003.; Burdukiewicz 1993.

7 Derevianko et al. 1998.; Ronen et al. 1998.; Merder et al. 1998.; Ranov 2001.; Ranov–Dobonov 2003.

8 Valoch 1977, 1984.

9 Gábori 1976.; Stepanchuk 1994.; Kuhn 1990–1991., 1995.; Lioubine 1998.

10 Behm-Blanke 1960.; Schäfer 1981.

11 Schäfer 1981.; Valoch 1984.

12 Valoch 1984., 1988., 1995.

13 Brunnacker et al. 1983.; Mania 1988.

14 Lozek 1954.

Geographic zones	*before isotopic stage 5*	*isotopic stages 5-4-3*
Italy		Pontinian (early Würm): zone of Monte Circeo Denticulate Micromousterian (San Bernardino)
Germany	Bilzingsleben (500-450,000 years)	Taubach (115-110,000 years) Weimar (130-105,000 years) Rabutz (130-105,000 years) Burgtonna-Thüringen
Czech Republic	Karlsteyn Mlazice Zadni Treban (350,000 ans)	Kůlna (stage 5) Předmostí II (stage 5) Praha-Ladvi Bešenova
Slovakia	Hôrka-Ondrej (180-140,000 years) Vyšné Ružbachy	Gánovce (stage 5) Bojnice III Hranovnica Beharovce (128-125,000 years)
Hungary	Vértesszőlős (350,000 years)	Tata (120,000 ans) Kiskevély Cave (stage 4 ?) Csákvár (stage 4 ?) Szelim Cave (stage 4 ?) Süttő (stage 4 ?) Tokod (stage 4 ?)
Poland	Trzebnica (500,000 years)	
Crimea		Tchokourtcha Adji-Koba Kosh-Koba Voltchy-Grot (stage 4)
North Caucasus		Mezmaiskaya (45-32,000 years) Barakaevskaya (Würm II-III) Kiik-Koba (upper) Prolom 1 Zaskalnaya V (layer 4)
South Caucasus		Paouk Gariatchy Klioutch Smolenskaya Ilskaya
Dniester valley Basin of the Don and the Donetz		Vasilievska Levinsadovska Volgograd Royok I-II Khriachtchy Konstantinovka

Kazakstan	Koshkurgan 1-2 Shoktas 1 (500-430,000 years)	
Israel	Revadim Quarry Bizat Ruhama	

Table I: Some sites with microlithic assemblages in Europe and the Near East

– *raw material?*

The lack of large stone blocks around the sites could explain the exploitation of small pebbles. However, geological studies provide evidence that diversified pebbles were certainly available in the surroundings in most cases (for example Kůlna),[15] except maybe for the Pontinian sites (small flint pebbes available in the surroundings). In Bizat Ruhama, small flakes also would be related to the superior quality of small flint pebbles compared to large pebbles.[16] On the other hand, any debitage system can control the flake size, and can produce not only small flakes.

– *specific locations, specific activities?*

The sites raise questions about specific activities near water springs, as favourable areas to animal and vegetal life. Humans would have come to hunt or scavenge dead or injured animals. These animals in most cases are large mammals. Therefore, the human activities would have been programmed. The frequency of elephants or rhinoceros would have a particular meaning, and is not a matter of coincidence. Humans could require a specific tool kit to work on the animal corpses, even the small artefacts of these sites do not seem to show clear functional characteristics. Other kinds of assemblages show the same kinds of artefacts.

The question of an association with a specific location, linked to a specific way of life, requiring a specific technology, has been first asked, even if a better preservation of the archaeological remains inside travertine deposits undoubtedly sheds a distorted light on this type of settlement.

– *specific environnement?*

Associated with various faunal remains, these assemblages indicate that different environments could have been exploited through this kind of artefacts. A specific environment cannot be consequently the single explanation. However, these locations are fre-

15 Moncel–Neruda 2000.; Oliva 2000.

16 Ronen et al. 1998.

quently associated with a dense vegetation, during a forest period like the Eemian s.s., but also the beginning of the OIS 4. In addition, the environmental patterns of some assemblages show that they are not always linked to a temperate and large forest environment. In this case, dense or scarce vegetation could not have contributed to a small pebble exploitation, a specific subsistence behaviour (high mobility in a scarce vegetation and more contacts among human groups?) or a game processing.

– lithic traditions?

Why did they make such small flakes without material reasons? The question of a specific tradition has then to be raised, the small flakes being used alone (Neanderthals were able to use them),[17] associated together on wooden blanks or to work wooden tools. We will be in this case in a different world, with another tool conception.

Traditions among Neanderthal groups and their ancestors seem to be everywhere proved in Europe, as in Africa for the first Modern Humans.[18] From 350 000 or 300 000 years old, lithic assemblages show more complex flaking methods.[19] The flake shape is moreover controlled, even if it could be easier to obtain the desired tool shape by retouch rather than by a direct production of a blank of appropriate shape in the cases of a poor quality raw material. Specific and long lasting processing systems appear in Europe, covering large areas, through time and environmental changes. They can give evidence of large technological traditions. Sometimes, within smaller areas, sites show specific behaviours which suggest that they could reflect local traditions related to geographical conditions or human choices.

Lithic assemblage studies, now, show that both technological traditions and activities have to be considered to explain the characteristics of the abandoned material at a site.[20] Consequently, it is necessary to try understanding their connection in order to describe the originality of a human settlement. Furthermore, the assemblage composition and variability are the result of complex interactions of behaviour, environment and the physical properties of the raw material used. The understanding of human occupation and the nature of the accompanying lithic assemblages are thus related to all the site data: type of location, faunal remains (part of the anthropogenic agents) and subsistence behaviour, raw material acquisition, technological behaviours, and types of tools. The manner in which the surroundings have been exploited has to be observed to know the reasons for settling. Plenty of evidences suggests that Neanderthals took the available animal resources in the nearby area and were able to organise specialised hunting of small or large herbivores (for example, La Borde, Mauran, Biache, Vaufrey or Salzgitter-Lebendstedt).[21] A repetitive hunting of ani-

[17] Villemeur 1994.

[18] McBrearty–Brooks 2000.

[19] Mellars 1996.; Shea 1997., 1998.; Gamble–Roebroeks 1999.

[20] Binford 1992.

[21] Grayson–Delpech 1994.; Geneste–Jaubert 1999.; Gaudzinski–Roebroeks 2000.

mals of various ages (prime-age or adults, evidence of intentional prey selection) and traditions of systematic processing of larger quantities of game have been proved, at least from 125 Ky to 55 Ky.[22] Faunal remains of a human activity could be an accumulation during repeated visits to the spot, a few animals being taken each time. Scavenging is also practiced, according to the resources. These studies, as the lithic ones, often provide evidence of short occupations, or at least of movement of mobile human groups according to the environment, thereby transmitting knowledge over generations.[23] Different hypotheses have been proposed to discuss the kind of the spatial occupation and the seasonality with home bases and specific extraction sites.[24] However, the accumulation in most sites cannot allow us to conclude on the duration of the settlements. Ethnographic studies suggest that humans move according to seasons and each site has specific characteristics, such as the topography, the function, and the diversity of activities. The artefact distribution is linked to a large number of factors which are not always visible on an archaeological site.[25] Otherwise, in the same environmental context, various behaviour can exist.

Use-wear analysis and the reduction sequence studies from raw material collecting to flaking and tools discarding; "chaîne opératoire" indicate that different kinds of stone tools or cutting edges can be used for the same work.[26] On the contrary, the same flakes can be produced by different debitage methods. These observations suggest that the Neanderthal abilities were both numerous and varied, through technological traditions, especially for the stone work. Most of the information on the technological behaviour is actually provided from this stone work. However, some discoveries, dated to OIS 5 or earlier, indicate that bones could be used sometimes, due to the lack of large stone blocks or tradition. Sites as Castel di Guido, Fontana Ranuccio, La Polledrara di Cecanibbio, Rebibbia-Casal de' Pazzi have yielded bone hand-axes, bone scrapers, or "compressors" (Bilzingsleben).[27] Wood is also a raw material, as the discoveries of Schöningen, Lehringen in Germany, Clacton in Great-Britain or Abric Romaní in Spain attest.[28] The spearpoints in Schöningen associated with horses, the wooden tools in Abric Romaní, or the wooden handles in Bilzingsleben, suggest a technological world much larger that we could assume by only stone studies.[29] The microwear analysis confirms that wood has been worked in a high proportion, even in the oldest settlements. Various kinds of tools, in size and shape, have

22 Speth–Tchernov 1998.

23 Moncel 1998.; Roebroeks–Tuffreau 1999.

24 Binford 1987.

25 Binford 1978

26 Beyries 1988.; Lemorini 2000.

27 Mania et al. 1980.; Mania 1995.; Radmilli–Boschian 1996.; Mania 1998.; Gaudzinski 1999.; Anzidei et al. 1999.; Anzidei 2001. But ivory is not used (Villa–d'Errico 2001).

28 Oakley et al. 1977.; Carbonell–Castro-Curel 1992.; Thieme 1997., 1998.; Mania 1998.

29 Koller et al. 2001.

been used as woodworking tools.[30] Nevertheless, a large production of blanks seems, above all, to be obtained only by a stone processing system, even numerous wooden tools could successively be prepared according to the wood resources and the needs.

A comparative study of some assemblages described as microlithic: Tata (Hungary), Kůlna (level 11) (Czech Republic) and Taubach-Weimar (Germany)

The sites

Site	entire pebbles	pebble tools	cores	flakes and fragments	% tools
Kůlna level 11	8	35	150	10 362	6%
Tata	?	100	268	< 20 000	< 10%
Taubach-Weimar	?	3	48	784-1288	< 5%

Table II: The lithic assemblages from Kůlna, Tata and Taubach-Weimar

Kůlna cave (level 11)

Kůlna cave is located in the Czech Republic, in the Moravian Karst. It was excavated by Karel Valoch from 1961 to 1976.[31] Several layers have been observed. In the upper part of the sequence, we can see four Micoquian levels (6a, 7a, 7b and 7c). Below these levels, the excavations show another Middle Palaeolithic level, number 11, subdivided into sub-layers (11a to 11d).

The level 11 corresponds, in the state of knowledge, to the second half of the Eem Interglacial. The upper part of level 11 (a and b) and level 10 could be dated to a steppic period belonging to the end of the late Interglacial. The Micoquian layers could belong to the beginning of the last cold period (50 to 69 Ky), according to ESR dating.[32]The Kůlna Micoquian assemblages show numerous Rangifer bones while temperate species (forest and steppic forest environment) exist in level 11 (Alces alces, Equus taubachensis, Cervus elaphus, Bos, Rhinoceros).[33]

30 Lemorini 2000.; Dominguez-Rodrigo et al. 2001.

31 Valoch 1988.

32 Rink et al. 1996.

33 Zelinova 1998.

Tata

This open-air site is located near Budapest in Hungary. It was excavated by László Vértes in 1958 and 1959.[34] A main human settlement was discovered in travertine. The faunal remains are poor, above all composed by Ursus arctos and Mammoths. In contrary, the rich lithic assemblage can be the remains of flaking areas. In 1964, L. Vértes dated the settlement from an interstadial period belonging to the beginning of Würm (Brřrup). A ^{14}C dating on a charcoal sample confirmed the first age hypothesis with a date of 55,000 ± 2500 B.P. However, the palaeontological and malacological studies put the level at the end of the last interglacial. These distorted results were explained by L. Vértes by the water springs related to the site. The first U/Th dating more agree with the palaeontological hypothesis. The human occupation would be dated to 70,000 ± 2000 B.P. to 116,000 ± 1600 B.P., from the end of the last interglacial to the beginning of the last glacial period.[35]

The two most famous artefacts from this site are a "chouringa" carved in a fragment of a mammoth tooth (determined by L. Vértes as a cult objet from Australian Aborigines) and an "amulet" with an engraved cross made on a polished nummulite fossil. The tooth fragment seems to have been carefully separated from the Mammoth molar tooth, then shaped, bevelled, and coloured in red by rubbing with ochre. Ochre remains have also been discovered inside the site.

Taubach-Weimar

Located in Germany, these two open air sites are a part of a complex of travertines along the slopes of the Ilm river valley, not far the city of Weimar. The material comes from collections accumulated by different researchers working in Weimar and Halle from about 1870. The travertine quarries are closed now. Recent dating by micromammals and radiometric studies give an age of 111 Ky and 115 Ky.[36] The travertine should be dated to the Eem Interglacial.

The faunal remains are composed by woodland rhinoceros (Stepanorhinus kirchbergensis) and brown bears (Ursus arctos). These two species provide 90% of all cut marks. Bison priscus and Cervus elaphus are also well represented.[37] Rhinoceros are above all young and total 76 animals.

34 Vértes et al. 1964.

35 Schwarcz–Skoflek 1982.

36 Heinrich 1994.; Brunnacker et al. 1983.

37 Bradlund 1999.

The main activity : debitage with a same processing system

Raw material acquisition: a preference for small pebbles and for various rock types

The raw material acquisition is above all local (less than 5 km), except for Kůlna. The stones employed are silicites-radiolarites in Kůlna (more than 50%) and Tata (88%), associated with quartz and quartzite.[38] In Taubach-Weimar, flint, chert and rhyolithes composed the most part of the assemblages, associated with quartz and quartzite, too. According to the geological study made by P. Neruda, some rare stones, as grey flint (80 km north), the porcelanite (East Moravian), and the rock crystal, are the only stones which came from a long distance (50 to 100 km). They could be arrived as tools (small bifaces on porcelanite) for the site.[39] Otherwise, the raw material choice does not seem to exactly reflect the stone possibilities in the environment.

The pebble tools, the entire pebbles and the cortical flakes show a selection of a large number of small pebbles, from 15 to 60 mm long for the most numerous, but also an exploitation of some larger pebbles (till 80-100 mm for the most). The abandoned cores measure sometimes more than the choppers (from 40 to 70 mm). A large quantity of collected pebbles occurs in each site. This number can be explained by the accumulation of numerous settlements. It could also be related to the pebble size and the reduction sequence requiring a large quantity of pebbles to produce the flakes.

The artefact size appeares to be intentional. Even on the largest cores, the removals are small. The local exploitation of very small pebbles from various raw materials characterizes first the industry and it was not completely imposed by the environmental settings. Actually, large pebbles were present around the sites, in diverse good quality rocks, and some of them have evidently been collected by humans. Otherwise, pebbles were chosen according to their shapes for flaking or shaping. Humans preferred a large variety of rock types, even if fine-grained stones and high good quality stones were available in the environment. This fact could be another characteristic of these human groups.

The cores: evidence of a unique "chaîne opératoire"

Some differences are visible between each stone category, but they reflect more details than a real specific technical behaviour. Men could have adapted their technology according to the different stone qualities, on pebbles or flakes, and this technology shows a lot of common points among the studied assemblages (fig. 2., 3., 4.).

[38] Vértes et al. 1964.; Dobosi 1983.; Moncel–Nerdua 2000.

[39] Valoch 1987.; Moncel–Neruda 2000.; Oliva 2000.

The core analysis enables us to see several kinds of management, but two of them are the most frequent and present in the three assemblages: cores with two opposite flaking surfaces and cores with orthogonal flaking surfaces (faces of quadrangular pebbles). Actually, they belong for the most to the same family, especially the "discoid" family, except for some cores (uni-bipolar method, prismatic or polyedric cores) (table III.). The variations within the flaking system could be explained by the pebble shape, even quadrangular pebbles of various sizes are above all chosen. The pebble volume is used from the start of the exploitation. The core turns in the hands to maintain angles for as long as possible.

The removal arrangement is similar on each debitage face: crossed, centripetal or uni-bipolar, involving different kinds of flakes (small and flat, thick with a back and some elongated flakes) (fig. 5.). Otherwise, the arris and the core edges guide removals on the trapezoidal or the pyramidal surfaces. Each debitage face shape reflects, therefore, a specific story, according to the debitage choice. The use of the core edges and of flakes leads to a flat debitage surface. The exploitation of two surfaces, on the contrary, results in wider and wider angles or it keeps good angles, and therefore in a pyramidal abandoned core. The core types (more or less cortical patches, removal organisation) could be a voluntary variation in the debitage in order to produce the most numerous and the most different kinds of flakes and for the longest time possible. From flint could be produced smaller and thinner flakes (good quality of the stone or men's needs?).

The size comparison of the cores shows that, regardless of the raw materials, the values are similar. A preference goes to the smallest pebbles (between 30-40 to 60 mm). The polyedric cores are smaller than the other ones. The cores with a cortical surface produce, in addition, the few largest ones. If we compare the core size and the removal size, we can see that men really wanted a lot of small flakes. The largest cores, which are present, result in a lot of small removals. The microlithic assemblage is, therefore, not only imposed by the small pebble size but also by a definite choice.

Because of its long sequence, Kůlna cave brings much more "Taubachian" or "microlithic" features to light. The main difference between the upper Micoquian levels, dated to the OIS 4, and Taubachian level 11 is based on the artefact size. The cores show the same processing system as in the Taubachian level.[40] However, the cores are technologically more diversified and the stone acquisition is really different as well, with a preference of flint as main raw materials for the Micoquian.[41]

[40] Boëda 1995.; Rink et al. 1996.; Moncel 2003.

[41] Valoch 1988.

type of cores	frequency	striking platform or debitage surface	debitage surface
A: 2 opposite surfaces 1 cortical	41 - 15%	total cortical surface or a few removals trapezoidal or oval butt of a pebble or a cortical flake	Triangular or trapezoidal section without cortex centripetal or crossed removals (some unipolar or bipolar removals)
B: 2 opposite surfaces large cortical remains	33 - 7%	large cortical patches butt of a pebble or a flake use of the morphology of the blank (some centripetal or crossed removals)	trapezoidal or flat surface without cortex centripetal or crossed removals (some bipolar removals)
C: 2 opposite surfaces limited cortical remains	18 - 12%	pyramidal, trapezoidal sections centripetal or crossed removals	Numerous flat surfaces centripetal removals
D: 2 opposite surfaces a cortical back	114 - 32%	1 or 2 cortical backs on a part of the core periphery (partial edge): part of a pebble or a flake as a natural striking platform step removals trapezoidal section	flatter surface centripetal, crossed and uni-bipolar removals
E: 2 opposite surfaces without cortex	14 - 5%	centripetal or crossed removals use of the core edges (backed removals) pyramidal or convex section	centripetal or crossed removals use of the core edges (backed removals) pyramidal or convex section non symmetric core
F: 1 debitage surface pebble slices	14 - 5%	butt of an oval pebble or a cubic pebble rare small removals	convex or flat surface without cortex or limited patches pebble slices (unipolar, bipolar, crossed axis)
G: orthogonal surfaces on a pebble	49 - 14%	use of the pebble faces (cubic or quadrangular pebbles) several debitage faces (2, 3 or more) more or less large cortical patches cortical striking platform or use of the previous removals short debitage	

Table III: The different types of cores in Tata

The men's needs: pebble tools, rough or retouched debitage products, retouched cores

In the three assemblages, several functional blanks were used by humans: micro pebble tools (15-60 mm), some large pebble tools (100-240 mm for Kůlna for example), flaking products, tools on flaking products or cores and whole pebbles (hammers or raw material stock?). Most of them are, however, rough flakes. Men obtained what they needed, using different methods: by a shaping system, which however stays on a very small scale and not easy to distinguish from flaking (both tool and core along their life, fig. 6.), and by a main debitage system, which gives flakes and even cores like blanks.

Some specific types of flakes were produced by the tool-makers. However, they were less demanding. Numerous broken flakes were used. This low degree of demand probably depended on the kinds of stones used, like quartzite or quartz which easily break themselves, but not always.

- The products are very small, in the majority of the cases less than 30 mm (more than 80% less than 10-15 mm), but there are also large flakes up to 80 mm. The fine-grained stone flakes seem to be mainly small (perhaps for its stone quality, for a micro debitage or their needs). However, Taubach artefacts are in general longer (20 to 50 mm) (fig. 7–8.).
- The flakes are, in general, similar for all the kinds of raw material, short, thick and wide. The shapes are various; even the rectangular and triangular morphologies (parallel edges) are more numerous for fine-grained stones than for quartzite and quartz. Some laminar flakes are also present, especially in silicites in Kůlna and Tata (bladelets).
- Between 25 and 50% of the flakes have a back (cortical or not), sometimes even two opposite backs. A debitage break could have been perceived like a debitage back (these flakes were used or retouched like entire flakes). It is possible that the wide and thick platforms could also have been perceived like a back.

Retouched artefacts make up less than 10% of the assemblage (fig. 9.). Most of the tools are side-scrapers and partially retouched points. The equipment is then limited in category. Retouches were made on flakes of all size. However, humans used the shape diversity of the flakes for the retouch. Triangular flakes or blanks with two convergent edges are used first for making points. The edges are either entirely retouched or partially retouched. Quartzite and fine-grained stone flakes are more often retouched on a long part of the available sharp side. The longest edge is chosen first for the side-scrapers. The retouches are, in general, opposite to the back, when it exists, or even to the platform. A back could have been retouched or used, especially when they were two on a piece.

The retouch does not, therefore, really change the flake shape in most of the cases. The retouch is simple and thin in general, more invasive on orthoquartzite in Kůlna. It is often small and steep on silicites, radiolarites and flint. Some silicite tools seem to have been used for a long time or the work is tidy on this kind of stone. Several series of retouches are indeed visible (due perhaps to a long utilisation or a resharpening linked to the quality of the raw material). Bifacial retouches are less numerous, except in Tata. Sometimes, flat retouches are located at the bottom of a point or on the inferior face of the flake, often on fine grained stone artefacts or long distance stones like porcelanite stone in Kůlna (precious stones, curiosity, tool collecting?).

The isotopic stage 5 microlithic assemblages

The technological analysis of the three collections shows a lot of common points. The exploitation of raw material is always conducted to gather local and different rock types. The geological studies and the presence of some large pebbles prove that the great number of small pebbles was a human choice and not imposed by the environment. The various stones could be employed like complementary raw materials, each one having its proper function (hardness, ability, pebble shape).[42] The flaking system is dominant, mainly using cores with two debitage surfaces and the pebble shape. The flake types are diverse. In contrary, the tools are in small number and the tool types are limited to side-scrapers and points. The bifacial retouch is rare, except in Tata for small points. Shaping and flaking were certainly successively practiced on some cores to obtain more blanks. We are in a voluntary microlithic world and a specific technological world, really different from the Micoquian behaviour observed in the upper levels in Kůlna (OIS 4).

How to explain the microlithic patterns?: activities, kind of sites, traditions?

The environmental conditions could involve with the most frequent production of small artefacts. The forest context, the temperate climate, good places for living near water springs, (archeological layers in travertins), river beaches, or caves (Kůlna) could explain an original behaviour adapted to the special climatic conditions. Wood work, easy in a forest context, could also be an aspect of the main activities of these people (small stone tools used to work numerous wooden tool). Wood pieces remains are indeed present in travertine German sites. In most of these sites, mammals are great size species. Sometimes there are only two species, Rhinoceros, Elephants, Bison stags, Mammoth (Tata), Deers, Horses.[43] A specialized activity in butchery is consequently possible to explain the technical patterns. But, a specialized butchery activity cannot be the only explanation to the small size of the lithic industry. Small flakes could be, of course, as good as other kinds of pieces for all kinds of activities. In Germany, microwear studies on small flakes give evidence of a use on vegetal products.[44] Wooden tools could be also well adapted to a diversified exploitation of what

[42] Svoboda 1994.; Moncel–Svoboda 1999.

[43] Gábori-Csánk 1968.; Patou-Mathis 1993.

[44] Richter 2001.

provides the environment in association to these small products. It is possible indeed that at a time of a temperate period, the meat supply was more limited. The human groups could develop a special food behaviour, explaining the kinds of lithic blanks, even other kinds of lithic assemblages existed during the same period in the same area. In this context, various traditions can as well explain the variations than activities. The more abundant bifacial points in Tata and a few bifacial tools in Kůlna will be signs of regional trends inside a vast technological family.

However, the men's behaviour in their choice of small tool making cannot simply be explained by only one factor like environment, food needs, site locations, physical characteristics and availability of raw materials. Customs have to be considered.

The reduction sequences show numerous common points among the assemblages. Most cores belong to a same processing system, based on two opposite flaking surfaces. This system can also be described as a suitable treatment of the volume of small pebbles, their cortical faces and their morphology. Quadrangular pebbles are the most common, and a possible choice by the toolmakers. It is easier to begin a flaking from flat surfaces than convex ones. The round and oval pebbles are in great majority reserved first for the pebble tools. This specific use of the pebble shape is also observed on some cubic cores with a few scars on each cortical faces. The kind of flaking can be regarded to the large discoidal group, and the products are for the most small, except for Taubach.[45] Except this characteristic, Taubach is not a specific case in technological point of view as it has been suspected in the past.

Flakes and tools on flakes are the common artefacts for all these assemblages but some bifacial tools and some small bifaces have maybe a greater sign that we suspect today.[46]

We see the same processing rules and the same kinds of tools in Předmostí II.[47] In Gánovce, the assemblage is poor but we can also observe a large use of quartzite and quartz points carry bifacial retouches which are rare in Bojnice. Radiolarite was available but, despite its exceptional quality, it was not easily used on a large scale in Czech Republic and Slovakia (preference for quartz, more durable edges on quartz?).

Recent analysis in Pontinian assemblages in Italy, dating to the OIS 4, shows various flaking methods, different from Central Europe (double percussion method, pebble slice method, two opposite surface cores).[48] A variety on the same scale is also observed among Italian sites of the Pontinian as among Central European sites of Tata, Kůlna and Taubach-Weimar. Thus, through the processing system studies, technological traditions appear among microlithic assemblages, not due to the raw materials. On the other hand, they are closely related to some assemblages located in the same area and using large pebbles for the debitage, for example Érd in Hungary.[49] Do we have then evidence of large regional trends within various traditions in

[45] Schäfer 1981.

[46] Valoch 2000.

[47] Svoboda 1994.; Moncel–Svoboda 1999.

[48] Kuhn 1995.; Bietti–Grimaldi 1996.

[49] Gábori-Csánk 1968.

regard to the raw material collecting and the flaking rules? There are other types of industries belonging to the Acheulian, Micoquian and Mousterian complexes which are contemporary.

A genetic link with older sites: Vértesszőlős in Hungary

This site is located in the same geographical area, in Hungary, and has been mainly excavated by L. Vértes from 1963 to 1968. Several travertine layers yielded artefacts, faunal remains, plant remains, fire places and human remains. The human remains could belong to Homo erectus.[50] The palaeoenvironmental data and the radiometric dating suggest that the human occupation took place during the isotopic stage 9, around 350,000 BP. The mammal species are numerous. However, most of them are Bison priscus suessenbornensis, Bison schoetensacki, Cervus elaphus ssp. and Stephanorrhinus etruscus.

The raw materials are varied and most of them could be collected in the alluvial deposits of the Által-ér or on the Pleistocene terraces nearby the site.[51] The rock types belong to sedimentary stones (radiolarites, jasper, opal, flint, chert, lydites, spongilites, marl, limestone) and to metamorphic stones (quartz, quartzite). The stone acquisition are consequently very close to what it is observed in the "Taubachian" sites. Otherwise, a great number of small pebbles have been brought to the site. The pebble average size is between 15 and 40 mm.

Almost 6000 artefacts were discovered in the different levels.[52] Most of them seem to belong to a flaking activity on very small pebbles. However, a lot of pebbles with a few removals lead to discuss about the border between flaking and shaping, especially in ancient collections. This one could not exist for the tool-makers.

The comparison of the technological behaviours between the Vértesszőlős assemblages and the three sites previously studied show numerous common points. It is also the case for Bilzingleben.[53] Do we have evidence of a "genetic link" between ancient and later microlithic assemblages, between human groups who lived in the same area. They are perhaps evidence of a same tradition which is not only related to the work of very small pebbles. These similar trends are: presence of cores with two opposite debitage surfaces (pyramidal section), polyedric cores, pebble shape used for flaking, frequent crossed removals on debitage surfaces, flaking on flake surfaces, cores with a cortical back which cannot just be explained by a technical reason (fig. 10.).

On the other hand, the artefacts analysis give evidence of specific treatments and a more diversified debitage system: abundant broken pebbles (pebble quarter, half pebble, pebble slice), numerous cores with just one debitage surface on the smallest edge or the largest surface of the pebble. The most frequent kind of flaking is organ-

50 Kretzoï–Dobosi 1990.

51 Kretzoï–Dobosi 1990.

52 Dobosi 1983b., 1988.; Kretzoï–Dobosi 1990.

53 Valoch 2000.

ized from one striking platform which is a face of the pebble. The angle between the striking platform and the debitage surface is more or less 80-90°. The removals are unipolar or crossed. Sometimes, from this unique platform, the flaking used a large part of the periphery of the pebble. Mostly, we can still observe the pebble shape on the cores. The removals are consequently less numerous and the flaking seems to be short. Humans had a great quantity of available pebbles. In this case, most of the flakes are cortical flakes, thick and with either a cortical back or an oval section (pebble cortical face). The retouches on the tools are thick and often denticulate.

The Vértesszőlős assemblages show technological rules for flaking but also an opportunistic use of the pebble shapes. Numerous pebble faces are quickly worked to give some blanks and then abandoned after sometimes a voluntary break. Other pebbles are just broken without preliminary preparation and the pebble fragments are used as blanks.

Whatever that may be, a genetic link cannot be discarded among old sites such as Vértesszőlős or even Bilzingsleben, and more recent ones in the same geographical area.[54] Microlithic trends would have to be considered as a human choice, punctually occurring again over time.

Conclusion

If traditions really persist over time within a microlithic world, without environmental explanations (for example, a lack of large pebbles), Neanderthals were able to use very small blanks coming from diverse methods. On the basis of such data, the manner in which they used these small flakes has to be considered, perhaps from a different point of view. Through technological and microwear studies, we have evidence that Neanderthals had a small tool kit, and microwear analysis suggests multifunction even if some tools could be considered as specialized regarding their type of retouches. By their morphology and the types of retouch, the small products can be viewed as the products of any assemblage. However, in the case of microlithic assemblages, the first and main question is the possible way to hold these small blanks and tools. Anthropological analysis of the Neanderthal hand provided evidence that it was more powerful that of Homo sapiens.[55] These artefacts could, thus, simply be held alone at hand. Nevertheless, the morphology and the location of the retouch for most flakes can lead to other hypotheses. In Tata, as in Kůlna or Taubach, numerous flakes are backed, triangular or elongated. They are thick or thin. The tools are rather rare, either side-scrapers or points. The retouch is ordinary and, above all, on one face, on the cutting edge opposed to the back or on the two converging edges. The bladelets are less retouched. The points are often, in the case of Tata, with a partial bifacial retouch, especially located on the base. Various studies on points show that

[54] Mania et al. 1980.; Dobosi 1988.; Kretzoï–Dobosi 1990.

[55] Villemeur 1994.

these ones could be used by hand, as a butchery knive, or fixed in a wooden handle, as a projectile.[56] The retouches are not always the utilized part of the artefact and the flat retouch can be a "shaping" retouch to fix more easily the stone artefact. Consequently, we can imagine that the frequent retouched backed flakes, the unifacial, bifacial or partial points, or the rough bladelets and flakes could be fixed separately or together in a wooden handle, as studies on Mesolithic or Neolithic assemblages suggest. Remains of bitumen on points have been discovered in the site of Umm-el-Tell (Syria), suggesting a usual preparation of hafted points.[57] The common characteristics of the microlithic assemblages with other ones with large flakes could indicate a similar range of use of the artefacts. However, the frequency and the size of the small artefacts could also indicate another relation to the tool kit, requiring flakes in large number, side-scrapers and points in various quantity according to either the activities or the habits.

The many clues for wood use by Neanderthal groups can also be a potential direction of research. These small artefacts could be yet tools to prepare wooden tools, especially when the environmental context is composed of large forest patches. The results of the microwear analysis in Grotta Breuil, yielding a microlithic assemblage related to the Pontinian (Italy), indicate a large number of cutting edges having worked wood.[58] Sharp cutting edges seem to be very efficient to work wood, as well as denticulates, as attested by various ethnographic examples.[59] Sites which yielded organic tools often show an association between wooden artefacts and various stone tools such as partial or total points with uni- or bifacial retouches or side-scrapers on thick flakes (for example, Schöningen or Lehringen, Germany).[60] This association can be seen as functional. In other cases, organic implements are associated with small stone tools (points or side-scrapers on thick and cortical flakes) and large pebble tools (for example, Bilzingsleben in Germany).[61] The production on the Tata site provided very small flakes (10-30 mm long), some micro-choppers (10 to 30-40 mm long) and only some large pebbles. The wooden tools could be complementary to smaller tools in stone for the activities. The Abric Romaní discoveries also show that the wood has not always been used to haft stone tools, but also to organize actions in daily life.[62] Moreover, the great quantity of compressors in assemblages with numerous small artefacts (for example, Bilzingsleben, Vértesszőlős, Kůlna or Tata) indicate a large variety of raw materials used by these humans, and then the likely necessity of using of hard surfaces perhaps to prepare small stone artefact edges.

[56] Beyries–Walter 1996.; Plisson–Beyries 1998.; Shea 1998.

[57] Boëda et al. 1996.

[58] Lemorini 2000.

[59] Leroi-Gourhan 1973.

[60] Thieme–Veil 1985.; Thieme 1999.

[61] Mania 1988b.

[62] Carbonell–Castro-Curel 1992.

While in the eastern part of Europe, the microlithic assemblages are linked with various kinds of sites and fauna in relation to the environmental context, in Central Europe, they are more often associated with hot water springs. Some lucky discoveries could explain it, such as the excellent preservation of remains in the travertine deposits. However, in spite of the current knowledge about sites in this geographical area, this specific location could notice a type of settlement for human groups with a microlithic tradition. It may have provided evidence of original human settlements in favourable areas for animals and vegetation.[63] Mobile human groups could find easy prey regardless to the environment.

Recent biochemical analyses on animal bones suggest that Neanderthals often prefered herbivores, mostly living in open areas, even if sites (in Spain) provide evidence of small prey hunting such as birds.[64] Furthermore, human settlements in northern Europe always provide occupation in a middle forest context, neither in a large woodland environment and nor in a cold one.[65] Neanderthals would not like total forest environment. Actually, most of the microlithic sites in the Central Europe basins, according to the palynological studies and the faunal remains analysis, indicate that the landscape could be a patchwork of both forests and open areas.[66] In this kind of context, Neanderthals could have found a favourable environment for their subsistence and especially a high density of mammals easily available near the water springs. An open landscape was certainly favouring the mobility of the Neanderthal groups. However, the scale of this mobility is impossible to estimate, even if assemblages include some long distance area stones. Researchers suggest that the discovery of these rocks indicates the territory size. Nevertheless, exchanges among human groups or mobile isolated humans could as well explain the movement of such strange objects.[67] Ethnographic studies show that objects move more than humans. From more than 100 km, the long distance area rocks in Kůlna are totally different from the whole lithic assemblage by their shaping, which, in contrary, looks like those of the Tata artefacts. Relations among groups inside Central Europe basins, through geographical gates, are not still demonstrated but artefact exchanges or collecting of extraordinary objects in an extend territory have to be discussed to survey the microlithic assemblages in a spatial point of view. The Tata bifacial points would be, in this case, evidence of traditions and not just functional needs.

The role of anthropogenic and non-anthropogenic factors are now well understood for some of these sites, according to the fauna analysis. Most animal remains are probably the result of a hunting or a human scavenging in the surroundings. Evidence for hunting is plentiful. Some of the Kůlna bones (Cervus elaphus) show human cut-

63 Auguste et al. 1998.; Moncel 2001b.

64 Bocherens et al. 1997.

65 Roebroeks–Tuffreau 1999.

66 Valoch 1988.

67 Moncel–Neruda 2000.; Moncel 2001c.

ting marks[68] and a large part of the faunal remains can be related to a human activity. While Kůlna level II only yields some elephant remains, the Tata assemblage yields young elephant remains as a main component. Unfortunately, these elephant remains are too few to implement a discussion on the evidence of hunting or scavenging. They indicate at least one or several summer settlements. Western site studies suggest that humans do hunted large herbivores such as the Rhinoceros or the Elephant, especially on young animals.[69] Furthermore, the high density of artefacts and bones seems to indicate that humans could have regularly occupied the water spring banks, possibly for hunting great herbivores on a large scale. For example, in Taubach (in Germany), the high frequency of young rhinoceros of 1-1,5 year old (Stephanorhinus kirchbergensis) in the bone assemblage attests an easy prey hunting.[70] On the 62 juvenile animal bones, numerous cut marks have been observed, especially on tibias. The Rhinoceros are associated with Ursus arctos bones which also bear cut marks. Bison priscus, Castor fiber and Cervus elaphus are well-represented but with few bone fragments with cut marks. The Rhinoceros mortality curve does not show a catastrophic profile, and according to B. Bratlund, this is evidence for an active hunting during repeated settlements. It would be the same case in Gánovce with both Elephas antiquus and Dicerorhinus mercki.[71]

If it is difficult to admit that the small tools have been used for hunting, except the points, it is conceivable that they could have been, at least, used for the animal processing. A Levallois point driven into the vertebra of a wild ass has been discovered in Syria, indicating a hunting weapon and a projectile use.[72] However, the point size is larger than the microlithic points from Tata and it is impossible to know if a smaller projectile could have the same effect than a larger one. Aerodynamic studies on stone points from Middle Palaeolithic assemblages suggest, in the state of knowledge, a high penetration at short distance because of their large base.[73] A close distance necessary for hunting implies a particular kind of subsistence behaviour. If the small points have been used as projectiles, it could perhaps explain the choice of water springs to stay, in order to pick up dead or injured animals or to hunt easy preys.

According to the site, the blank categories vary while the processing system remains the same. In Tata, triangular flakes and elongated flakes (laminar flakes and bladelets) are more frequent among the assemblage as in Kůlna or Taubach-Weimar. Bifacial points also characterize the tool kit. A relationship between the debitage and a particular activity can be considered for each kind of blank related to a specific tool, in the presence of a retouch (points on triangular flakes and scrapers on backed flakes or ordinary flakes). It could be attractive to see within these tool types a clue

[68] Valoch 1988.; Zelinova 1998.

[69] Auguste et al. 1998.

[70] Bratlund 1999.

[71] Lozek 1954.

[72] Boëda et al. 1999.

[73] Ellis 1997.; Knecht 1997.

for a larger range of activities and perhaps a more developed hunting in Tata than in the Kůlna cave or the open air site of Předmostí II.[74] The bifacial points or the flat retouch on the blank butt would have been more efficient to haft them. Nevertheless, the idea of a different tradition can no longer be discarded, as the rare bifacial tools in Kůlna suggest. Furthemore, technological studies in the recent years have focussed on the danger to closely associate a flaking method, such as the discoidal method, with a specific activity such as a large hunting and butchery processing.[75] Each flaking method, especially the laminar processing method, is able to produce efficient blanks to treat animal corpses. The toolmakers actually selected among their technical abilities the best processing systems, or several ones, to meet the needs of the human group during a settlement. In Tata, the debitage method used, similar to those in Kůlna, Předmostí II and even Vértesszőlős, certainly attests a large range technological behaviour over space and time, whatever the climatic changes.

At least, some assemblages show that large herbivores with cut marks and evidence of hunting are associated in Central Europe during the OIS 5 and 4 with humans, using in particular microlithic assemblages. The frequent occurrence of these human occupations in water spring locations is most likely evidence of deliberate behaviour of some European Neanderthal groups who knew the extraordinary richness of life and natural resources around the springs. These groups used small pebbles in various rocks and made small tools. Activities could be varied and butchery activities cannot only be related to these settlements in regard to the tool type, the blank variety and, especially, the number of bones broken for the marrow. It is another technological world, intentionally microlithic, with certainly another conception of the tool kit.[76]

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[74] Moncel–Svoboda 1998.

[75] Tuffreau 1993.; Moncel et al. 1998.; Geneste–Jaubert 1999.; Moncel 2001a.

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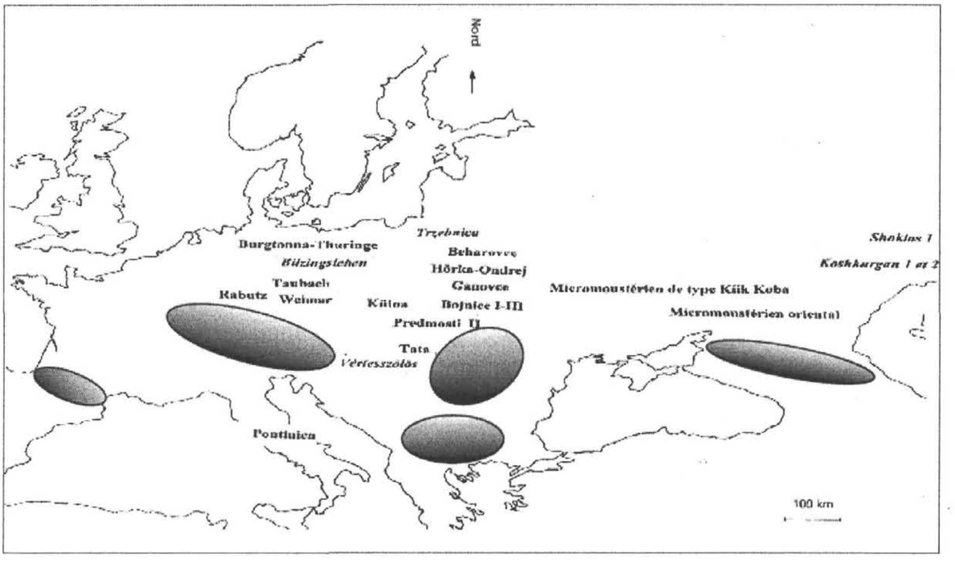

Fig. 1: Microlithic sites in Europe

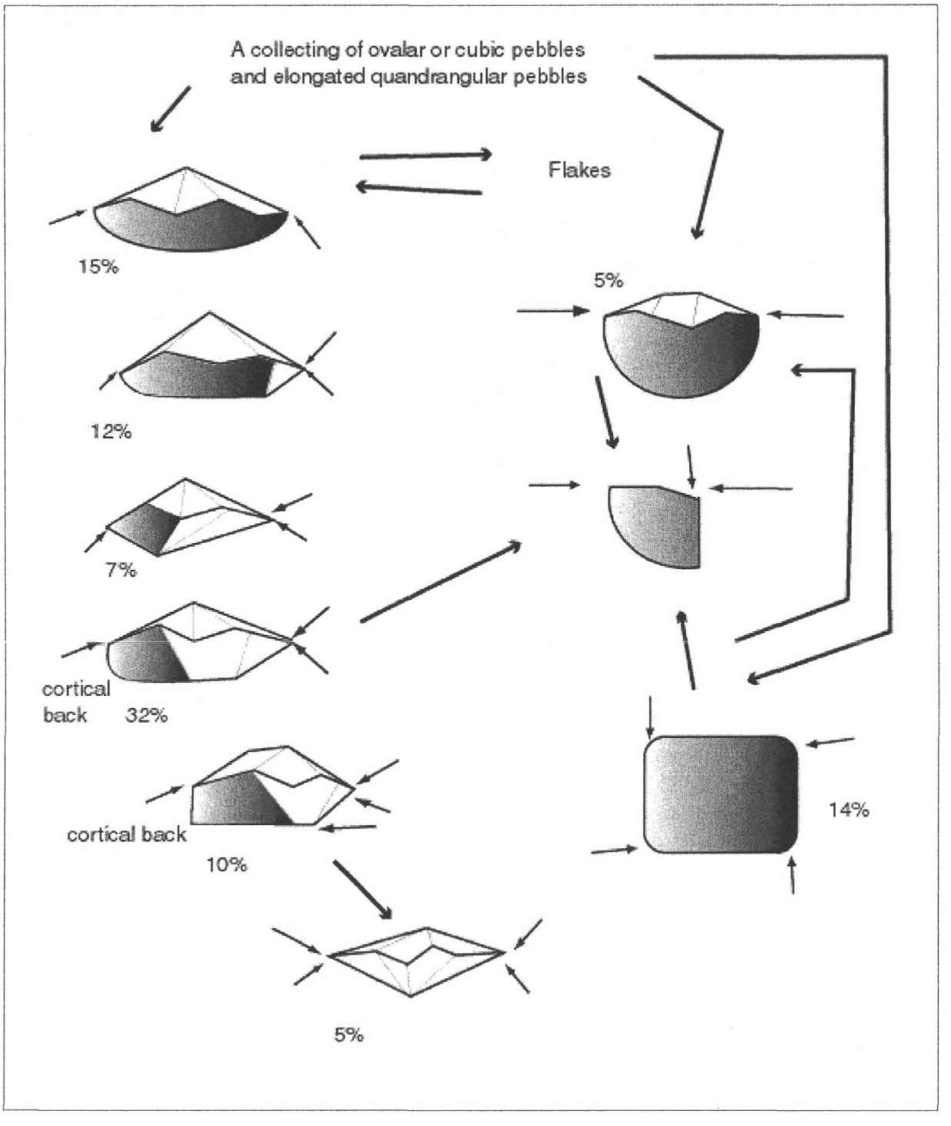

Fig. 2: The processing system in Tata

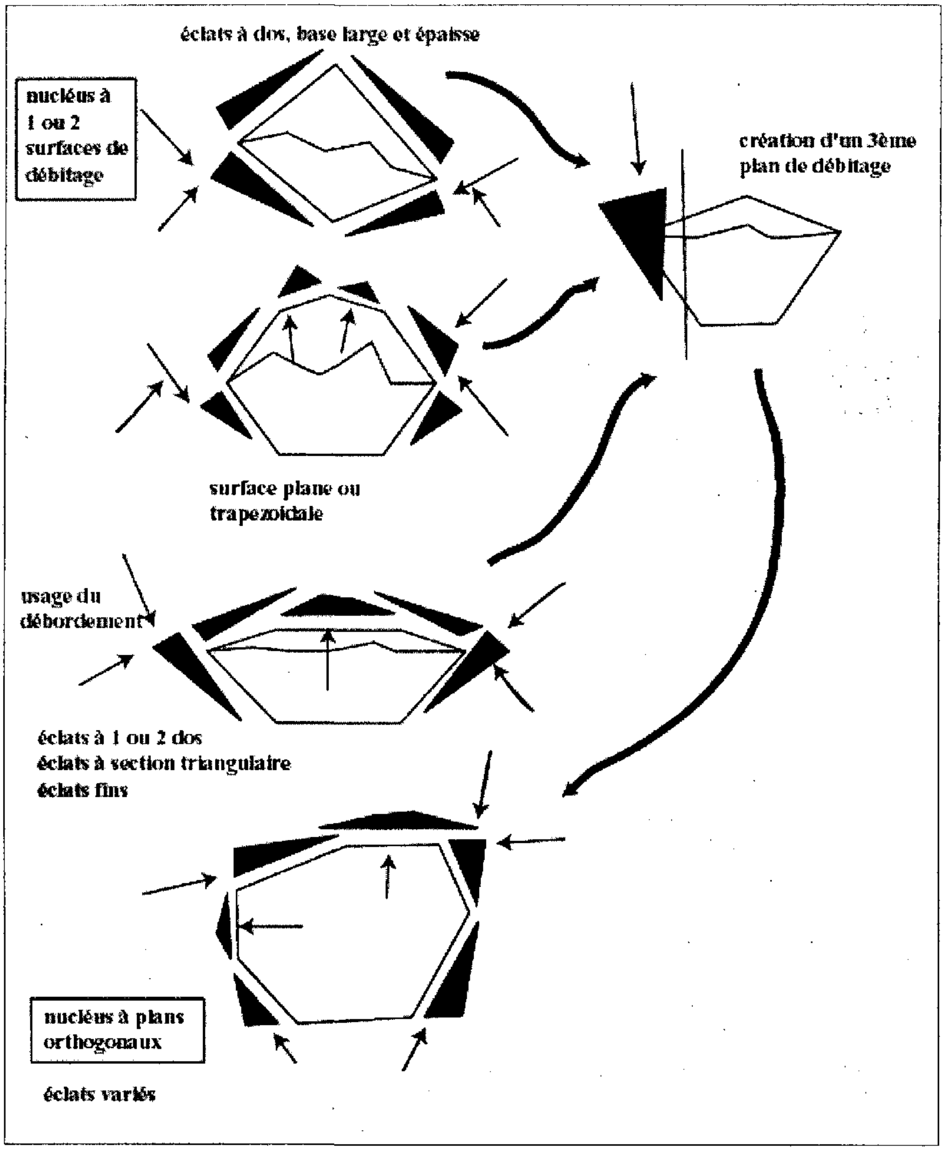

Fig. 3: The processing system in Kůlna

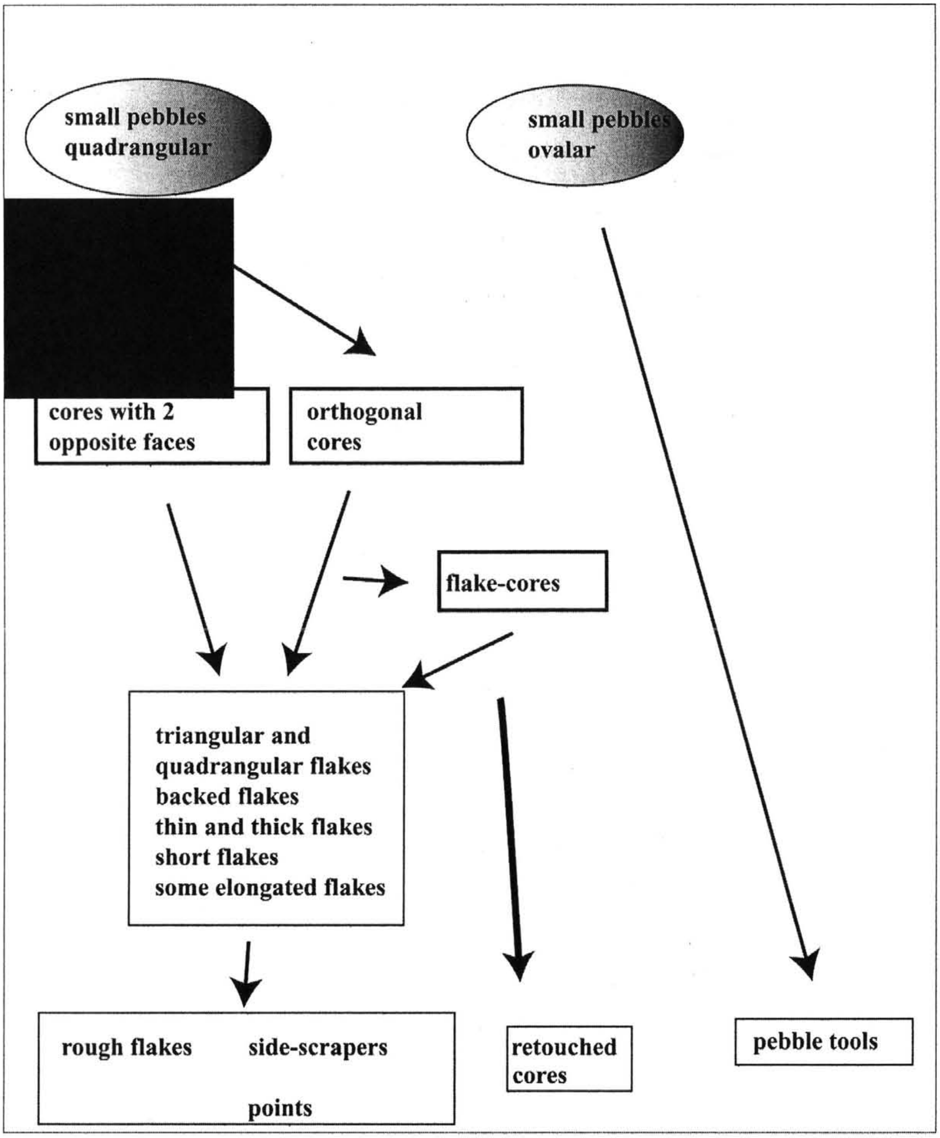

Fig. 4: The technical behaviour in a microlithic assemblage

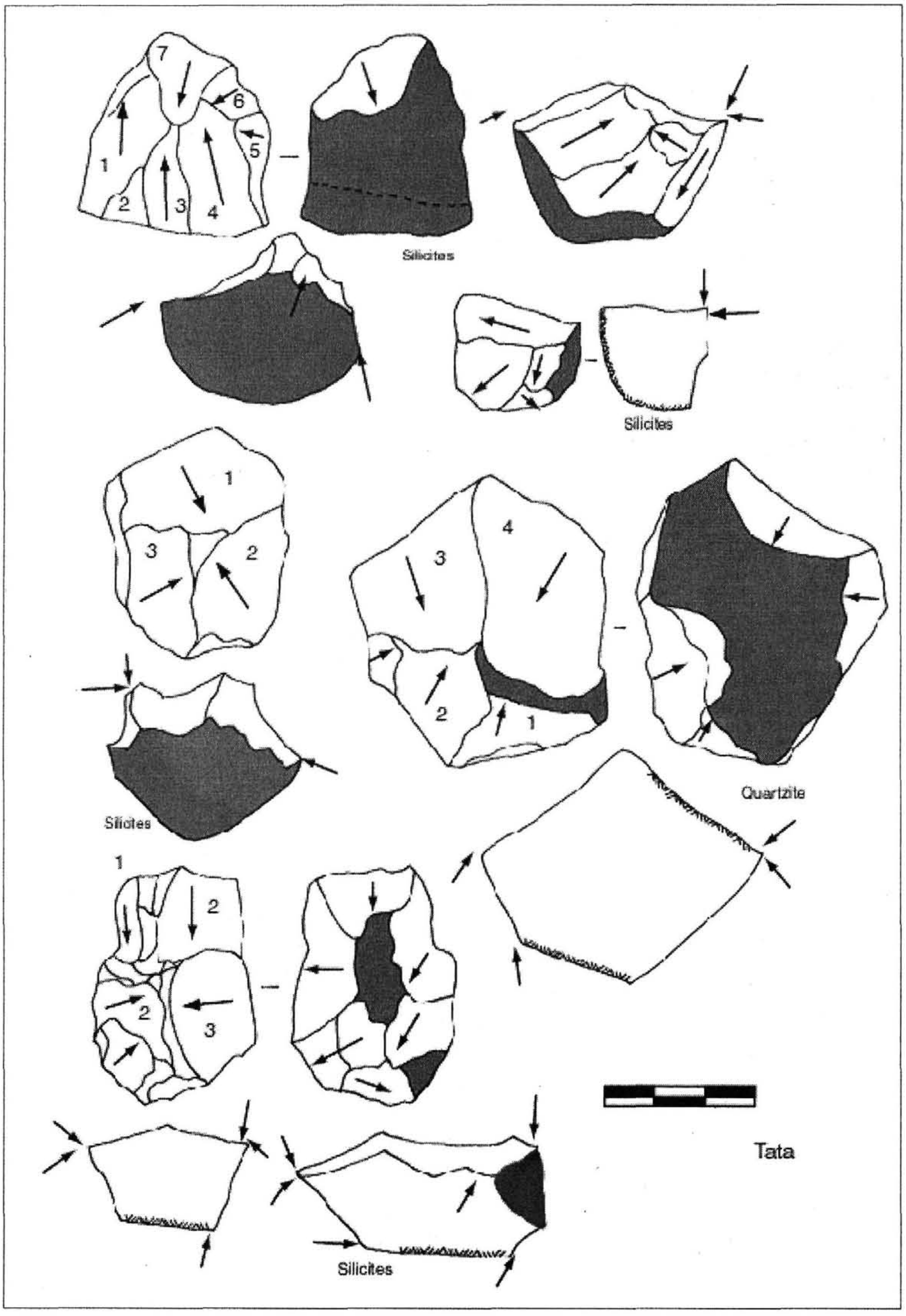

Fig. 5: Tata cores

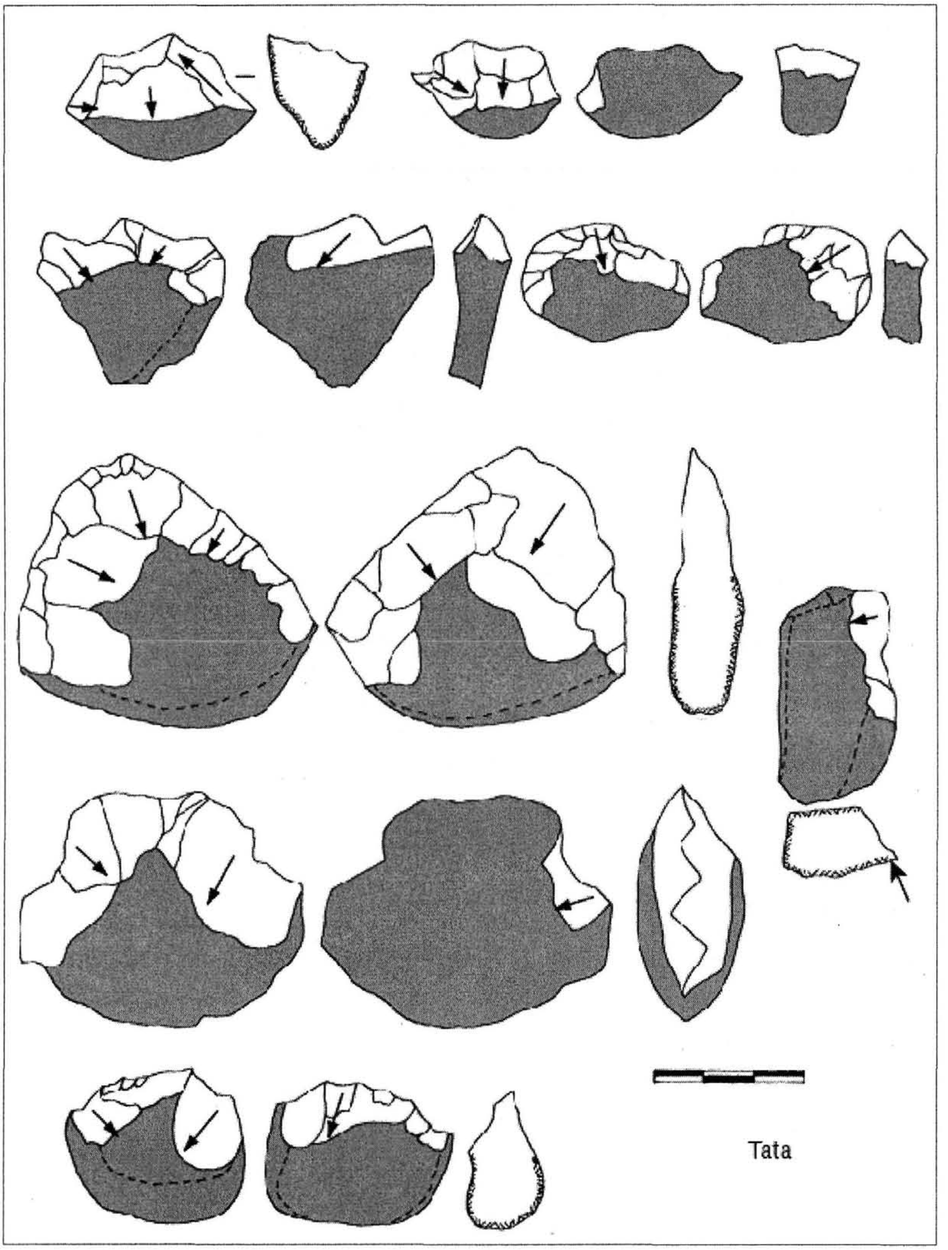

Fig. 6: Tata pebble tools: tools or cores?

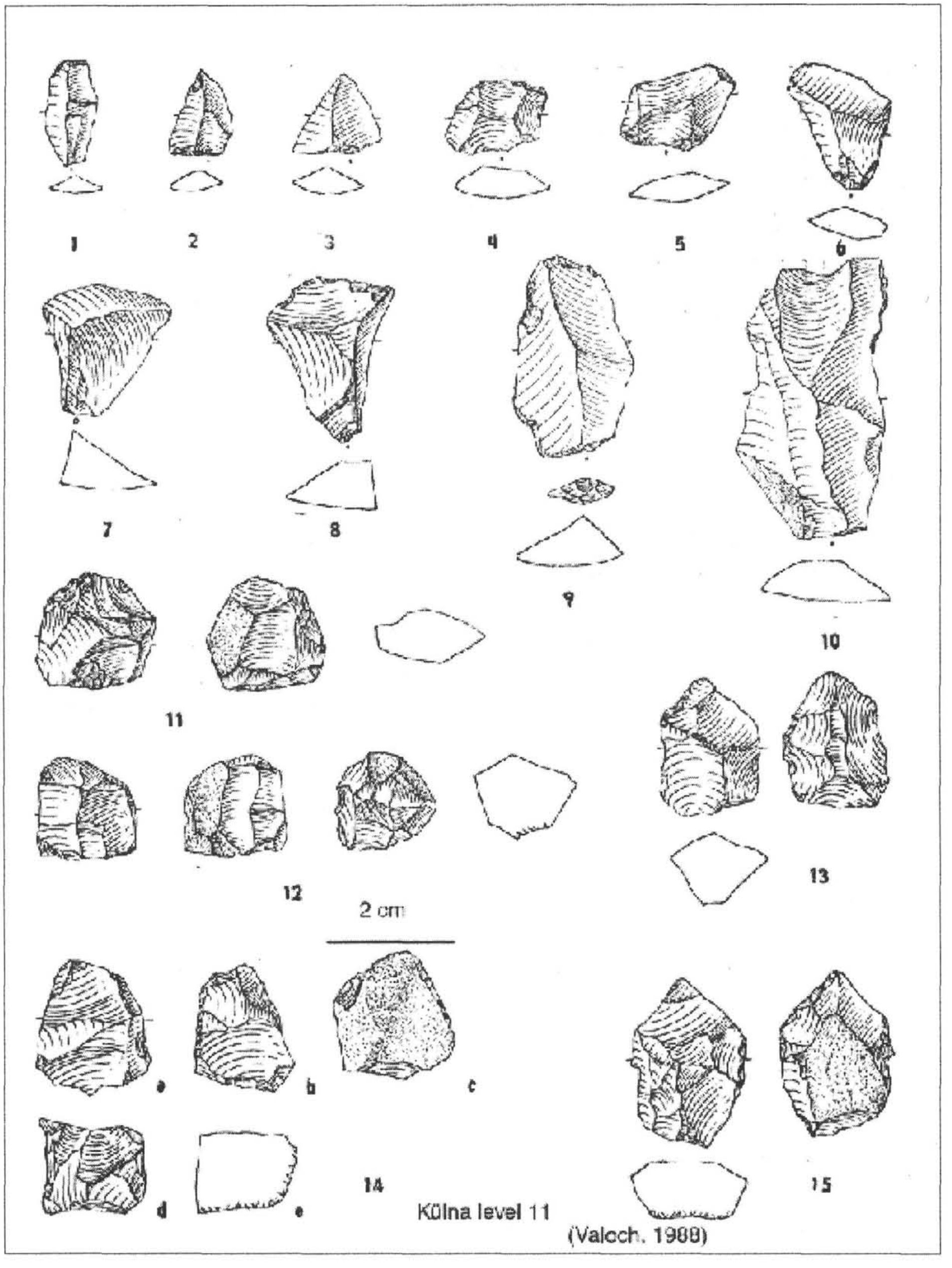

Fig. 7: Kůlna artefacts (Valoch 1988)

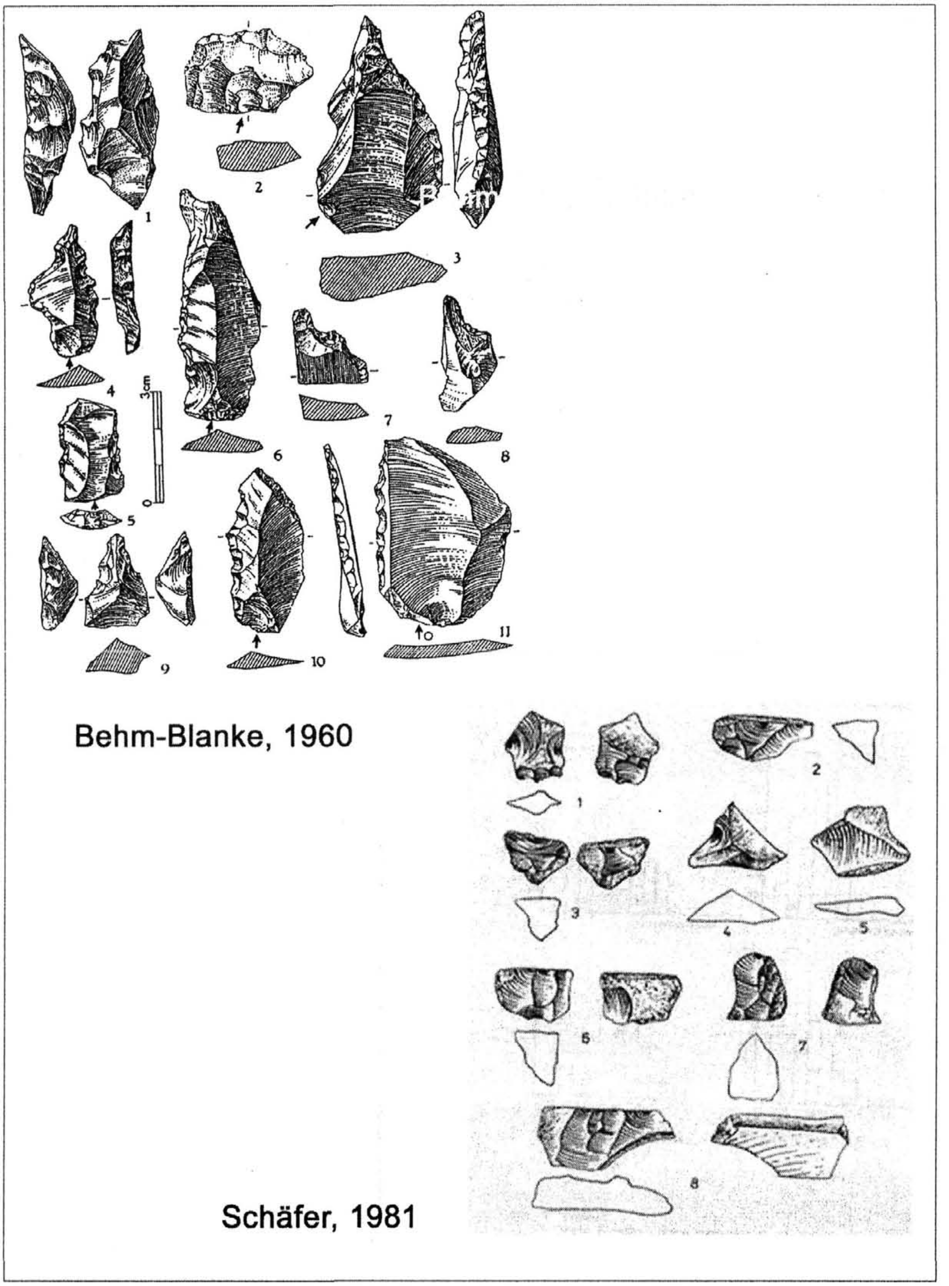

Fig. 8: Taubach artefacts (Schäfer 1981; Behm-Blanke 1960)

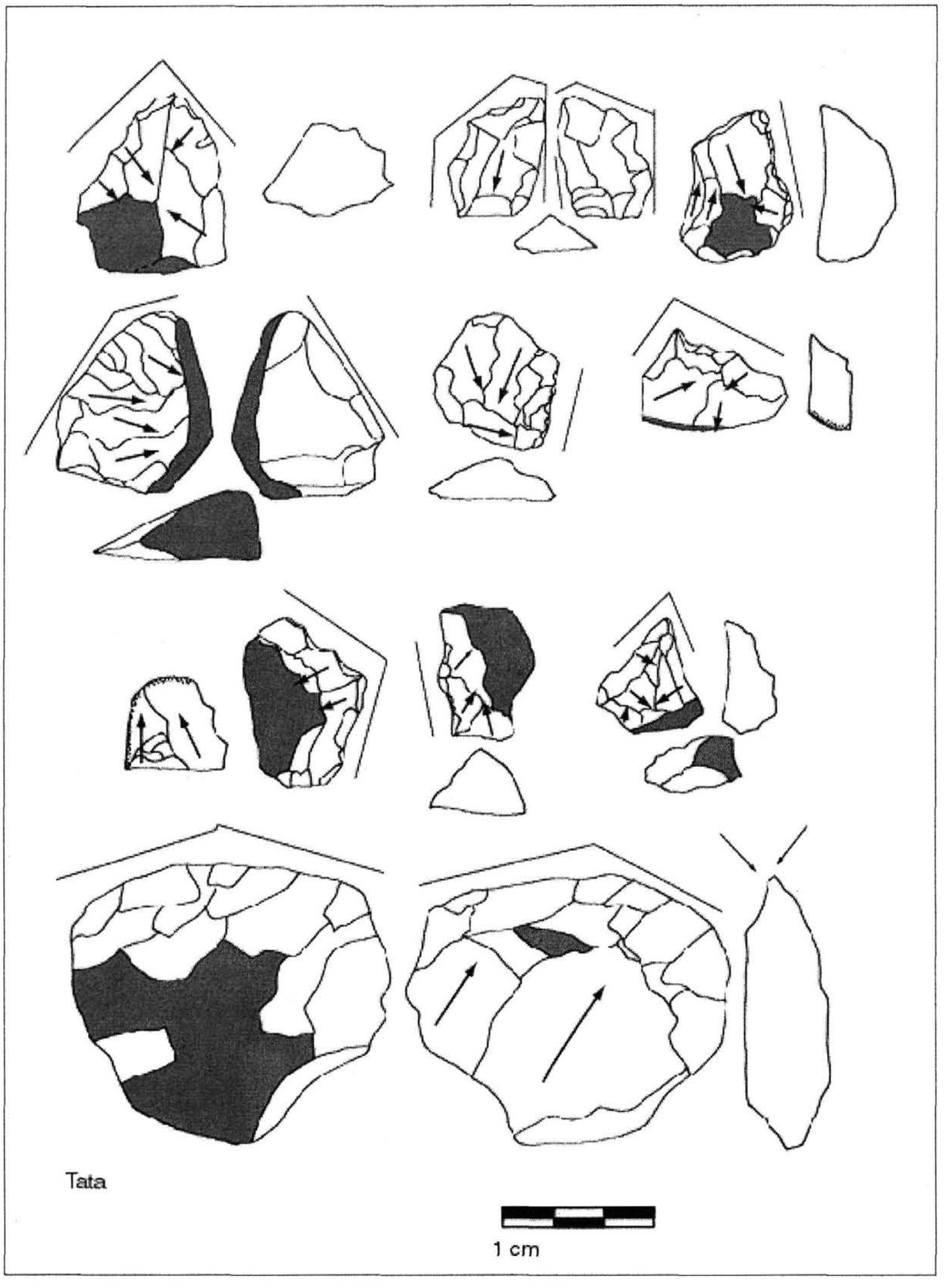

Fig. 9: Tata tools on flakes

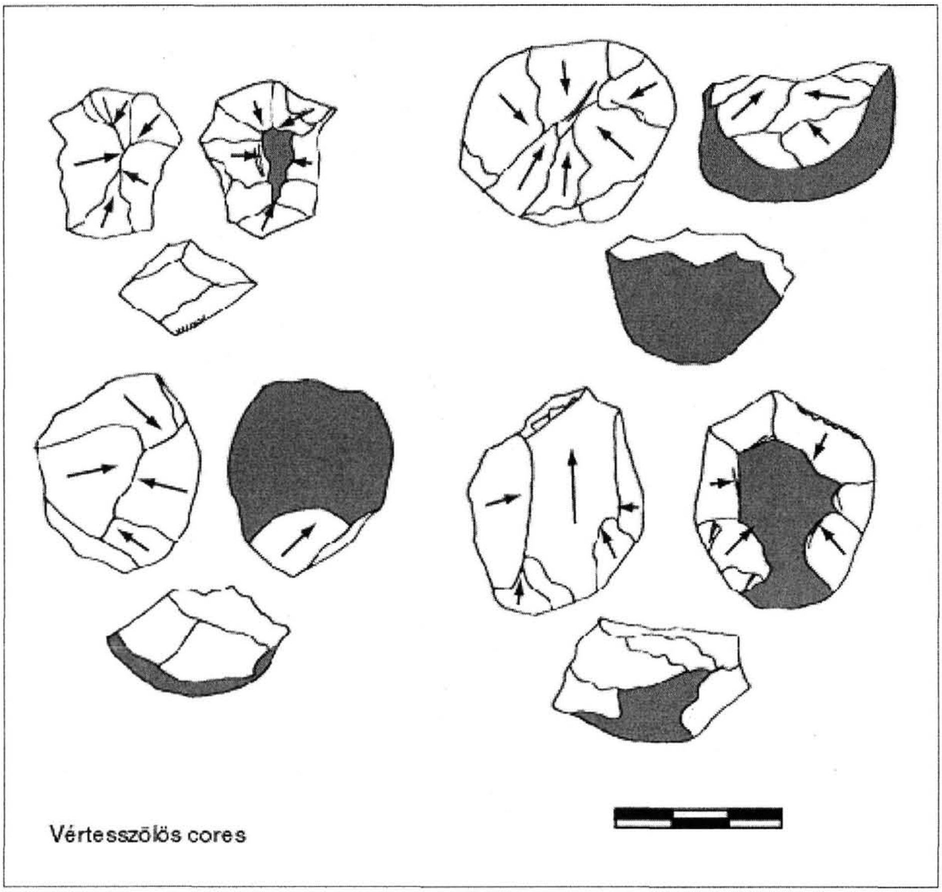

Fig. 10: Vertesszőlős cores

New Evidence of Middle Palaeolithic in South Poland

Jan Michał Burdukiewicz – Andrzej Wiśniewski

Introduction

Recent years were a period of renewed energetic investigation of Middle Palaeolithic sites in South Poland. It is interesting that new discoveries were made in areas which have a long tradition of research (the Krakow-Częstochowa Upland region) as well as in those previously having a poor archaeological record (fig. 1; Lower Silesia). The present article is an attempt at reviewing the latest research results of Middle Palaeolithic sites in Poland.

Results obtained have contributed significantly to our understanding of functional differentiation of open sites. A particularly insightful development was the discovery of sites associated with hunting practices, and the recovery of evidence in a state of preservation which has made it possible to subject them to multifaceted analyses of technology combined with spatial analysis (before now this aspect of Middle Palaeolithic studies in Poland could not be developed more extensively). The present excavations covered sites dated to the time period between Odranian Glaciation (correlated with OIS_8) until the Weichselian interpleniglacial (Grudziądz interstadial—OIS_3). Sites discussed in the present paper were dated with the help of conventional as well as by physical and chemical methods (fig. 2.).

The Middle Polish Complex (OIS_{8-6})

Recent excavations at Biśnik Cave, lying in the region of an eroded limestone outcrop at Strzegowa in the Krakow-Częstochowa Upland region, included excavation of the cave chamber and entrance. Next to the Ciemna cave Biśnik is the only cave site to have produced artefacts dated to the period from before the Eemian. Investigator K. Cyrek distinguished twelve Middle Palaeolithic assemblages (fig. 3.). The oldest finds (assemblages A_5 and A_6) occurred inside layers 16 and 17 of clay. The lower barren layer 18 was dated by U/Th to 280 ka. Combined with the ecological evidence this suggests that the earliest artefacts at Biśnik may date from the cooler period of the Odranian glaciation. According to K. Cyrek, they represent Mousterian assemblages with a participation of Levallois elements and presence of bifacial knives (fig. 4.). The same researcher is inclined to classify the assemblage to the so-called Piekary industry, named after one of the culture horizons at the known site Piekary II.[1] The next assemblage A_4—with elements of Levallois technique—was discovered in a layer of

[1] Krukowski 1939–1948.

light brown clay (layer 15). It comprised just 32 flint artefacts. Climatic and stratigraphic studies show that the layer may have formed during the Lublinian interglacial. Artefacts discovered in the layer of greyish-yellow dusty clay (layer 14) were classified on the basis of typological attributes to Acheulean assemblages with knives (including forms similar to Prądnik knives), with the Levallois technique (assemblage A_3), and are dated stratigraphically to the Wartanian glaciation. K. Cyrek[2] notes that this is the oldest assemblage in Poland with a so-called *"representative group of asymmetrical knives"*.

The next site which produced traces of human occupation dating from OIS_{7-6}, is in Wrocław, Hallera street (SW Poland). It was discovered in 1990 during earthwork. Geological analyses helped to establish that the site occupies a small elevation—fragment of an erosion "terrace" formed during the Odranian glaciation. It's core is built by two till series from the San and Odranian glaciation, separated by fluvioglacial formations. The first stage of investigation at Hallera street, completed in 1992, covered the margin of the elevation joining in the north on the fossil valley. The finds (155 artefacts and over 1000 chunks and isolated bones rested on a secondary deposit, dispersed within several layers.[3] In successive seasons (1995, 2000–2002) excavation extended to the area of the plateau, which lies to the south of the curve of the slope;[4] the area was found to contain a less disturbed stratigraphic sequence with two easily distinguished traces of Middle Palaeolithic occupation episodes (fig. 5.). Artefacts were contained within two neighbouring layers. The lower, recorded as layer 11, was the remains of a moraine pavement and rested on the folded surface of an erosion remnant. Analysis of stratigraphy helped to date the layer to the Lublinian interglacial or, possibly, the Wartanian glaciation. But the stratigraphic dating is not consistent with the recently secured EPR date, which suggests links with the Wartanian glaciation (140±3.9 ka, spoken communication from M. Wencka). The layer was covered by slope sediments (silty mud, sands and gravels) as much as 4 metres thick in places. The sediments originated from the erosion of the uppermost layer of moraine clays of the Odranian glaciation. The layer was found to contain bone remains of fauna, with an over-representation of dentition. We believe that this may be the result of the impact of secondary biostratinomic factors. Animal species identified included the horse *(Equus sp.)*, woolly rhinoceros *(Coelodonta antiquitatis)*, bison *(Bison priscus)*, and *Cervidae sp.*,[5] indicating that humans were exploiting an open (steppe or tundra) environment. The substantial accumulation of bones outside the valley suggests that a part of it could have been associated with hunting practices.

The set of lithic artefacts comprises 687 pieces, including 23 tools. Implements are represented by side scrapers, notched and denticulated, flakes and retouched blades as well as single examples of knives and choppers. Most of them were fashioned from

2 Cyrek 2002, 54.

3 Wiśniewski et al. 1994.

4 Wiśniewski 2001.; Wiśniewski–Kufel 2002.

5 Wiszniowska et al. 2002.

erratic Baltic flint. A number of pebbles were also recorded, used as hammer stones and a stone slab. The assemblage resembles Mousterian inventories. The central area of the site contained the remains of an artefact concentration. The concentration, some 5 meters in diameter, included close to 250 artefacts. Some of them could be refitted into blocks representing production sequences and secondary working (retouch) with some admixture of secondary breaks.

Analysis of technology helped to establish that the cluster represented the remains of a small workshop, where flake blanks were produced. The same area produced traces of test reduction and advanced exploitation, characterised by a longer use of core forms. Advanced exploitation was carried out most often using centripetal method, more rarely, unidirectional method. Reduction was dominated by non-Levallois method (fig. 6a.). Isolated elements and the refittings show perfect command of this method of obtaining blanks (fig. 6b.). Selection may have been limited by a poor supply of raw material or a specific profile of production. We hope to clarify this issue by extending the scope of investigation in the coming season.

Further discoveries were made at Dzierżysław site 1, known from two culture horizons containing leaf points, attributed to the early stage of the Upper or to late cultures of the Middle Palaeolithic.[6] In 1992 underneath layers containing the finds in question, a layer of stratified sandy banded loess yielded a number of flint artefacts (fig. 7.).[7] Earlier, the same layer is known to have produced a single flake.[8] The layer is dated by TL to 180 ± 35 ka. The researchers who discovered the artefacts propose to date them to the Wartanian glaciation (OIS_6) or the preceding Lublinian interglacial (OIS_7). The small assemblage includes a characteristic *Blattschaber* with a slightly convex back and a fragment of a bifacial tool with a coup de tranchet latéral, typical for Prądnik knives. Authors of research believe that the artefacts represent the Eastern Micoquian. This would make them one of the oldest of their kind in Central Europe. It is worth noting that similar categories of tools as in the modest assemblage from Dzierżysław occur also in assemblages classified to the early Mousterian (type Piekary).

The site Pietraszyn 49, found several kilometres to the south-west of Dzierżysław, furnished more numerous finds of bifacial tools.[9] The site lies on the rim of the Głubczyce Heights, on the right-hand slope of the valley of small river Troja. Artefacts (46 items) were found over moraine clay of Odranian glaciation and alluvial sands, under a layer of clays formed in a periglacial environment. Similarly as artefacts from Dzierżysław, the pieces dated from the Wartanian glaciation. Tools included hand axes, knives, two of them Prądnik, a Bockstein, four less characteristic knives, a hand axe/knife, a *Faustkeilblätter* and 4 side scrapers (fig. 8.). Unfortunately, the age of the deposits which contained the finds has not been determined yet.

6 Kozłowski 1965.; 1996.

7 Foltyn et al. 2000.

8 Kozłowski 1965.

9 Fajer et al. 2001.

Authors of research are inclined to link the material with the Micoquian, looking for close analogies to sites such as Mesvin IV.[10]

The same region recently furnished an Acheulean hand axe.[11] The site in question lies in the vicinity of the village of Owsiszcze, in the river valley of the Przykopa, in the upper reaches of the Odra valley (fig. 9.). The specimen was discovered on the eastern slope of the valley of Przykopa. Excavation produced several score artefacts contained in fluvioglacial sediments of the Odranian glaciation, buried under Weichselian loess. It is highly probable that the hand axe had a similar stratigraphic position, which may be related to the Lublinian interglacial, possibly the Wartanian glaciation. The hand axe was fashioned from an oblong nodule of erratic flint. According to the F. Bordes system it represents a variant of amygdaloid hand axes with a blunted base (fig. 9., 10.). Its length, width and thickness are 14.6, 9.6 and 4.2 cm respectively; its weight is 420 g.

A similar specimen was discovered at Konradówka in south-eastern area of the Silesian-Lusatian Lowland. Two other hand axes discovered in Silesia originate from Bohuslavice and Polanka on the Odra (the Czech sites are located at a distance of just 6 to 23 km from Owsiszcze). One of the pieces is a cordiform hand axe, the other a *Faustkeilblatt*. Hand axes from Owsiszcze and Konradówka in their size and shape have close analogies among the large hand axes known from East Germany (Weddersleben, Zschorna and Naumburg).

The North Polish Complex (Eemian, Weichselian—OIS_{5-3})

The largest sequence of layers containing Middle Palaeolithic artefacts from the period coinciding with the Eemian interglacial and the Weichselian glaciation was discovered at Biśnik Cave. Assemblages recorded as A_1 and A_2, detected in layers of sandy clay or loamy sands (13 and 12), included artefacts representing—in K. Cyrek's view—Acheulean assemblages with the Levallois technique. Assemblage A_1 is associated with traces of fire-making (hearth?). Accumulation of the layers in question occurred in a period of temperate and humid climate, while the presence of woodland fauna indicates a link with the Eemian interglacial.

Layers of sandy clay / loamy sands (layers 10–11) contained a small number of finds - assemblage B/C (fig. 11, 1-6.)—which may be a part of the inventory recorded in the overlying stratum. The upper layer 9, and partly layer 8, contained artefacts included in assemblage D. The layers were both sandy clay and loamy clays.[12] According to K. Cyrek,[13] assemblage D has features common with the Taubachian. The layer which contained assemblage D, found at the entrance to the cave, produced traces of fire-

[10] Fajer et al. 2001, 51.

[11] Burdukiewicz 1999.

[12] Mirosław-Grabowska 2002, 169.

[13] Cyrek 2002, 50.

making (remains of a hearth?). The next assemblage—E—consists of no more than a dozen or so lithic artefacts. Pieces included in this assemblage occurred within layer 8.

One of the two younger Middle Palaeolithic assemblages (F_2) is represented by 180 lithic artefacts. It occurred in the zone of transition of stratified sands (layer 7) and underlying clays (layers 8–9). Characteristic tools were represented by knife forms resembling *Prądnik* knives. K. Cyrek classifies the assemblages to the older Micoquian-Prądnikian phase in Poland, comparing it to Wylotne type assemblages.[14] The next assemblage—F_1—included asymmetric knives of Prądnik, Klausennische and Bockstein type (layer 5). The finds were contained within a layer of grey stratified sand. 761 specimens were recovered, including 104 tools (fig. 11, 7-8.). K. Cyrek[15] relates them to Ciemna type assemblages, distinguished some decades ago by J. K. Kozłowski and S. K. Kozłowski (1977, 70–74.). Assemblages F_1 and F_2 were dated on the basis of biostratigraphy to the Brørup interstadial. This dating is supported by UT analysis of bone samples using the EPR method.

One of the more striking discoveries made at Biśnik was a fragment of a structure with a "stone wall", found at the cave entrance in layer 5.[16] The perplexing feature contained a concentration of bone and flint artefacts. The author of research has suggested that this may be the remains of a dwelling structure. It is also interesting that sub-assemblage F_2 included three antler objects with traces of use/wear, all of them resembling "axes" in shape. According to K. Cyrek, one of these specimens showed traces of having been used as a hammer.

More evidence was recovered at the housing district Oporów in Wrocław.[17] Sites A1, A2 and B recorded in the area lie at a distance of just 2.25 kilometres or so in a straight line from the site at Hallera street, situated on the upland margin and the valley of the Ślęza river (left hand tributary of the Odra). The artefacts occurred almost 2 metres below the ground level. Site A1 is situated at the northern elevation of the upland, site A2, containing artefacts in two layers, on the eastern incline of the same elevation (fig. 12.), site B—on the southern side of the elevation. The latter is built of till and fluvioglacial deposits of the Odranian glaciation. Sites Oporów A1 and A2, with a well identified stratigraphy, lie only 170 metres apart. Artefacts from site A1 and the lower level of site A2 formed during a similar period; finds contained by the upper level of site A2 and isolated artefacts from site B are slightly younger. Artefacts representing the older horizon are dated by TL and EPR methods to between 66 and 41 ka; artefacts recovered from the upper level of site A2 and from site B—to about 35 ka. The period may be synchronised with the final stages of the lower stadial (4 OIS) or the onset of the interpleniglacial, which corresponds to interstadials Glinde,

14 Cyrek 2002, 45.

15 Cyrek 2002, 36.

16 Cyrek 2003.

17 Szynkiewicz–Wiśniewski 1994.; Wiśniewski et al. 2003.

Oerel and Moershoofd (OIS_3). If these dates are right they challenge the concept of "depopulation" of areas to the north of the Carpathian and Sudeten Range during the pleniglacial and immediately after ($OIS_{4/3}$).[18]

Site A1 furnished 51 flint artefacts, including seven tools. The latter group—apart from a side scraper and an implement fashioned from a core—included forms with marginal retouch. The lower level of site A2 is represented by 101 flint artefacts, including eight tools (fig. 12.). The latter were poor in diagnostic forms. The upper level of site A2 contained 50 artefacts, including six tools, similarly non diagnostic as in the older level. Site B furnished isolated finds in the form of a side scraper and a flake. All the objects were fashioned from erratic flint. In the light of typological data it is difficult to classify the described collections to any of the taxonomic unit of the closing stages of the Middle Palaeolithic or to so-called transitional taxonomic units.

The artefacts were accompanied by the remains of steppe-tundra fauna, including the mammoth *(Mammuthus primigenius)*, woolly rhinoceros *(Coelodonta antiquitatis)*, horse *(Equus sp.)*, and reindeer *(Rangifer tarandus)*, as well as fish species, including pike *(Esox lucius)*. The lower level of site A2 contained also traces of juniper charcoal *(Juniperus sp.)*. At a distance of about 200 metres to the south of site A2, during the older and the younger occupation phase alike, there had been a number of undrained lake reservoirs with *Nuphar, Nymphaea, Sphagnum, Sellaginella selaginoides* and *Pediastrum* vegetation. Mineral-organic sediments of the reservoirs retained traces of animal bones from the same game species as occurred together with the lithic artefacts, except the reindeer and remains of fish, including pike-perch *(Stizostedion lucioperca)*. Pollen and macroscopic plant remains recovered from the lake sediments indicate that the older phase of occupation was associated with a slightly warmer climate. Palaeobotanic data suggests the occurrence of zones typical for this type of ecosystems. One of them was formed by a humid littoral and sublittoral zone, another—a zone of dry terraces which contained the concentration of artefacts, and a third—a ridge rising between the valleys. Evidence from Oporów, similar to the known remains from Zwoleń near Radom,[19] is an example, unique in Poland, of exploitation of lower terrace levels by the people of the Middle Palaeolithic.

The last glaciation is a period to which it is possible to associate the fragment of an assemblage discovered in the SW area of the site at Hallera street in Wrocław.[20] Artefacts occurred on the surface of layer 11, one covering the earlier discussed material from the period of the Middle Polish glaciations, and in the floor of the silty mud layer 16 covering the moraine pavement. Basing on the results of archaeometric EPR analysis of bone remains the age of the level was estimated as around 50 ka (information from M. Wencka). At the same time stratigraphic analyses do not rule out an even older dating for the discussed culture level (Eemian interglacial, onset

[18] cf. Chmielewski 1970.

[19] Schild et al. 1988.; 2000.

[20] Wiśniewski 2003a.; 2003c.

of the Weichselian glaciation). The artefacts formed an uneven arrangement with observable concentrations having the nature of anthropogenic clusters. Artefacts originating from these clusters subsequently could be refitted into blocks. The largest of them contained 48 specimens.

The area around the lithic material produced finds of highly fragmented bone and teeth of game fauna, representing the mammoth, *Mammuthus primigenius*, and horse, *Equus sp.* During the 2002 investigation of the eastern area of surface I/02 uncovered a concentration of bone remains of two bisons *(Bison priscus)* (information from K. Stefaniak). This accumulation was possibly linked to human activity. Preliminary palynological analysis of the silty mud layer (information from T. Kuszell) helped to determine plant species composition typical for open plant communities.

The set of artefacts recovered in 2000–2002 includes 581 specimens, 15 of them tools. Except for a handful, the artefacts were fashioned from erratic Baltic flint. A number of isolated hammer stones from coarse-grained crystalline rock were also discovered. Material used in production included large lumps, and their fragments originating from the disintegration of blocks of erratic flint. It is unclear whether this fragmentation was the result of accidental disintegration caused by a blow, or of intentional activity. In the discussed case no evidence was found of testing the raw material such as was observed on the lower level, it is unclear nevertheless, whether this phenomenon had a functional basis or was dictated by a different technological approach.

The content of the cultural artefact concentration indicates that at least two types of flint working were used. One of the smaller clusters (with an area of around 0.8 m^2) represents the remains from the reduction of two small cores. One of these, after its striking platform and the flaked surface had been shaped, was taken out of the investigated area. The other cluster, the largest of the studied ones so far (with an area of 2 m^2—some 160 artefacts) contained traces of tool production using the shaping method (fig. 13.). One of the tool fragments as well as a part of the concretion were most probably taken outside the area excavated so far. An area some distance away from the two flint concentrations produced a tool with a fitting fragment of a chip, indicating attempted retouch. The rest of the area was found to contain other, smaller, concentrations, containing up to 30 artefacts. Unfortunately, the western part of the excavated area had suffered substantial damage as a result of dislocations of unstable banding and excavation, causing gaps in our understanding of the way the site was exploited during the Middle Palaeolithic.

Basing on the material, especially the refitted blocks, it is possible—despite the fairly small selection of artefacts—to determine the main lines of tool production. The first of them involved modification of flake blank. Flakes were obtained using methods lacking evidence of application of advanced preparation techniques. The technique of hard hammer was used. Methods used included: centripetal unifacial, atypical unidirectional and bidirectional, as well as multidirectional cores. The obtained debitage was small sized. The flake tools are mostly marginally retouched, being represented by denticulated pieces or notched tools, side scrapers as well as retouched flakes and blades. The other line of flint working was associated with production of tools from chunks and concretions using the shaping method. The achieved forms were larger in size. Tool forms included choppers, a side scraper or a fragment of a point (fig. 14.) as well as a unifacial knife. The two methods of production did not overlap, and from the ratio of the two groups of retouched tools it may be seen that the tools produced by shaping in the investigated part of the site may have been used with a higher frequency.

Further evidence was recovered from a site studied in 1998–1999 by K. Sobczyk and V. Sitlivy, at ks. Józefa street in Krakow, Zwierzyniec-Salwator. The site lies on the northern incline of the Vistula valley, within the Krakow Gate (Brama Krakowska). Preliminary geological studies determined the presence of three series of deposits: cover loess, silty mud overbank deposit and channel sands (fig. 15.). The terrace containing the lower level (series III) is dated to the early Weichselian or the lower pleniglacial. Series II containing the middle and the upper culture assemblage is dated to the interpleniglacial. Series II was found to contain artefacts from the Upper and the Middle Palaeolithic, referred to as the upper culture level (16 specimens). Authors of research maintain that the artefacts of the upper level formed "ephemeral" or "peripheral" sites with singe isolated artefacts—products of flake and blade debitage with a participation of non retouched blanks of Upper and Middle Palaeolithic type. Series III contained two culture levels—the middle (1560 artefacts) and the lower (248 artefacts). The middle complex is being related to the blade technology of Upper Palaeolithic type from the Middle Palaeolithic, while the lower is a Middle Palaeolithic assemblage. Both occurred within sediments of the channel facies. Most probably the river terrace had been formed before the early Weichselian and the lower pleniglacial. The middle horizon represented, according to the authors of research, the remains of a flint workshop or a zone of debitage, and contained numerous blades and a number of tools and blades with traces of use wear. At present this is the largest blade assemblage from the Middle Palaeolithic in Central Europe. Basing on its analysis the authors were able to determine in preliminary manner differences in the methods of core exploitation. Six methods were identified, beginning with unidirectional exploitation, ending in prepared bidirectional cores (fig. 15).[22] The lower complex, having a similar functional significance as the middle level, furnished for the most part flake products with some participation of blade tools and rare tool forms in Middle Palaeolithic context.

Also worth mentioning is the renewed investigation of site Piekary IIa (Okrążek Hill). In 1998–1999—following a break of almost two decades—a survey was carried out, helping to specify in greater detail the quality and duration of blade methods in assemblages of the Middle Palaeolithic.[23] It was established that traces of using these methods are present in three late Middle Palaeolithic layers: 7a (loess with traces of cryoturbation), 7b (sandy loess or loam) and 7c (stratified sands), rather than being contained, as suggested previously, in just one layer. A trench was cut in the vicinity

[21] Sitlivy et al. 1999a.

[22] Sitlivy et al. 1999a, 98–99., fig. 23.

[23] Sitlivy et al. 1999b.

of the area investigated by W. Morawski, to re-examine the cross-section and secure numerous samples for chronometric analysis.

The results of dating of burnt flints from layer 7a with the TL method indicate their period of formation as between 35.6±2.6 and 46.3±3.6 ka, with a weighted mean of 38.5±1.9 ka.[24] The data helps to narrow down the dating of the decline of Middle Palaeolithic blade industries in this part of Europe, confirming at the same time the dating of the so-called transition to the Upper Palaeolithic.

Final remarks

The most recent Middle Palaeolithic research in Poland has been helpful in refining some of the data on settlement chronology. The first traces of Middle Palaeolithic industry in Poland recorded at Biśnik Cave (Strzegowa) probably date from the Odranian glaciations (correlated with OIS_8). As such, they predate the oldest finds of Middle Palaeolithic character recorded previously (excepting unstratified artefacts) datable to a slightly later period—$OIS_{7\ and\ 6}$.[25] Similarly, the discussion on the closing stages of the Middle Palaeolithic, in the light of recent research, has taken on a new meaning. Renewed investigation of Piekary IIa (layers 7a, 7b and 7c) helped to establish the age of Middle Palaeolithic industries to ca 38 ka. Studies carried out at at Wrocław–Oporów sites A1 and A2 (lower level) confirmed the functioning of industries with Middle Palaeolithic attributes during the interpleniglacial.

Recent research also generated new data, some of it on technology. The better preserved remains from Hallera street, Wrocław, and from ks. Józef street, Krakow (middle level), made possible technological studies on the basis of refitting blocks. Basing on the material recovered in Wrocław it was possible to identify flake production showing non-Levallois features as well as traces of mixed production (reduction + shaping); evidence from Krakow provided a basis for reconstructing blade exploitation of Upper Palaeolithic type in Middle Palaeolithic assemblages.

It is also worth mentioning that new evidence was added to the existing taxonomic model: Acheulean (Owsiszcze, Biśnik), Mousterian elements, including Piekary type assemblages (Wrocław, Hallera street, Biśnik), and collections recalling assemblages of the so-called Wylotne and Ciemna type (Biśnik). One of the most discussed issues is the identification of Micoquian elements dated to the penultimate glaciation, both at open air (Dzierżysław 1, Pietraszyn 49), and cave sites (Biśnik).

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[24] Mercier et al. 2003.

[25] cf. Burdukiewicz 2003.

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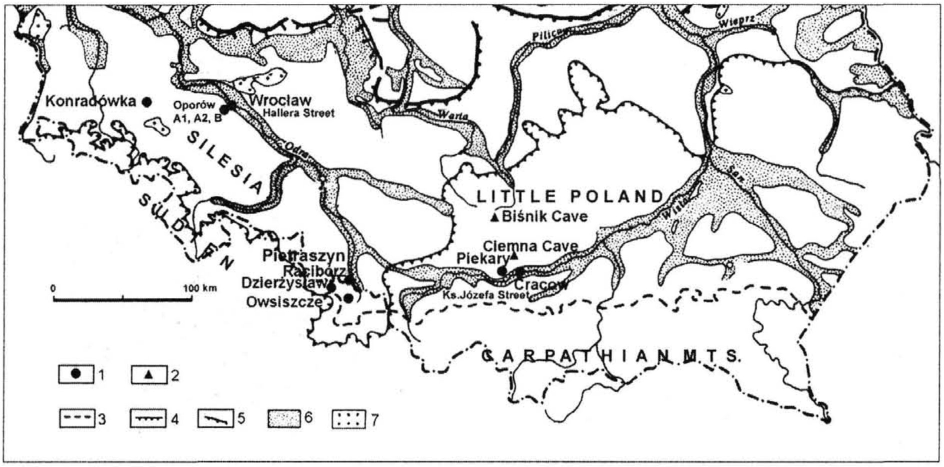

Figure 1. Middle Palaeolithic sites excavated recently in Poland: 1 – open air sites, 2 – cave sites, 3 – San glaciation, 4 – Odranian glaciation, 5 – Wartanian glaciation, 6- ice marginal valleys, 7 – sandurs

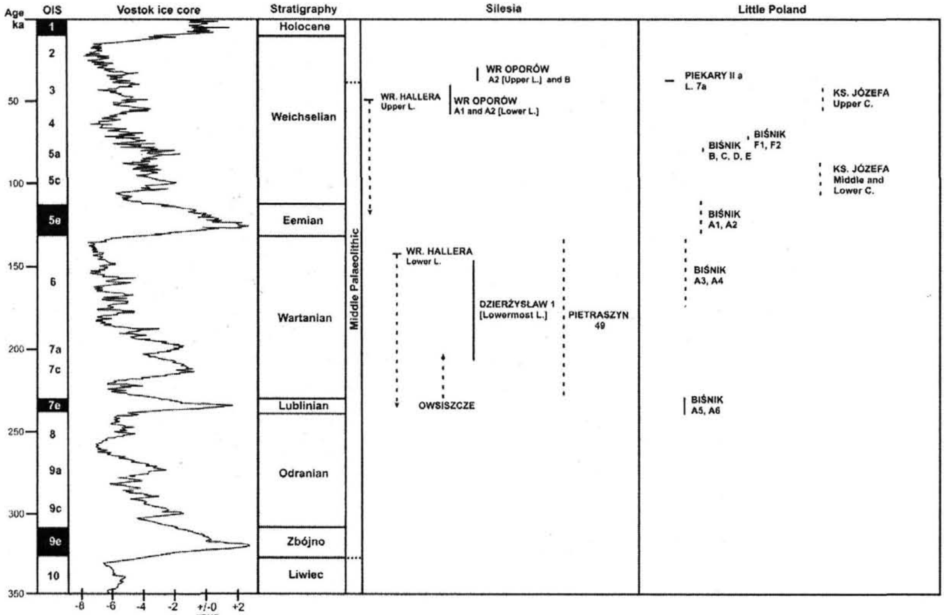

Figure 2. Chronology of Middle Palaeolithic sites discussed in the article

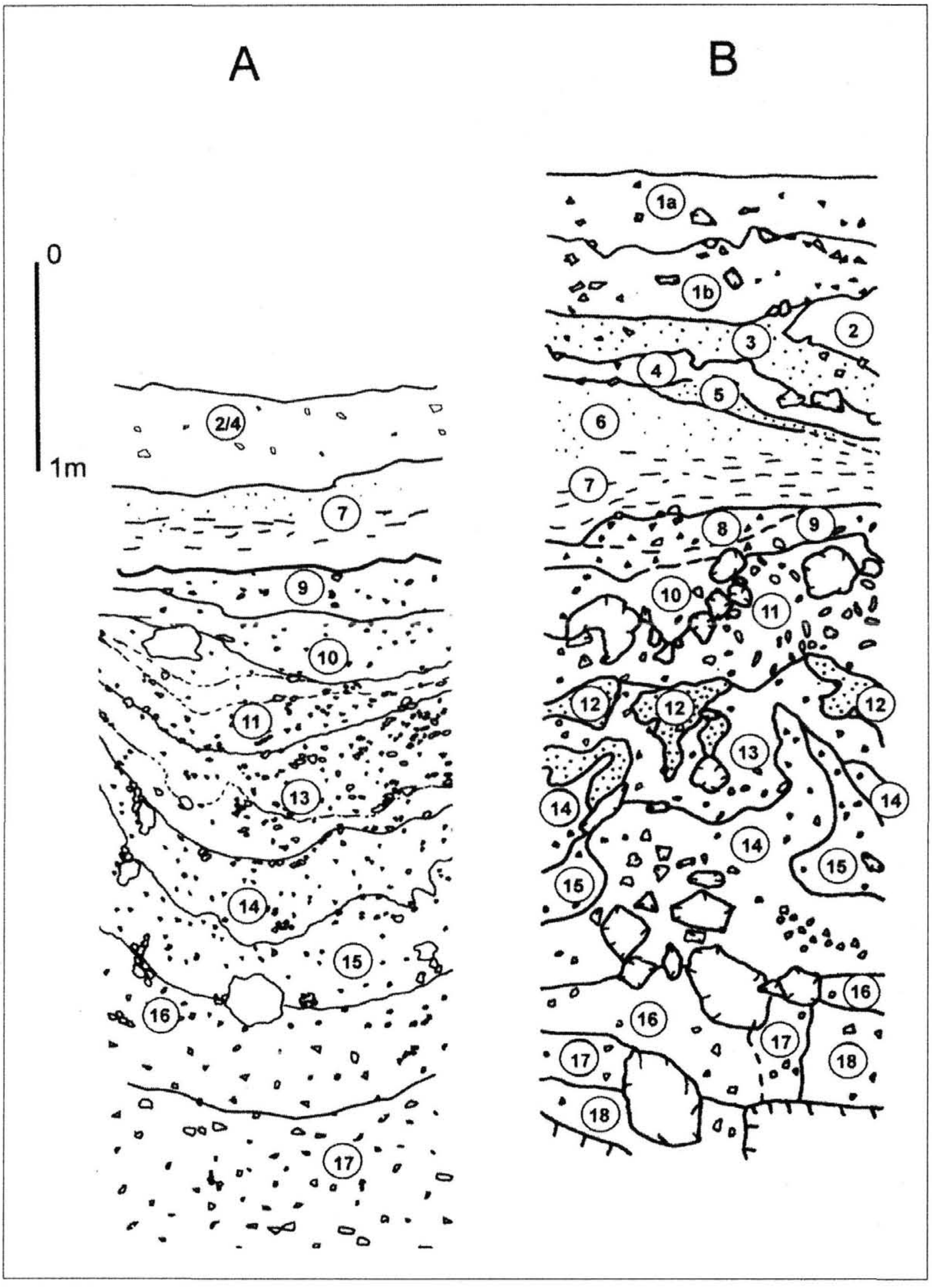

Figure 3. Biśnik Cave – stratigraphy: A – cave; B – rock shelter
(according to Mirosław–Grabowska 2002.)

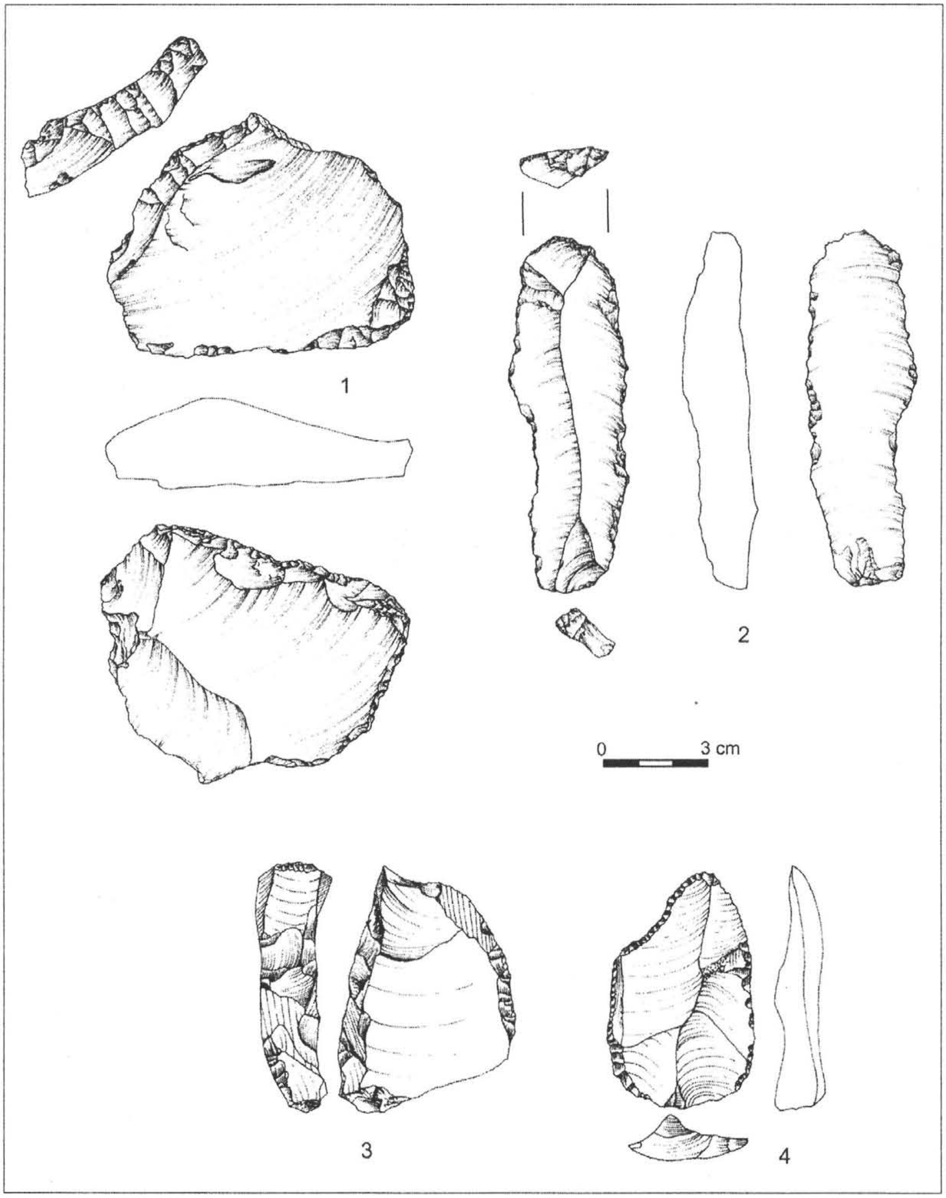

Figure 4. Biśnik Cave. Assemblage A_5. Selected artefacts: 1 – retouched Levallois flake; 2 –retouched blade; 3 – knife; 4 – retouched Levallois point (according to CYREK 2002.)

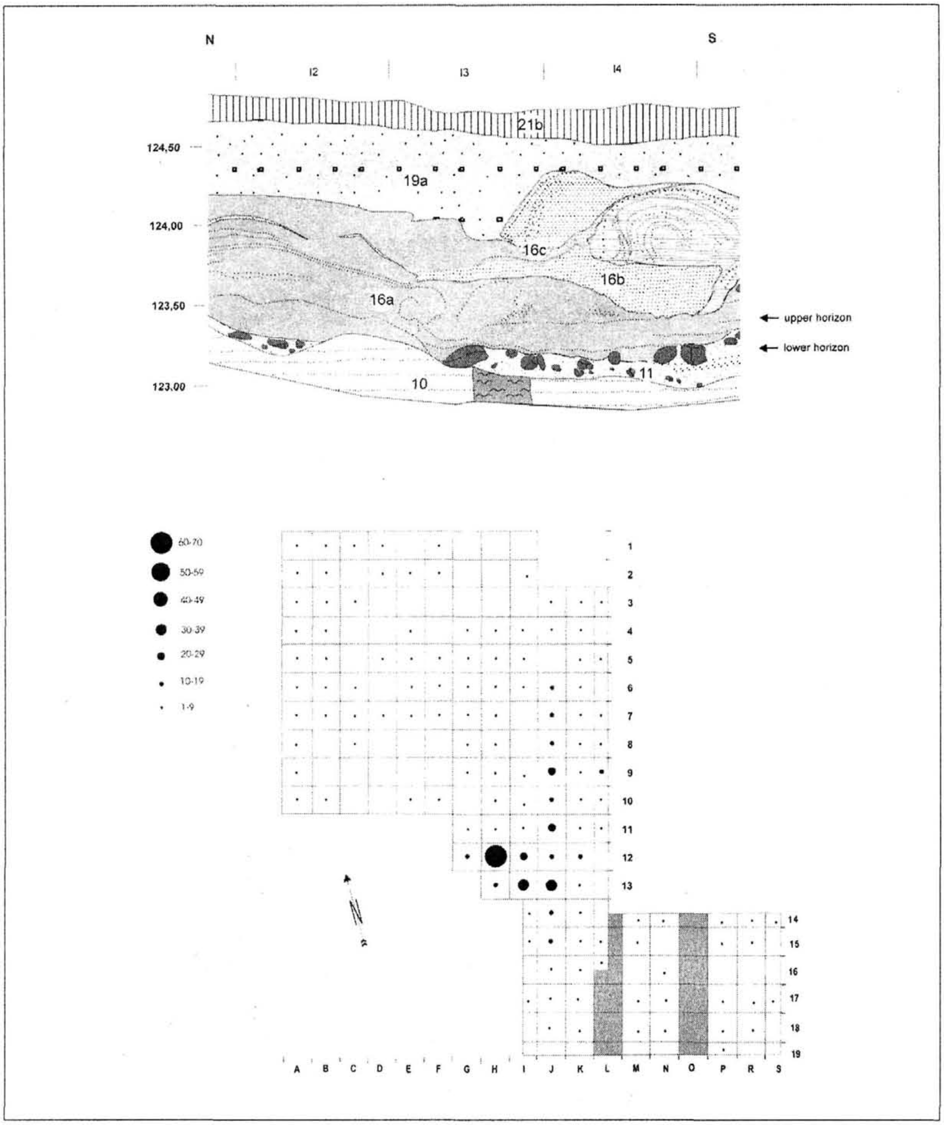

Figure 5. Wrocław, Hallera street, site 1: above - fragment of the eastern section of trench I/2000: 10 – fluvioglacial deposits; 11 - residual moraine boulders with addition of sands and gravels; 16a – till and fine grained sands with artefacts of upper horizon in the lower part of the layer; 16b – gravels and sands; 16c – gravels, sands and tills; 19a – sands and gravels; 21b – present soil; below – density of lithic artefacts at the lower horizon. Unexcavated areas are stippled in grey.

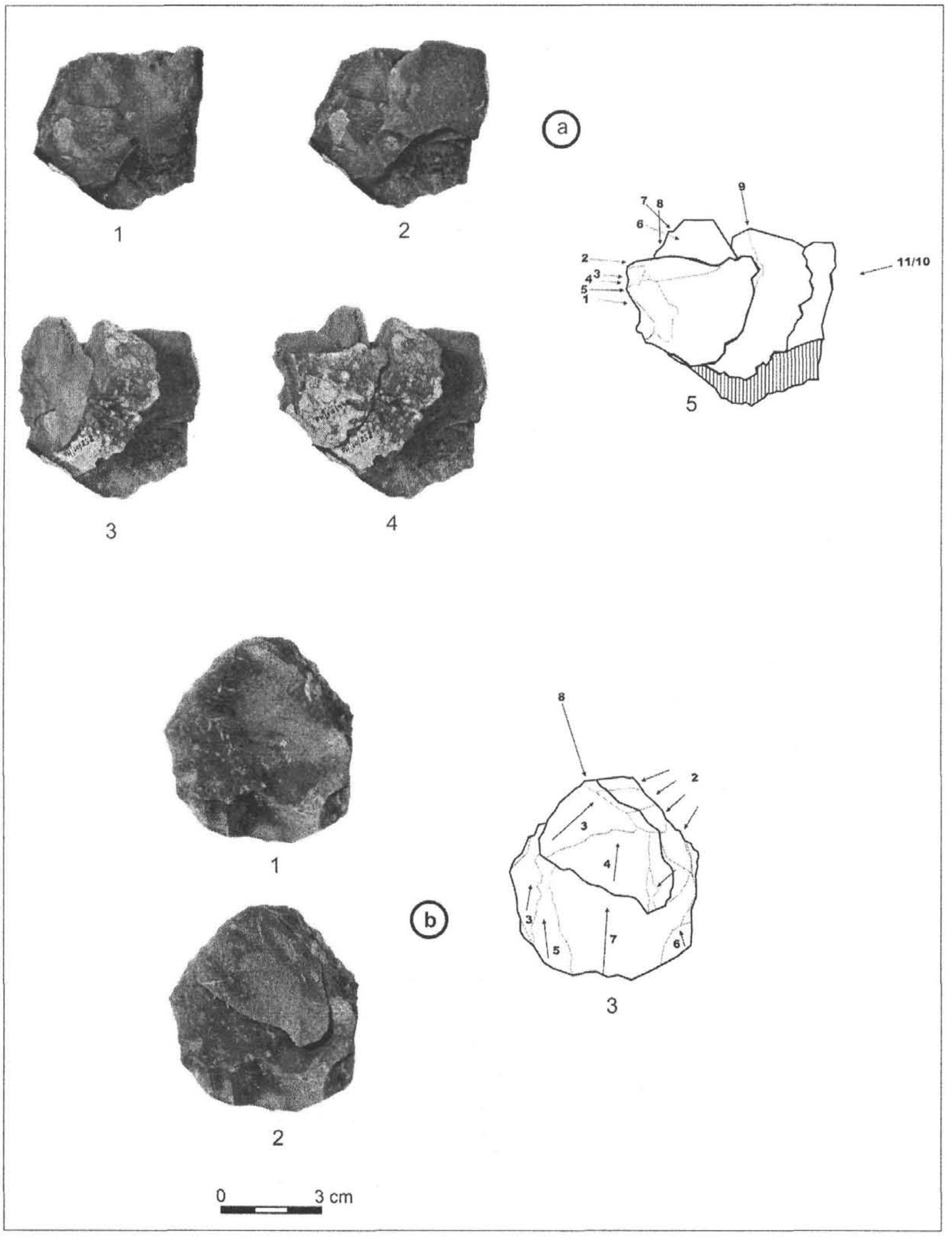

Figure 6. Wrocław, Hallera street, site 1. Selected refittings of cores and flakes:
a – block l, 21; b – block u/l 9

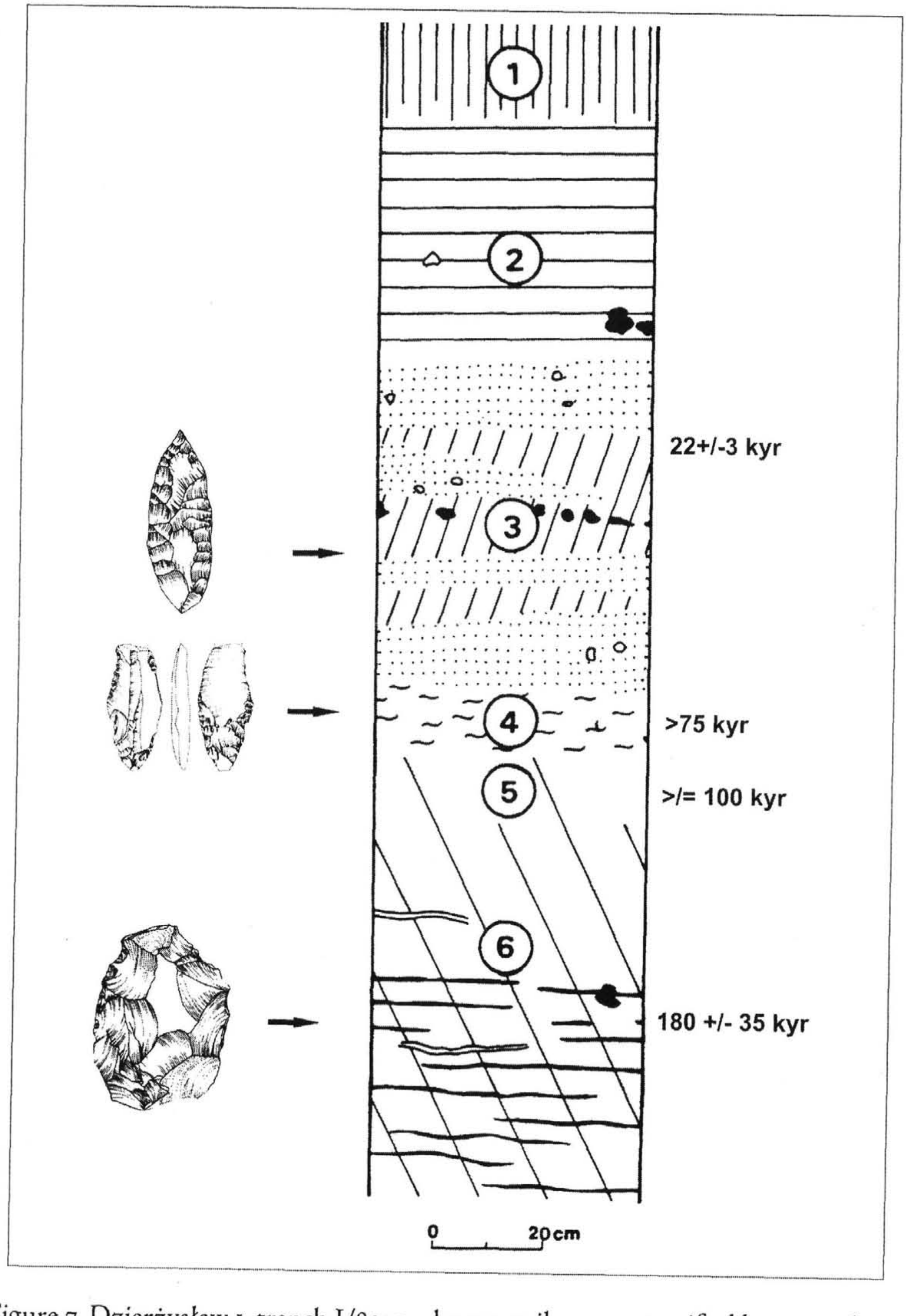

Figure 7. Dzierżysław 1, trench I/89: 1 – brown soil; 2 – unstratified loess; 3 – layer of solifluction with sand, gravel and loamy material; 4 – pseudo-gley soil; 5 – stratified loess; 6 – banded loess (according to BLUSZCZ et al. 1994.)

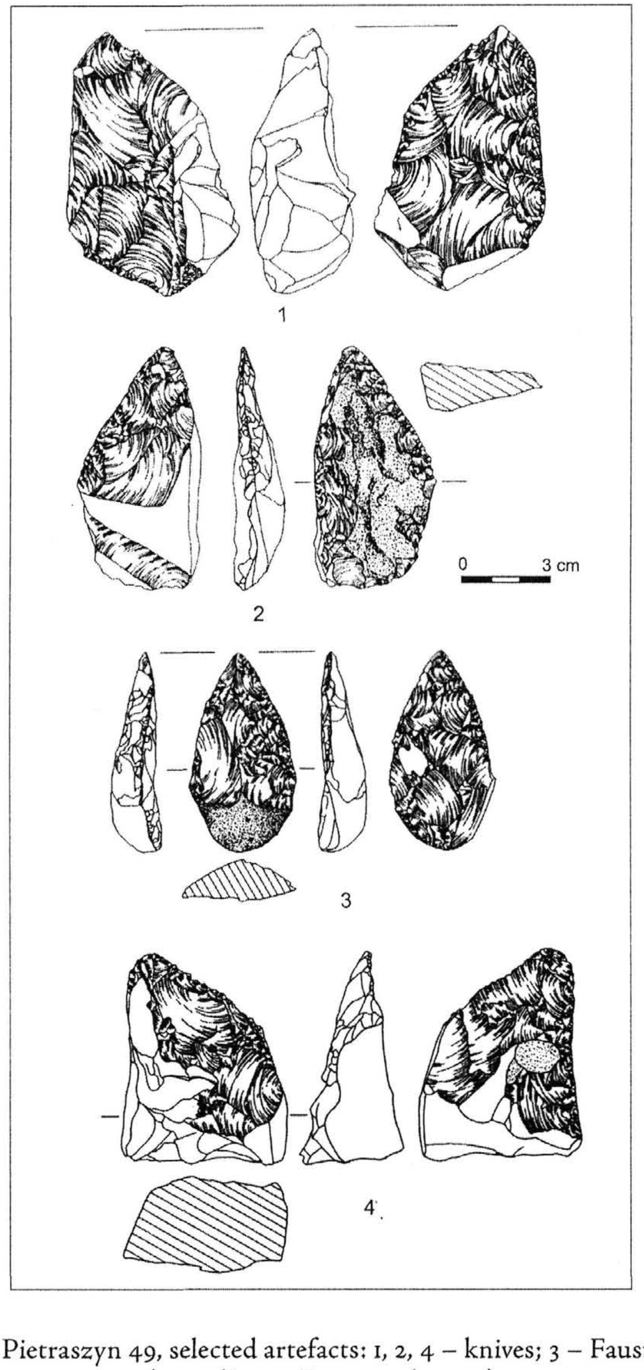

Figure 8. Pietraszyn 49, selected artefacts: 1, 2, 4 – knives; 3 – Faustkeilblatt (according to FAJER et al. 2001.)

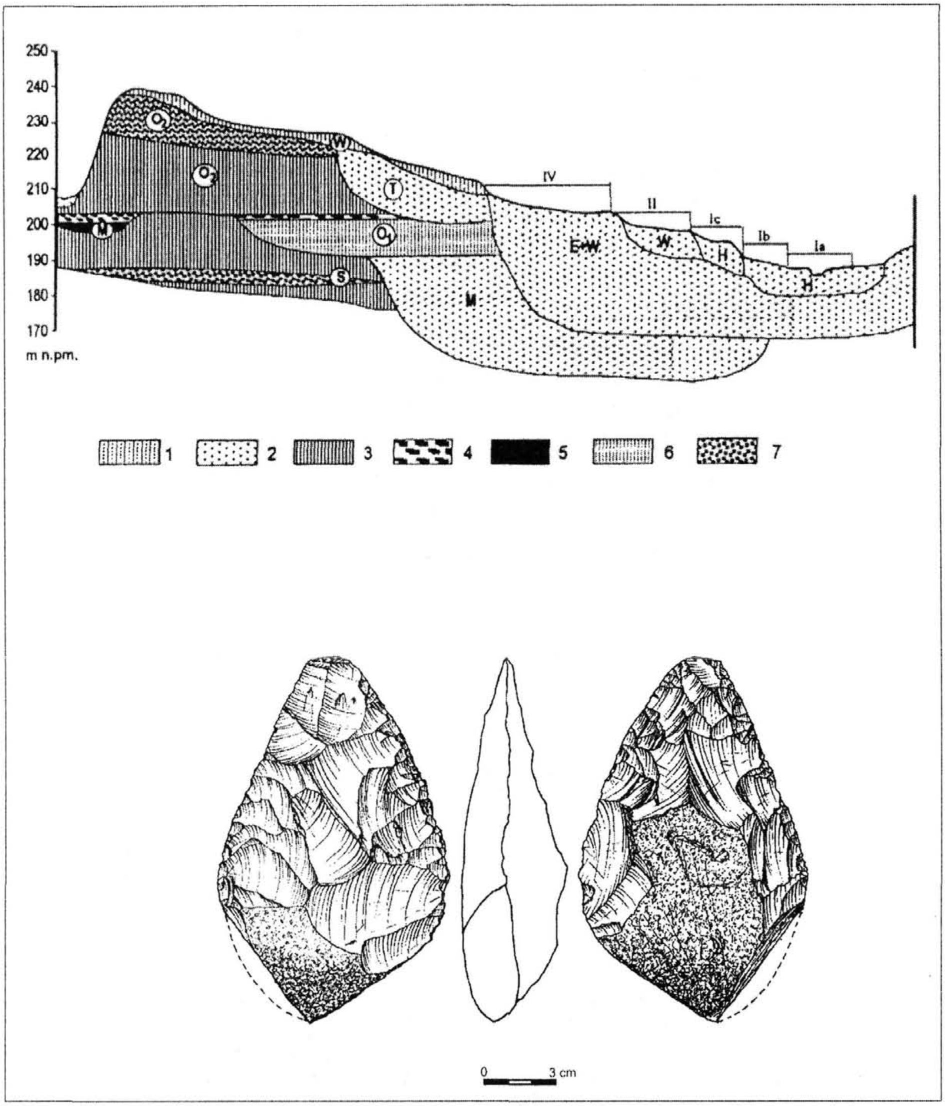

Figure 9. Owsiszcze, site. 1, Upper Silesia. Above: synthetic geological profile of the upper reaches of the Odra valley in the vicinity of Owsiszcze: 1 – loess; 2 – river sands and gravels; 3 – glacial till; 4 – peaty silt; 5 – ice-dam silt; 6 – river and prolluvial sands; 7 – fluvioglacial sand and gravel; H – Holocene; E – Eemian; M –Mazovian Interglacial; O – Odranian glaciation; S – San glaciation; T – Wartanian glaciation; W – Weichselian glaciation. Below: handaxe (according to Burdukiewicz 1999.)

Figure 10. Owsiszcze, site. 1, Upper Silesia. The Acheulian handaxe

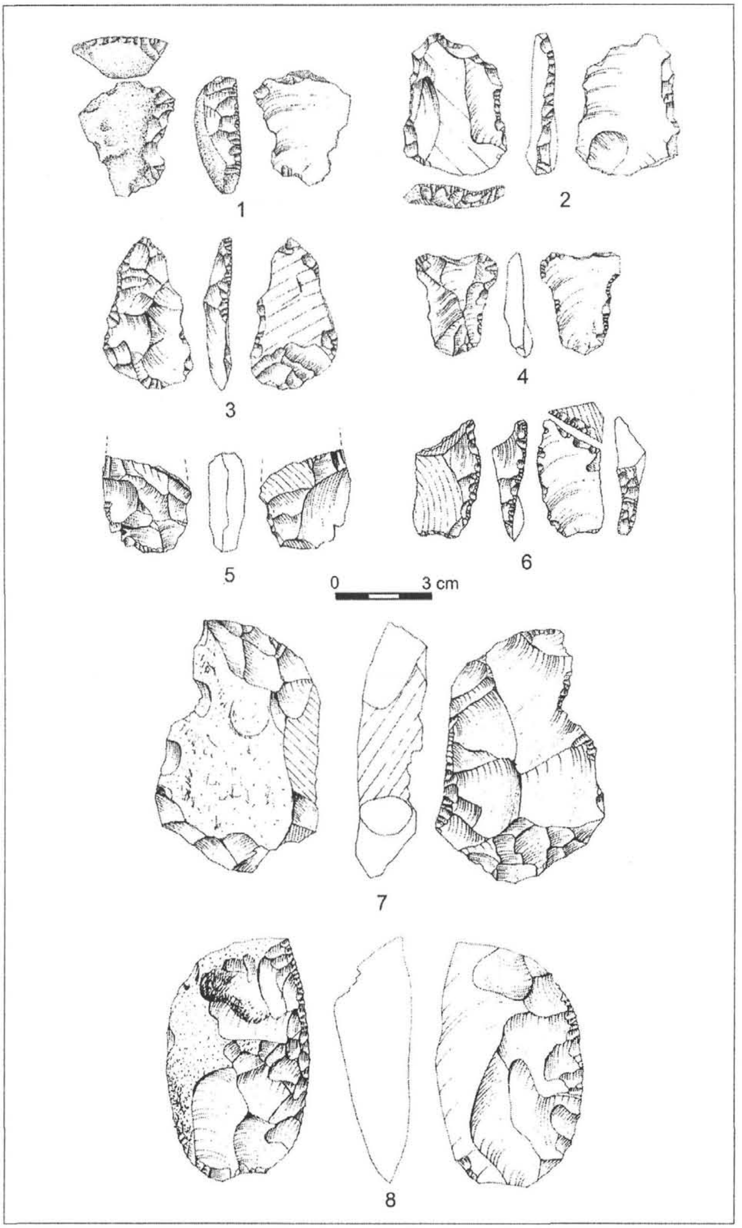

Figure 11. Biśnik Cave, Upper Silesia. Selected artefacts. 1 – 6 – assemblage B/C: 1, 2, 4 – denticulate-notched tools; 3 – atypical Tayac point; 5 – fragment of a bifacial tool; 6 – pseudo-perforator; 7 – 8 – assemblage F_1: asymmetrical knives (according to CYREK 2002.)

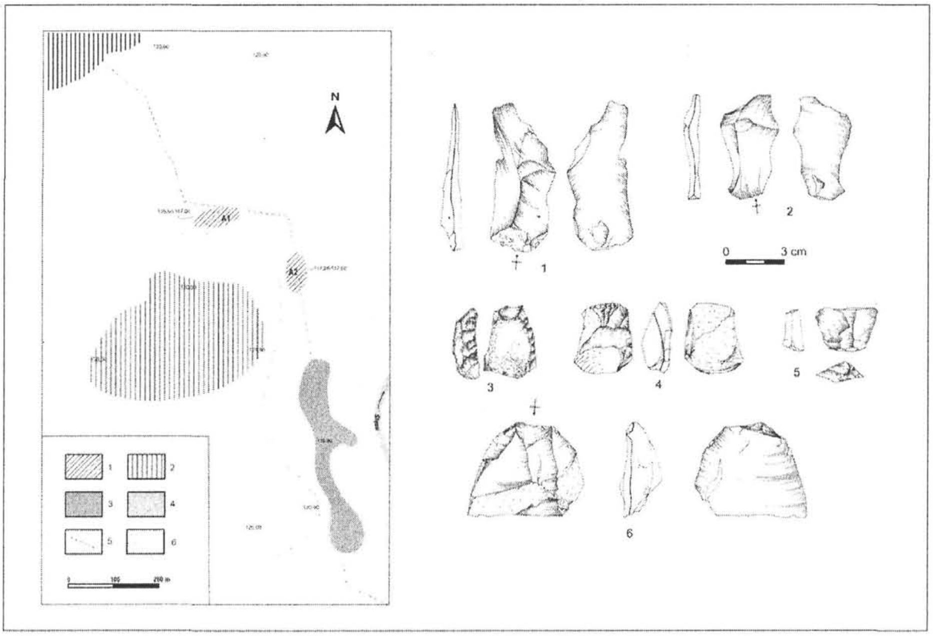

Figure 12. Wrocław Oporów. Left: topography of the area ca. 50 thousand BP. a) horizontal projection: 1 – Palaeolithic sites; 2 – upland zone; 3 – areas of mineral-organic accumulation in terrain depressions; 4 – contemporary channel of the Ślęza river; 5 – trench for sewage collector; 6 – hypothetical border between upland and valley when the area was exploited by the Middle-Palaeolithic communities. Right: selected artefacts from the lower level of site A2: 1, 2 – flakes; 3 – side scraper; 4–5 – fragments of retouched tools; 6 – retouched flake

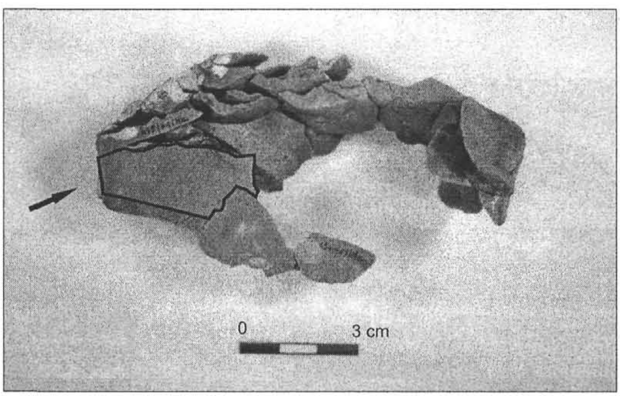

Figure 13. Wrocław, Hallera street, site 1, upper level. Fragment of a block with a tool (arrow)

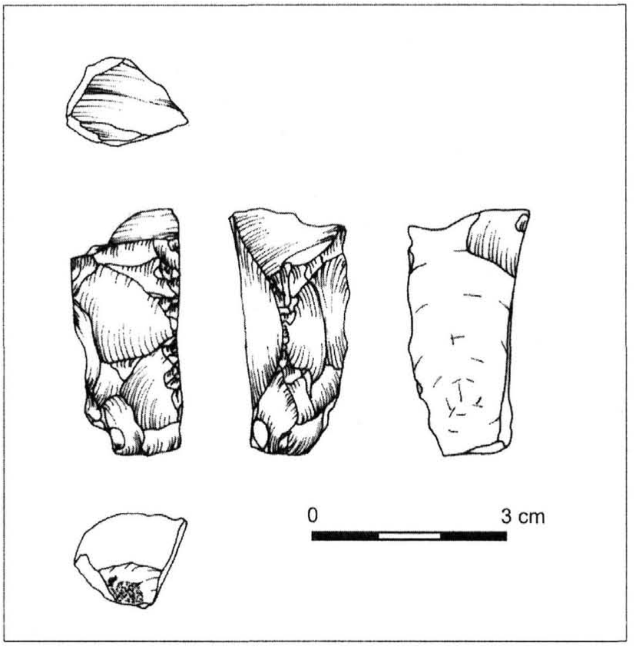

Figure 14.
Wrocław, Hallera street, site 1, upper level. Retouched tool from the block presented on 15. Ks. Józefa street, Kraków. Left: section showing the upper, middle and lower complex, I – aeolian deposits; II – overbank deposits; III – channel deposits; Right: selected unidirectional blade cores from the middle complex (according to Sitlivy et al. 1999.)

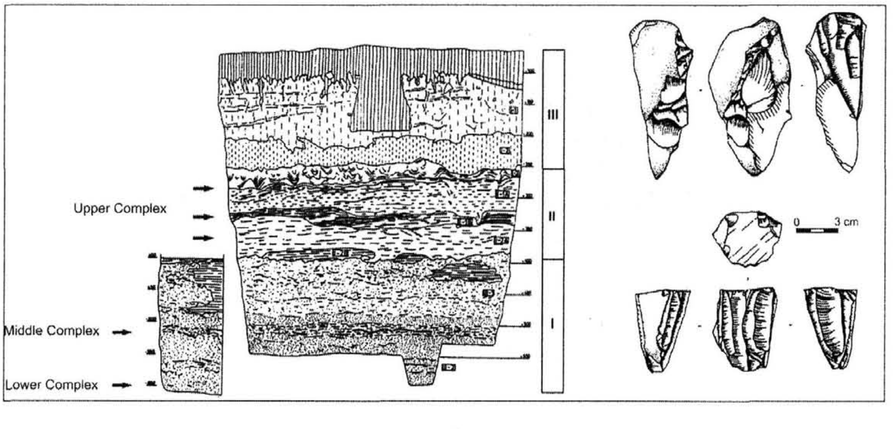

Figure 15.

The Taubachian from Diósgyőr-Tapolca cave (Hungary)

Árpád Ringer – Marie-Hélène Moncel

Topography

Magdolna Hellebrandt, archaeologist of Herman Ottó Museum of Miskolc, conducted the excavation at the entrance of the cave in 1973. The Middle Paleolithic assemblage found in the bottom layer was compared to the lithic industry of Weimar-Taubach first by Lajos Tóth. Árpád Ringer, after his excavation in 1988, made the modern chronostratigraphical study of the site together with László Kordos and Endre Krolopp. Ringer also classified the oldest Middle Paleolithic assemblage of the age of Eem as Taubachian.

In present paper the authors present the litho-, bio- and archaeo-stratigraphy of the site and the technological approached characterization of the Taubachien type assemblage.

Diósgyőr-Tapolca cave is situated in the Eastern side of Bükk Mountains at 179 m asl, in the valley of Szinva stream, in the territory of the city of Miskolc. Several well known Paleolithic cave sites can be found in its neighborhood, such as Szeleta, Büdöspest, and Lambrecht Kálmán caves (Fig 1.).

The 70 m long complex cavity system formed in Trias limestone was originally spring cave. The spring activity was especially strong during the Eem interglacial. At the end of the optimum of the interglacial, on the border of Emiliani sub stages 5c and 5d the Szinva was cut intensively into the valley basin's gravel. By the sinking of erosion-base, the cave became inactive and the ruin of the cave wall by chilblain and dissolution and the growing of the cavity in size began.

The cavity filled up to the ceiling between the oxygen-isotope sub stage 5d and Holocene Atlantic period. In the cave deposit, the cave-loess layers of cold periods that contain lime stone fragments alternate with the cave-soils of warm periods.

In the front of the cave mouth facing N-NW, on the Szinva stream's gravel terrace, simultaneously with the filling up of the cavity, subaeric sediments stratified by paleosoils were deposited. On top of stratigraphy Holocene brown forest soil was formed, which is covered by anthropogenic stony deposit formed not long ago.

In the front of the cave, 150 m away from the entrance in the direction of W-NW, the spring of Szent-György arises. Its water is taken by the Waterworks of Miskolc.

Sometime the spring was the source of the shallow Szent-György stream, whose hot water deposited calcareous sand and travertine onto the edge of valley basin. Such calcareous sand and travertine deposit were found in the stratigraphy of the excavation in 1988, from the trench set 18 m away from the entrance, in the depth of 2,0–2,4 m (Fig 2). Paleo-ecologically well identifiable mollusk and micro mammal fauna were found which are rich in deposits connecting to paleosoils compared to Arcy-Stillfried B interstadial.

History of research

The excavation of Diósgyőr-Tapolca cave began at the end of 19^{th} century. In the karst-cavity redone as cellar, János Szendrei the famous historian of Miskolc conducted first excavation in 1882. He described the prehistoric pottery found in deposit, but did not recognized the Paleolithic artifacts and remains of Pleistocene animals.[1]

After him, the excavation of the cave continued between 1932 and 1934 by Andor Saád and István Gaál. Paleolithic artifacts and occupational horizons connected to hearths in different sizes were unearthed in layers 5, 4, and 3 of the cave.[2]

The city of Miskolc decided to establish a sauna in the territory of Diósgyőr-Tapolca lido in 1973. The pool of the sauna was planed to be built in the cave. Preparing the work for construction, Magdolna Hellebrandt, archaeologist of the Herman Ottó Museum of Miskolc conducted the rescue excavation with the participation of Andor Saád at the entrance of the cave (Fig 2).

Hellebrandt set up two trenches parallel to each other, in which four (trench I) and five (trench II) layers were found. Amongst the trenches, the former's layers 3 and 4 and the latter's layers 3–5 yielded archaeological remains of prehistoric man.

Árpád Ringer excavated a trench in the area of 3,0 × 2,0 m down to the depth of 4,5 m in 1988, 18 m away from the entrance. The aim of the excavation was the modern stratigraphical interpretation of the subaeric deposits and their correlation to those of the entrance and the cave. But according to the expectation, the lowest Taubachian cultural layer of the cave and the entrance was found between -4,1 and -4,3 meters.

The excavation in 1988 and the interpretation of complex stratigraphic section also connected to the establishment of the Upper Pleistocene chrono-stratigraphy of Northeastern Hungary, and significantly moved forward the setting up of method for comparison of Hungarian caves and subaeric deposits.

Litho- and biostratigraphy

Saád A. és Gaál S. distinguished three Pleistocene layers in the Diósgyőr-Tapolca cave in the 1930's.

According to their time's practice, the layers were differentiated on the basis of their color and sedimentological features—loess and clay content and the characters of lime stone fragments (Fig. 3. A. Layers 2–3–4). A series of sedimentological samples collected by Saád could be re-evaluated in the 1990's and correlated to the stratigraphy of the excavations carried out in 1973 and 1988 (Fig 3. A, B, C).

M. Hellebrandt carried out the excavation at the entrance of the cave in 1973 (Fig 2.).

Five layers were described from trench II. Amongst them layers 3–4–5 are Pleistocene and in accordance with layers 2–3–4 of Saád–Gaál and layers 5–12 of the

[1] Szendrei 1883.

[2] Gaál – Saád 1935.

trench of 1988 (Fig 3. A, B, C). The latter layers belong to a subaeric sequence situating 18 m away of the cave entrance and are composed of the superposition of paleosoils and loess loams. The intermediate accumulated deposits consisting of limestone fragments belong to intensive Upper Pleistocene periglacial climate oscillations. In this stratigraphy (Fig 3. C), there is a significant hiatus between layers 6 and 7.

We refer in connection with the paleosoils of the stratigraphy to the third paper in this volume written by Á. Ringer, which discusses the chrono-stratigraphy and paleohuman ecology of Northeastern Hungary.

The MS1–MS2, MS3 paleo-soils and the M1 pedo-complex are equivalent to Arcy-Stillfried B, Hengelo and Warnenton. The equivalents of these in cave are the Sz S2, S3 and L cave soils.

The bio- and archaeo-stratigraphy of Diósgyőr-Tapolca cave confirm the chronology of these stratigraphical formations.

S. Gaál paleontologist dated layer 4 and the lower part of layer 3 of the 1932–34 excavation on the basis of fauna consisting of hyena and mammoth, according to the 1930's knowledge, to the beginning of the Würm.[3]

L. Kordos, on the basis of the excavation of 1973, re-interpreting the paleontological vertebrata assemblage of the 1932–34 excavation as well, placed the fauna between Lambrecth and Tokod climatozone in the Upper Pleistocene bio-stratigraphy established by M. Kretzoi and D. Jánossy.[4] These climatozones are equivalent to the 5c–5a substages and the end of stage 3 in the oxigen-izotope stratigraphy (see also the third paper in this volume, written by Á. Ringer).

Archaeo-stratigraphy

A. Saád classified the Paleolithic assemblages of Diósgyőr-Tapolca cave into the Magdalenian culture (layer 2) and the Hungarian Solutrean.[5]

L. Tóth classified the Paleolithic artifacts coming from trenches I and II of the excavation in 1973 as Middle and Upper Paleolithic. According to him, pieces of layers 4 and 5 of trench II are similar to those of Weimar-Taubach, and chronologically belong to the *"Quartz-Mousterian"* of Lambrecht Kálmán Cave.[6] The artifacts of layers 3 and 4 of this trench, after sorting out the Gravettian elements, were identified as Szeletian.

Á. Ringer collated the industry found during the excavation in 1988 in layer 12 and on the border of layers 11 and 12 with the collection of layer 5 and of the border of layers 4 and 5 of trench II of 1973, and with that of layer 4 and the bottom of layer 3 of the

[3] Gaál-Saád 1935.

[4] Hellebrandt et al. 1976.

[5] Gaál-Saád 1935.

[6] Hellebrant et al. 1976.

excavation of 1932–34. These assemblages were identified as Taubachien by Ringer,[7] and chronologies were pointed out from layer 11 of Kulna cave (fig.).[8]

The eemian lithic assemblages

The origin of the artefacts

The artefacts come from three different parts inside the site. The first assemblage, the richest, has been discovered in 1932–34 inside the cave and come from only one layer. The second and third ones come from two trenchs digged at the cave entrance (trench I: level 4; trench II: levels 4 and 5). The excavations took place at the beginning of the seventies. The three levels are located at the base of the sequence. All the artefacts are dated to the Eemian.[9]

The bone remains are rare.[10] Among the microfauna remains, Arvicola sp., Microtus cf. gregalis et Microtus arvalis are the most frequent. The large mammals from the levels from the cave entrance are composed by some remains from Crocotta spelaea, Mammuthus primigenius, Equus sp., Asinus hydruntinus et Bison priscus or Bos-Bison.

Evidence of a large occupation of the cave by the carnivores or the bears occupation have not been observed. The bone remains could be consequently remains of short human settlements.

The raw materials and their collecting areas

The raw materials are composed by several kinds of stones, with various qualities. The most frequent belong to the porphyrites, grey, brown or violet stones with fine grains. The other types of stones are flint (grey, blue and brown) and radiolarites, associated to pieces of hyalin quartz, quartz-quartzite, sandstone and obsidian.

7 Ringer 1993.
8 Ringer 1993.; 2000.
9 Hellebrandt et al. 1976.; Ringer 1993.
10 Hellebrandt–Kordos–Tóth 1976.

T=619	*Cave*	*Level 4 Trench I*	*Level 5 Trench II*	*Level 4 Trench II*
quartzporphyre	277-60,6%	5-50%	21-17,1%	16-55,1%
porphyrites	45-9,8%	1-10%	57-46,3%	2-6,9%
Quartz	17-3,7%			3-10,3%
Flint	46-10,1%		11-8,9%	2-6,9%
radiolarites ?	10-2,2%			
Obsidian	22-4,8%	2-20%	3-2,4%	1-3,3%
Quartz-quartzite	46-10,5%	2-20%	1-0,8%	4-13,8%
Chert	1-0,2%		22-17,9%	
Sandstone			5-4,1%	
Calcite			3-2,4%	1-3,4%
Total	464	10	123	29

Table 1: The kinds of stones according to the location of the excavations

The porphyres and the quarztporphyres are local,[11] as the flint, the cherts, the quartz-quartzites and the sandstones which can come from the Bükk mountain. However, the obsidian could not be collected from this mountain. Consequently, this raw material comes from a long distance area. The closest obsidian layers are located in the Tokaj mountain, from 40 to 60 km from the cave.[12]

The work of the raw materials: a same processing system, a full *"chaîne opératoire"* for the porphyrites and a partial "chaîne opératoire" for the flint and the obsidian (fig. 4, 5, 6.)

	quartzpor-phyre	*porphy-rites*	*quartz*	*flint*	*obsidian*	*quartz-quartzite*
Cortical flakes	7,4%	16,6%	7,1%	11,3%		4,7%
Large and thick flakes	51,9%	55,5%	7,1%	52,8%	52,4%	45,2%
Backed flakes	22,2%	22,2%	7,1%	32%	19%	42,8%
Elongated flakes	4,4%		78,5%			
Thin flakes	9,4%	2,7%		1,8%	19%	4,7%
Cores	4,4%	2,7%		1,8%	9,5%	2,4%
Tools on flakes	13,3%	24,4%	29,4%	75%	18,2%	22,4%

Table 2: Types of flakes according to the types of stones from the excavation inside the cave

11 Vértes–Tóth 1963.; Mester 1989.; 1995.

12 Takács-Biró 1986.

T=10	quartzporphyre (+ *flint ?*)	Porphyre	obsidian	quartz
Micro-bladelets			1	
Backed flakes			1	
Flakes with a back-platform	1			1
Thick flakes		1		1
Fragments	3			
Cores	1			
Total	5	1	2	2

Table 3: The lithic assemblage lithique from the level 4 (trench I)

T=123	*porphyres*	*quartz porphyre*	*flint*	*Chert*	*obsidian*	*sandstone*	*quartz-quartzite*	*calcite ?*
Fragments	23	5		11	1	4		3
Thick and large flakes	20	8	4	3		1		
Flakes with a back-platform		1						
Backed flakes	3	2	1	1	1			
Cortical backed flakes	5	3	4				1	
Thin flakes	1	2	2					
Core fragments	1				1			
Cores	1							
Broken pebbles	2			5				
Pebble tools bifaces	1			2				
Total	57	21	11	22	3	5	1	3
Tools on flakes	9	3	5	3	1			3

Table 4: The lithic assemblage from the level 5 (trench II)

T = 29	*quartz-porphyre*	*porphyre*	*quartz*	*flint*	*obsidian*	*quartz-quartzite*	*calcite ?*
fragments	10				1		1
Flakes	6	1	3	2		3	
Cores						1	
Pebble tools		1					
Total	16	2	3	2	1	4	1
Tools on flakes	1		1				1 ?

Table 5: The lithic assemblage from the level 4 (trench II)

The quartzporphyres and the porphyrites are the most frequent stones, while the flint, the radiolarites and the obsidian stay rare. All the raw materials, through the flakes and the cores, have been exploited by a same processing system. The debitage uses the stone shape from broken pebbles or plate stones (quadrangular blocks with traces of a river carrying). It takes place without first cortical removals and by crossed, unipolar and bipolar removals, on two opposed flaking surfaces or several orthogonal flaking surfaces. The use of the core edges explains the hight frequency of backed flakes. The kind of debitage also explains the large and thick flakes while the thin flakes and the laminar flakes are rare. The flakes are often broken, due to the numerous sublayers inside the blocks, sublayers which have been however used during the debitage. The flake shapes are consequently very various.

The flake sizes are, for the most, between 10 and 50 mm long, except some flakes from 70 mm long. The debitage products in quartzporphyre and porphyrites are longer (20–40 mm) than the flint and obsidian ones (10–30 mm). It could be explained by the collecting of smaller obsidian blocks or a greatest intensity of the debitage of this stone due to its quality and the long distance origin.

The "chaîne opératoire" is more or less complete according to the kind of stone. Through the cortical flakes and the cores, evidence exist that the quartzporphyre and the porphyrites have been totaly worked inside the site. The low frequency of the cortical flakes is due to the type of flaking which uses the cortical faces at the beginning of the debitage and eliminates it very quickly. On the other hand, the flint and the obsidian have been worked outside the cave, maybe on the stone sources. The obsidian flakes are in general small (10–20 mm) and have been brought as flakes inside the site (rare cortical flakes). For the quartz and the quartzite artefacts, the cortical flakes show a debitage which certainly took place inside the cave but the small number of the artefacts disturbs a fine study. Whatever, more than 60% of the stones have been worked in the site.

The technological patterns are common for the whole assemblages, whatever their origin, inside and outside the cave.

– *Some flake tools with a large use of the whole edges*

	cave	*Level 5 Trench SII*	*Level 4 Trench SII*
Quartzporphyre	12,2%	14,3%	6,2%
Porphyrites	22,2%	15,8%	
Quartz	29,4%		33%
Flint	75%	45,5%	
Obsidian	18,2%	33%	
Quartz-quartzite	22,4%	13,1%	
Calcite		100%	100%
Total	106-23,2%	24-19,5%	29-10,3%

Table 6: Tool frequency for each kind of raw material

Less than 25% of the products show a retouch. The tools are on all kinds of flakes and the broken flakes were also selected. The demand seems to be low. The whole cutting edges on the retouched flakes or, sometimes, on a rought flake show a high use and are crushed. It is not necessary due to successive retouches but rather to activities which use the sharp edges. The back of the flake is rarely retouched, sometimes on the inferior surface of the flake. The retouches are in general marginal, steep, and do not change the shape of the product. They are for the most on the upper face of the flake, except if the lower face is more convex. In some cases, the inverse retouch seems to participate to a specific shaping, associated to retouched areas on the opposite edge or the adjacent edge. The bifacial retouch is rare and often partial. The side-scrapers are dominant, associated to some points on triangular products. Some tools are also end-scrapers, always associated to notches and retouched cutting edges. These composite tools could be considered each time as one tool composed by different parts.

For the quartzporphyres and the porphyrites, the tools are longer than the rough flakes. It is the opposite for the obsidian and the flint, due maybe to the long distance location and a specific use.

Tools with retouches on edges	Crushed edges	Crushed edges + retouches	Marginal, ordinary retouches, abruptes or denticulates	Bifacial retouches	Alternating retouches
The whole edges	5 cases		dir + inv part.: 20 cases		
two edges		lat + inv ret on a back: 2 cases	inv lat + dist: 1 cas dir lat + dist: 1 cas bilat: 1 cas		
One edge			inv lat: 5 cases inv distal: 1 cas dir lat: 10 cases dir dist: 4 cases dir prox: 1 cas	lat part.: 3 cases	lat: 4 cases (with 2 on an opposite back)

Table 7: Types of tools in the assemblage from the cave and the other kinds of tools:

- 2 points: marginal, denticulate
- end-scraper + retouches on one edge
- end-scraper on an angle (short and abrupt retouches)
- *"careen"* end-scraper + lateral and **abrupt retouches** + distal notches joined to the end-scraper
- abrupt retouches on two edges and on the flat surface + notches + distal and marginal retouches
- end-scraper + 2 notches + alternate retouches on one edge

tools/flakes	Large and thick flake	Backed flake
Latéral-short	Marginal retouches	
Latéral-long	Abrupt ret. + crushed edges : 5 abrupt ret., inverses dent.	
Distal + latéral	lat notche+ crushed distal edge dej scraper + marg. Inv. Ret. 2 end-scrapers + lat. notche	marg. Dir. Ret. + inv. Lat. end-scraper + notche + marg. Lat. ret.
Proximal + latéral		Abrupt ret.
Bilatéral	Abrupt inv. Ret. + crushed edges	ret. abruptes dir et inv. ret. marg. Dir + envahiss. Inv. Sur dos
bilatéral + distal	Marginal ret.	
The whole edges	marg. Ret. + crushed edges : 14 end-scraper + abrupt ret. distal direct + lat. Inverse 2 denticulate points + notches	Marginal retouches

Table 8: Types of flint tools

	Tool types
fragment	– ordinary Retouch on a whole edge – bifacial retouches – abrupt and denticulate Retouches
Backed flake	– Notche
Back-platform flake	– crushed edge – latéral notche
Large and thick flake	– bifacial Retouch – latéral denticulate abrupt retouches + crushed edge on the opposite face + retouches – Transversal ordinary inverse retouch
Pointed flake	– Flat inverse retouch – Abrupt inverse denticulate – convergent bifacial retouches
Thin flake	– crushed edge

Table 9: Tool types from the level 5 (trench II)

– *A reduce shaping system*

The assemblages have yielded some bifacial tools (50–80 mm long), only on the most frequent raw materials, the quartzporphyres and the porphyrites. Most of them are partial and frequently on plate flint stone. The more or less invasive shaping is linked to the block shape: no-symetric section and independent shaping of each tool face. Some small removals are closely located and could be evidence of functional areas. The edges are very crsushed, as for the flake tools.

The eemian industry from Diósgyőr-Tapolca cave (Hungary)

In the state of knowledge, three kind of lithic industries have been identified in Hungary.[13] One of them yielded bifacial tools, in particular *"pointes foliacées"*, belonging to the Jankovician type or the Babonyian type (Remete Felső cave, Kecskésgalya cave, Méhész-tető, for example). The Subalyuk cave levels, in the Bükk mountain, belong to a second group with several layers with Typical Mousterian rich in side-scrapers and one layer with a Mousterian type Quina.[14] The sequence dates from the OIS 5d and 4. There is the same type of assemblage in the Büdös-pest cave (Kecskésgalya) or

[13] Dobosi 2000.

[14] Mester 1989.

in the Sólyom-kút rock shelter.[15] The raw material is above all local (various flint) and the obsidian artefacts could come from a 80–90 km distance.

These kinds of assemlages seem to be independant. The Bábonyian (OIS 5) is supposed to be the origin of the Szeletian, especially observed in the north-east of Hungary, finding its roots inside the Micoquian.[16] The Jankovicien type would be dated from the last glacial time. The raw materials used are frequently porphyres and obsidian from the northeast of Hungary.

The assemblages from Diósgyőr-Tapolca show a main activity based on the debitage. Some bifacial tools on quartzporphyre plate blocs are similar to those observed in the babonyian levels. However, they are too rare to give evidence of a specific technological behaviour. These levels are consequently closer to the industries without bifacial points, for example the Taubachian, one of the types of lithic assemblages described in Hungary.

Described in 1969 by D. Collins and confirmed by the Kulna cave excavations lead by K. Valoch, the Taubachian gathers together microlithic industries.[17] These microlithic assemblages are dated for the most from the OIS 7–5 or the beginning of the OIS 4 and located in the central Europe.[18] Other kinds of these assemblages have been observed easter, but, according to the researchers, they belong to the Micoquian facies or other facies (Kiik-Koba for example). Older sites have yielded similar industries as Bilzingleben in Germany or Vértesszőlős in Hungary. The question of a microlithic tradition along time, with local trends, is not solved.[19] A lot of these sites are linked to travertins, deposits from water sources, favourable areas to animals and vegetation. The hypothesis for specific activities around water sources is often discussed but why to do so small? The bone remains indicate human actions on large herbivores. In this case, do we have evidence of original technical trends, proof of independant human groups ?

In Hungary, two sites belong to the microlithic industry group, Vértesszőlős (OIS 9) and Tata (OIS 5–4).[20] While Vértesszőlős assemblages show both large pebble tools and a debitage of very small pebbles, Tata assemblage indicates a large debitage on very small radiolarite pebbles and flint pebbles, all of them being local. The processing system is "*discoid*", with various rules resulting in the same kinds of products.

15 Mester 1995.

16 Bosinski 1967.; Bosinski et al. 1995.; Ringer et al. 1995.; Mester 2000.

17 Valoch 1984., 1988., 1995., 1996.; Stepanchuk 1994.; Golovanova et al. 1998.

18 Lozek 1954.; Schwarcz et al. 1982., 1988.; Kaminska et al. 1993.

19 Mania et al. 1980.; Dobosi 1983., 1988.; Kretzoi–Dobosi 1990.

20 Vértes et al. 1964.

The Diósgyőr-Tapolca industry appears with technical common points with the Taubachian:[21]

- the product size is small; numerous flakes measure between 20 and 30–40 mm long;
- the raw material employed by humans are above all local are diversified. There are few long distance stones and, when there are, they are brought always prepared;
- the processing system is similar on all the types of stones. This method uses the pebble shape, without first removals, and is based on two flaking surfaces or several orthogonal surfaces. Products are thick, with a back. There is no trace of a Levallois debitage;
- the retouch is marginal, not bifacial, and the side-scrapers are frequent;
- the tools are made on all kinds of blanks ; broken flakes are even used;
- the bifacial tools are rare; the shaping processing system is secondary.

The intensity in the use of the cutting edges of some products is original and without doubt linked to the kind of occupation of this cave. The other characteristics of the assemblages seem to distinguish Diósgyőr-Tapolca from, for example, Tata. In Tata, the product size is low (10–20 mm). The points are rare and the bifacial retouch is observed on 10% of the tools. In this case, which meaning gives to these differences: traditions or a specific site function ?

On the other hand, the kind of debitage observed in Diósgyőr-Tapolca is similar to the Érd debitage, while the product size are longer and took place especially on large quartz pebbles.[22]

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[21] VALOCH 1984., 1996.; MONCEL 1997–98.; MONCEL–SVOBODA 1998.; MONCEL–NERUDA 2000.; RINGER 2001.

[22] GÁBORI-CSÁNK 1968.; GÁBORI 1976.

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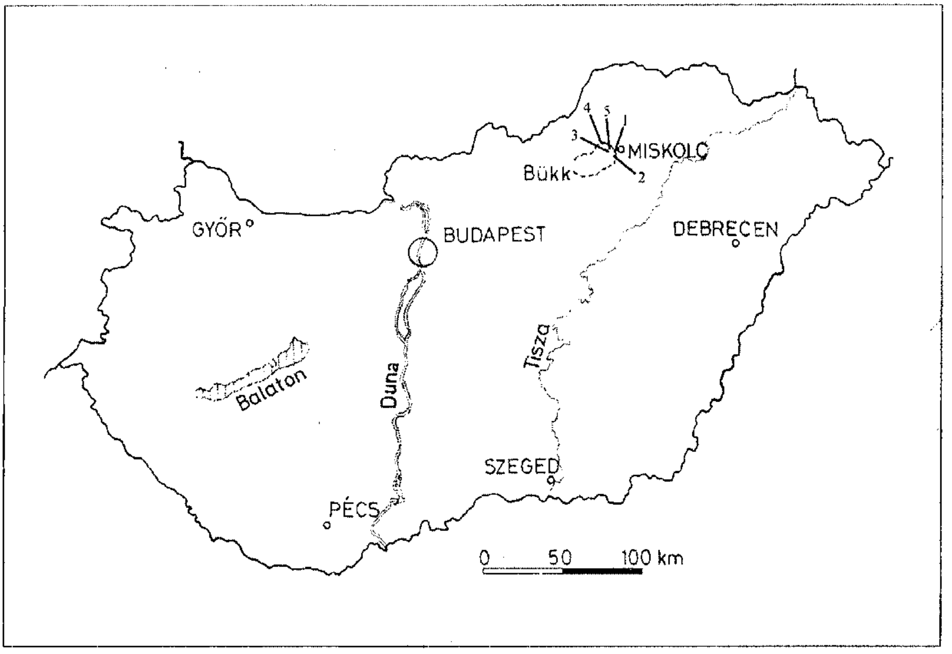

Fig. 1. Taubachian sites in the Bükk Mountains (Hungary): 1. Diósgyőr-Tapolca cave, 2. Cave of Mexikó valley, 3. Szeleta cave, 4. Lambrecht Kálmán cave, 5. Büdös-pest cave

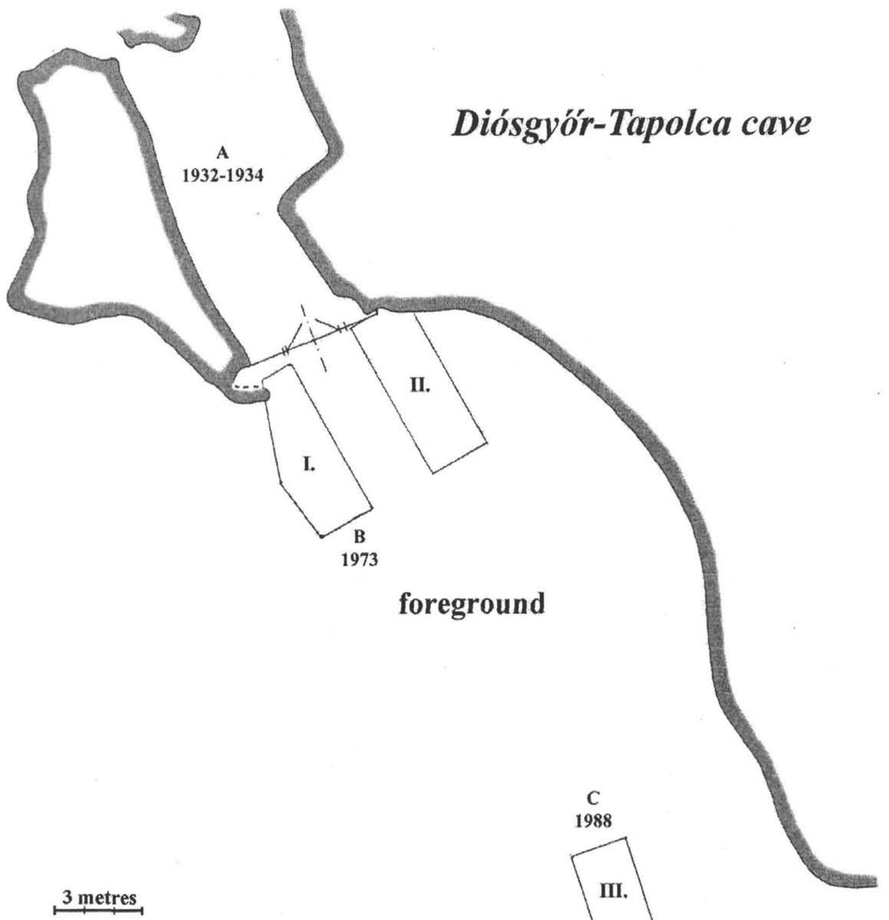

Fig. 2. Trenches of excavations in 1932–34 (A), 1973 (B) and 1988(C) in Diósgyőr-Tapolca cave

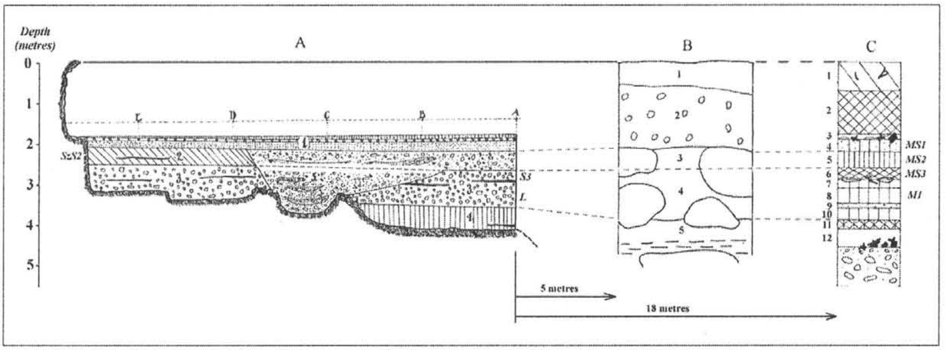

Fig. 3. Stratigraphy of Diósgyőr-Tapolca cave based on excavations of 1932–34 (A), 1973 (B) and 1988 (C)
SzS2, S3, MS1, MS2, MS3: paleosoils of interstadials
L, M1: Paleolsoils of Eem interglacial in the 5c–a stages

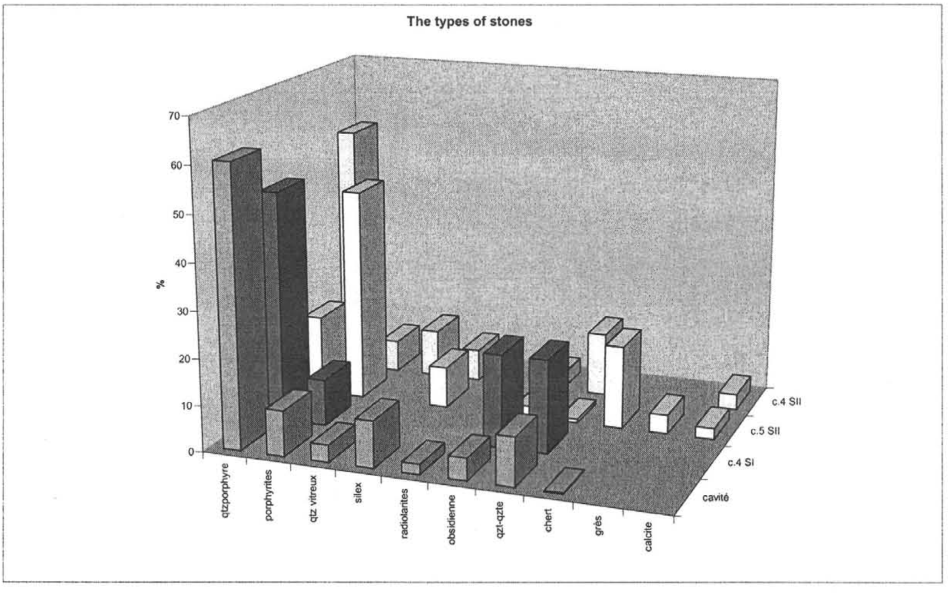

Fig 4: Quartzporphyre artefacts from the excavations outside the cave (Diósgyőr-Tapolca cave, Hungary)

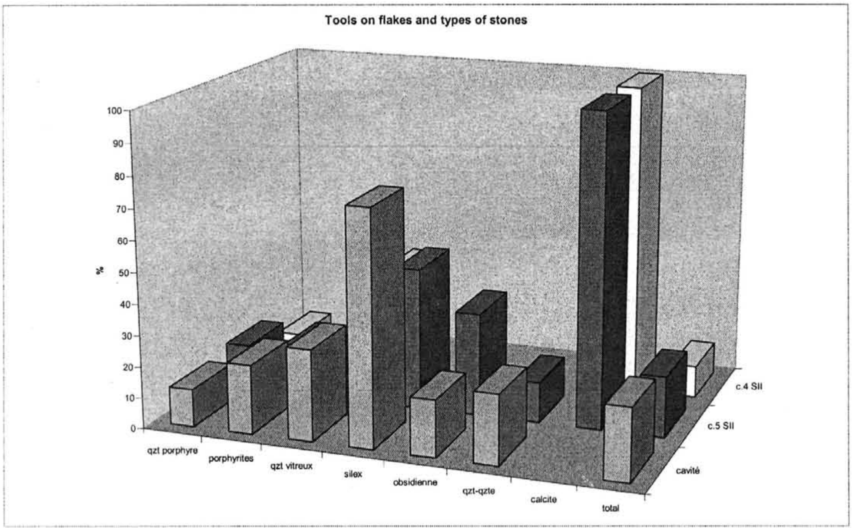

Fig 5: Flint, obsidian and black radiolarite artefacts from the excavations inside the cave (Diósgyőr-Tapolca cave, Hungary)

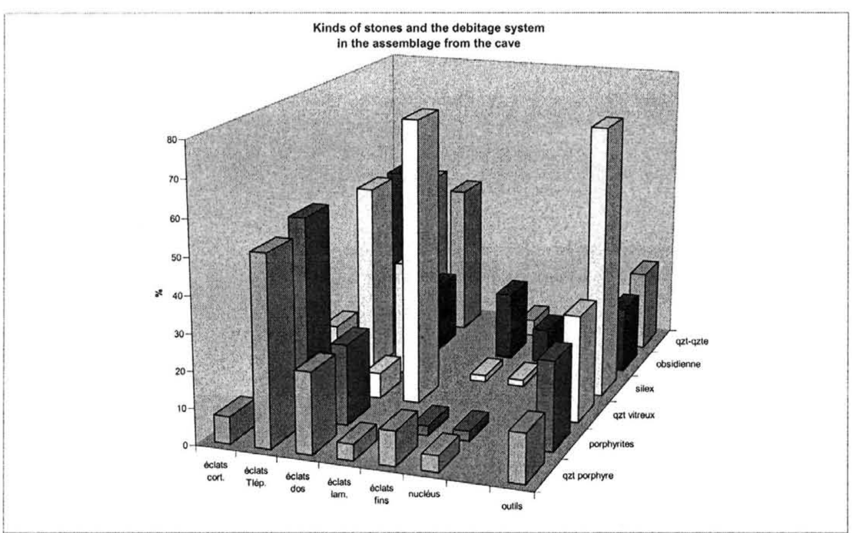

Fig 6 : Quartzporphyre artefacts from the level 5 (trench II) (Diósgyőr-Tapolca cave, Hungary)

Nouvelle analyse de la faune de Tata (Hongrie)

Marylène Patou-Mathis

Le site de plein air de Tata, à 70 km de Budapest dans la partie Nord-Est de la Transdanubie, est localisé dans une dépression qui correspond à un bassin de tuf calcaire où se trouvaient des sources d'eau chaude. Il a été fouillé à plusieurs reprises, par T. Kormos (1909–1910), par L. Vértes (1958–1959) et plus récemment par V. Dobosi et J. Cseh (1995–2002). Le matériel archéologique a été découvert dans des lentilles loessiques, d'un mètre d'épaisseur, au sein du travertin. On note également la présence d'empreintes de feuilles d'arbres tempérés et de mollusques dans ce travertin. Plusieurs datations de matériels provenant de la couche archéologique loessique ont été réalisées. Celle par ^{14}C, sur charbon de bois, a fourni un âge de 50 000 ± 2500 BP correspondant à l'interstade de Brörup.[1] De nouvelles dates, obtenues par U/Th, donnent des âges plus anciens : 70 000 ± 2000 BP et 116 000 ± 1600 BP et 101 000 ± 1000 BP et 98 000 ± 8000 BP.[2] Ces dates situent la formation de Tata durant le dernier interglaciaire ou lors d'une phase du début de la glaciation Weichsélien. Le matériel lithique est abondant, plus de 20 000 pièces dont 40% présentent des traces d'utilisation et 10% des pièces sont retouchées.[3] Les racloirs, de types variés, dominent l'assemblage avec 52% des 2300 outils reconnus. L'outillage, de petites dimensions, est attribué au Moustérien (Taubachien?). D'après M.-H. Moncel,[4] Tata serait essentiellement un site de débitage lithique. Ce que semble confirmer la proximité des gîtes de la matière première utilisée (silex, chert et radiolarite) et la relative rareté des restes fauniques. Des foyers et des traces d'ocre ont été repérés lors des fouilles. Deux objets insolites ont également été exhumés : un fragment d'ivoire, enduit d'ocre rouge, de Mammouth et une nummulite polie et gravée d'une croix.

Lors de notre séjour, en 1997, à Budapest nous avons étudié le matériel faunique issu des fouilles de Kormos et de Vértes qui se trouvait au Musée Géologique de Hongrie. À ce matériel s'ajoute onze ossements (fouilles de L. Vértes) rangés dans la collection du Musée National Hongrois. En comparant les pièces que nous avons étudiées à celles mentionnées par M. Kretzoi dans la monographie de Tata,[5] nous constatons que nous n'avons pas vu la totalité du matériel osseux. Il nous a paru cependant intéressant de faire connaître le résultat de notre recherche. Lors de ce travail, pour avoir une vision globale, nous avons pris en compte l'ensemble des ossements, ceux que nous avons réétudiés et ceux qui sont décrits par Kretzoi et que nous n'avons pas retrouvés.

1 Vértes 1964.
2 Schwarcz–Skoflek 1982.
3 Moncel 2003.
4 Moncel 2003.
5 Vértes 1964.

A. Analyse du matériel faunique

Le matériel osseux rapporté à la grande faune mammalienne comprend 369 restes appartenant à 37 individus de 18 espèces différentes (Tableau I). Les herbivores sont légèrement plus abondants, en nombre de restes (NR) et en nombre d'individus (NMIc) que les carnivores (Figures 1 et 2).

Les Carnivores

Huit espèces de carnivores sont présentes à Tata (Tableau I) : l'Ours des cavernes, l'Ours brun, le Loup, la Hyène des cavernes, le Lion des cavernes, le Blaireau, le Putois et un Mustélidé demeuré indéterminé. Nous n'avons réétudié que les ossements des quatre premières espèces. Les carnivores sont donc très diversifiés cependant, ils ne sont représentés que par un faible nombre de restes (Tableau I). Ceci indique un déficit important des ossements. La famille des Ursidés et celle des Canidés dominent largement, en nombre de restes et en individus (Figures 3 et 4).

Les Ursidés

Les ursidés sont représentés par deux espèces, l'Ours des cavernes et l'Ours brun en proportion voisine pour le nombre de restes, mais, il y a plus d'individus estimés pour la seconde espèce (Tableau I). Chez l'Ours des cavernes, les ossements du squelette post-crânien sont plus abondants que ceux du squelette crânien (que des dents appartenant à un seul individu adulte). Toutes les grandes unités squelettiques sont représentées. Les os sont tous fragmentés. Les cinq individus estimés sont des jeunes (3 dont un nouveau-né ou fœtus) et des adultes au sens large. La courbe de mortalité est donc proche de celle du type attritionnel et pourrait donc correspondre à une mortalité naturelle. Cinq de ces os (soit 22,7%) portent des marques de radicelles de plantes (vermiculations) qui témoignent d'un séjour en sub-surface assez long et d'une couverture végétale. Huit autres (soit 36,4%) présentent des empreintes de dents de loup ou de jeune hyène. Ceci confirme l'hypothèse d'un apport sur le site d'une partie de ce matériel attribué à l'Ours des cavernes par un autre prédateur que l'Homme. Cette hypothèse expliquerait également le faible nombre de restes, par rapport au nombre d'individus estimés, relativement plus élevé et la présence de ce grand ursidé dans un site de plein air. Les deux ours bruns, un jeune et un vieux, ont été estimés à partir essentiellement d'os de l'autopode (85,7% des restes post-céphaliques) et de dents (30% du nombre total de restes).

L'âge de ces deux individus et la présence sur une première phalange de marques de dent de loup ou de jeune hyène attesteraient, là encore, d'une intervention d'un autre prédateur que l'homme qui aurait apporté sur le site de Tata des morceaux de carcasses d'ours bruns.

Le Loup

Les restes de Loup (Tableau I) sont, relativement au nombre d'individus estimés, plus abondants que ceux des Ursidés (NME/NMIc respectivement de 16,5 et 8,7). Tous les âges sont représentés (jeune, adulte jeune, adulte dans la force de l'âge et vieux), cette courbe de mortalité se rapproche de celle de type catastrophique et correspondrait donc à une mort par prédation. Toutes les grandes unités squelettiques sont représentées avec une abondance des os de l'autopode (53% du nombre de restes du squelette post-céphalique), notamment les métapodiens et les phalanges. Un os porte des traces de dissolution et un autre est inclus dans une brèche. Il est difficile de savoir si ces restes de loups sont intrusifs ou si, tout au moins certains, résultent d'une activité anthropique. Il est possible en effet que l'homme les ait chassés pour récupérer leur fourrure. La présence essentiellement de restes crâniens et d'os de l'extrémité des pattes témoigne en faveur de cette hypothèse.

Les autres carnivores

D'après M. Kretzoi,[6] l'hyène est présente par huit restes crâniens (Tableau I) : sept dents isolées (I1, I2 et P3 inférieures et I3, M1, P2 droite et P4 droite supérieures) et une hémi-mandibule gauche portant I3, C et P2. Ils appartiennent à un individu adulte. Le putois est représenté par une canine inférieure gauche, le blaireau, par un pré-maxillaire droit et un fragment d'hémi-mandibule droit et le mustélidé indéterminé, par une P4 supérieure (Tableau I). En outre, T. Kormos signale la découverte d'une molaire supérieure de lion des cavernes. Ces restes dentaires sont trop peu nombreux pour permettre de comprendre leur origine (intrusifs?).

Les herbivores

Les herbivores sont représentés par dix espèces (Tableau I). Le Mammouth et le Cheval dominent en nombre de reste et en individus (Figures 5 et 6).

Le Mammouth

Nous n'avons pas pu malheureusement avoir une idée précise du nombre exacte de restes appartenant à ce proboscidien. D'après notre étude et les données fournies par M. Kretzoi,[7] le nombre d'ossements de Mammouth dépasse la centaine, environ 130 (Tableau I). Les restes dentaires sont les plus abondants, ils nous ont permis d'estimer à sept le nombre d'individus : six jeunes (dont un très jeune) et un

[6] Vértes 1964, 116.

[7] Vértes 1964, 116–117.

adulte jeune. Le matériel est très fragmenté, même les dents, et l'état de surface des os présente des marques de *weathering* de stade avancé. Ceci atteste d'une exposition à l'air libre relativement longue. On note que des éléments de toutes les grandes unités squelettiques sont présentes. La chasse ou le «charognage» de ces individus peut être envisagé. Il est possible que les hommes aient piégé ces animaux venus s'abreuver aux sources ou enlisés dans ces zones particulièrement marécageuses à la sortie de l'hiver ou en automne.

Les Rhinocérotidés

Le rhinocéros laineux est représenté par 19 restes (Tableau I) : des dents (84,2% du nombre total de restes), une vertèbre lombaire et deux métarcapiens (III et IV droits) appartenant à la même patte antérieure. Ces deux os ont été rongés par des carnivores. Les hommes ont-ils «charogné» ces animaux? La question demeure posée. M. Kretzoi[8] a identifié un fragment de molaire (que nous n'avons pas vu) comme appartenant au rhinocéros de Merck.

Le Cheval

Quarante-neuf ossements de cheval ont été retrouvés (Tableau I). Ce sont essentiellement des dents (81,6% du nombre total de restes). Deux jeunes (un âgé d'environ 10 mois et l'autre de 2 ans 1/2 – 3 ans 1/2), un adulte jeune et un adulte âgé (probablement un mâle) ont été identifiés. Seuls, quatre fragments d'os longs ont été déterminés : un radius, un tibia, un fémur et un métatarsien. À ces os s'ajoutent un métatarsien vestigial, un talus et un cuboïde appartenant vraisemblablement à la même patte postérieure. Le squelette axial est représenté par un fragment de vertèbre cervicale qui porte des stries de découpe. Le tibia a été fracturé intentionnellement (stigmates de percussion sur os frais sur la face postérieure de la diaphyse distale). En outre, deux os ont été rongés par des porcs-épics. Nous pouvons envisager que les Préhistoriques ont abattus, à proximité du site, probablement au printemps ces chevaux. Soit, ils n'ont transporté sur ce site que des quartiers de viande soit, ils ont emporté dans un autre lieu la majorité des carcasses. M. Kretzoi[9] attribue les restes de ces chevaux à *Equus steinheimensis*, nous nous accordons avec lui et proposons une attribution à un caballin de type III de taille moyenne. D'autre part, cet auteur, signale la présence de trois molaires (issues des fouilles de T. Kormos, que nous n'avons pas retrouvées) d'*Equus hydruntinus*.[10]

[8] VÉRTES 1964, 120–121.
[9] VÉRTES 1964, 117–119.
[10] VÉRTES 1964, 119–120.

Les Bovinés

Seulement neuf restes, appartenant à deux individus (un jeune et un adulte au sens large), ont été reconnus (Tableau I). D'après le calcaneus et le cubo-naviculaire droit, nous attribuons les restes de l'adulte au Bison. Un fragment d'humérus, seul os long déterminé, porte des stigmates de percussion anthropique sur la face antérieure de la diaphyse distale et des marques de rongement, par un canidé, sur la poulie distale. Les dents sont majoritaires (66,6% du nombre total de restes). Comme pour les chevaux, nous pensons que ces deux animaux ont été chassés par l'homme et que la majorité des carcasses a été transportée ailleurs.

Les autres espèces

D'après la monographie de Tata, le Mégalocéros, le Cerf, le Sanglier et un *Ovis sp.*, sont également présents (Tableau I). Ce ne sont que des fragments de bois (un de Mégalocéros et un de Cerf), des dents (cinq de Mégalocéros et deux de Sanglier) et des os de l'autopode (quatre métapodiens de Mégalocéros, un métacarpien de Cerf et trois phalanges *d'Ovis sp.)*.

B. Paléoécologie et biochronologie

Les grands mammifères

La diversité des espèces carnivores et la présence d'animaux fouisseurs, comme le blaireau, ou forestiers comme les Ursidés, nous conduisent à proposer une formation du dépôt sous un climat peu rigoureux (absence de permafrost) et relativement humide et dans un environnement mixte avec des espaces ouverts de type prairie-steppe entrecoupés de zones boisées.

La présence du mammouth, du rhinocéros laineux et du bison, atteste d'un environnement steppique sous un climat froid. Cependant, l'*Equus hydruntinus*, le rhinocéros de forêt (rhinocéros de Merck), le mégalocéros, le cerf et le sanglier apportent une note plus tempérée et plus humide.

L'ensemble de la faune, si l'on considère que le matériel étudié provient d'une seule couche, atteste d'une phase de transition où cohabitent des animaux plutôt froids et steppiques et des animaux plus tempérés et forestiers.

La microfaune[11]

Les rongeurs déterminés comprennent : la souris des steppes *(Spalax cf. leucodon)*, le souslik d'Europe *(Citellus cf. citellus)*, le campagnol des champs *(Microtus arvalis)*, un campagnol non identifié *(Microtus sp.)*, un hamster non identifié *(Cricetulus sp.)*, le campagnol roussâtre (Clethrionomys *cf.* glareolus) et le castor *(Castor fiber)*. Ce sont à la fois des animaux des steppes (les deux premières espèces) et des animaux tempérés (le hamster) et des bois (le campagnol roussâtre et le castor). Les oiseaux sont représentés par un canard ou une sarcelle *(Anas sp.)* et le lagopède *(Lagopus sp.)*. Des restes d'insectivores *(Talpa europea* et *Sorex cf. araneus)*, de lagomorphes *(Lepus cf. timidus, Lepus europeaus* et *Ochotona pusilla)*, de poissons (non déterminé spécifiquement) et d'amphibiens *(Rana cf. arvalis* et *Bufo cf. viridis)* ont également été retrouvés. Il faut signaler la présence dans les environs du site de porc-épic, ces derniers n'ont pas laissé de restes osseux mais des marques typiques de rongements sur deux os de cheval.

Comme pour la grande faune, on remarque la présence d'espèces à cachet froid et steppique et des espèces plus tempérées d'espaces boisés.

Le cheval, *Equus steinheimensis*, est caractéristique de la moitié supérieure du Pléistocène moyen, sa présence, associée à celle des autres espèces, nous conduit à proposer comme cadre chronologique la fin de l'avant dernière glaciation et le début du dernier interglaciaire. Cependant, nous soulevons la question d'une couche unique. Si l'on envisage le mélange de deux (ou plusieurs) couches nous pouvons suggérer qu'une partie du matériel appartient à une phase interstadiaire de l'avant dernière glaciation (Saalien) ou au tout début du dernier interglaciaire et qu'une autre partie à une phase stadiaire du début de la glaciation Weichsélien. Le cortège Mammouth–Rhinocéros laineux–Bison priscus s'accordant avec cette seconde période et le cortège *Equus steinheimensis*–Ursidés–Mégalocéros–Cerf–Sanglier avec la première.

Discussion

L'interprétation palethnographique du matériel faunique de Tata est complexe à cause de sa relative pauvreté et de son mauvais état de conservation. Les carnivores semblent être intrusifs à l'exception peut-être des loups qui ont pu être chassé pour leur fourrure. Des loups et/ou des hyènes sont venus sur le site, probablement attirés par des restes de carcasses, comme le montrent les marques de rongement qu'ils ont laissées sur certains os d'ours, de bison et de rhinocéros laineux. Les chevaux, les bisons et peut-être le mégalocéros ont probablement été chassés par les Néandertaliens en tout cas, comme l'attestent les marques anthropiques observées sur certains de leurs ossements, traités et/ou consommés. Quant aux mammouths et aux

[11] Kretzoi in Vértes 1964.

rhinocéros laineux la pratique d'une chasse, mais plus probablement, d'un «charognage» ne peut être exclue. D'après la conservation différentielle des ossements de l'ensemble de ces grands mammifères, nous avançons l'hypothèse d'un transport hors du site de morceaux de carcasses.

Le site de Tata correspondrait, en accord avec les observations relatives au matériel lithique, à un camp temporaire à occupations récurrentes, peut-être saisonnier (estivale : printemps-été), où l'activité principale aurait été le débitage de la matière première lithique[12] et la préparation, en vue de la mauvaise saison, de quartiers de viande et de peau (d'où peut-être l'explication de la présence d'ocre).

Remerciements

Nous tenons à remercier les professeurs Viola Dobosi et László Kordos pour leur accueil lors de nos séjours à Budapest ; ainsi que le Dr Zsolt Mester, pour ses précieux conseils et sa gentillesse.

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[12] Moncel 2003.

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Species	NR	MNIc
Equus cf. steinheimensis	49	4
*Equus hydruntinus**	3	1
Bison cf. priscus	9	2
Coelodonta antiquitatis	19	2
Stephanorhinus kirchbergensis?*	1	1
Mammuthus primigenius	130	7
*Cervus elaphus**	2	1
*Megaloceros giganteus**	10	1
*Ovis sp.**	3	1
*Sus scrofa**	2	1
Sous-Total Herbivores	**228**	**21**
Ursus spelaeus	30	5
Ursus arctos	30	2
Ursus sp.	2	
Canis lupus	66	4
*Panthera (Leo) spelaea**	1	1
*Crocuta crocuta**	8	1
*Meles meles**	2	1
Putorius sp.*	1	1
*Mustelidea (petit)**	1	1
Sous-Total Carnivora	**141**	**16**
TOTAL	**369**	**37**
Castor fiber	4	1
Lepus cf. timidus	3	1
Lepus europaeus	1	1
Ochotona cf. pusilla	8	1
autres rongeurs	18	6
oiseaux	5	3
Insectivora	4	2
poissons	2	1
amphibien	4	2

NR = Nombre de Restes ;
NMIc = Nombre Minimal d'Individus obtenu par combinaison ;
* Détermination M. Kretzoi in VÉRTES 1964.

Tableau I. Spectre faunique de Tata

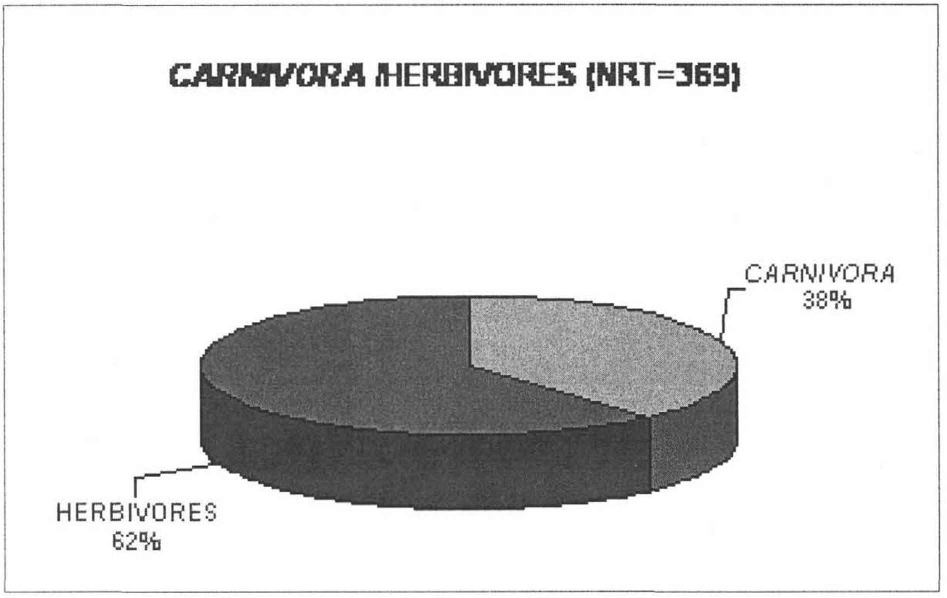

Figure 1. Rapport entre le nombre de restes de carnivores et le nombre de restes d'herbivores
NRT = Nombre de Restes Total

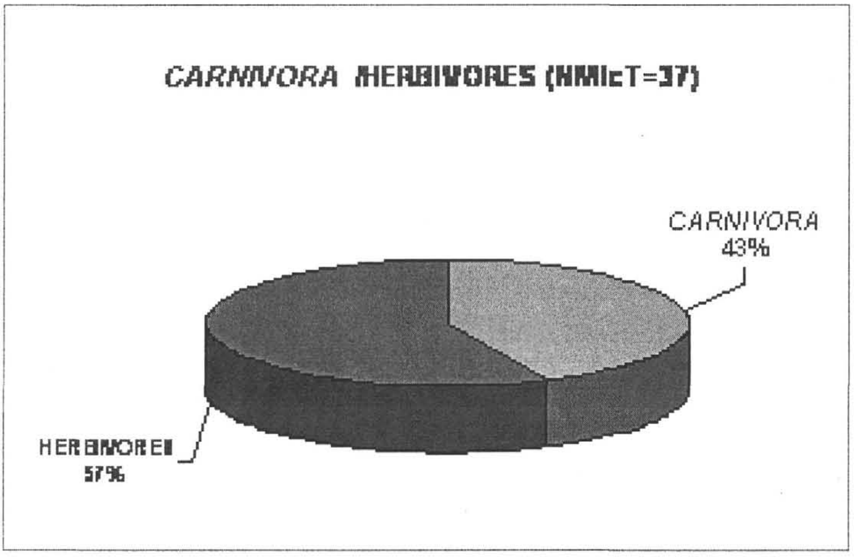

Figure 2. Rapport entre le nombre d'individus carnivores et le nombre d'individus herbivores
NMIcT = Nombre Minimal d'Individus Total obtenu par combinaison

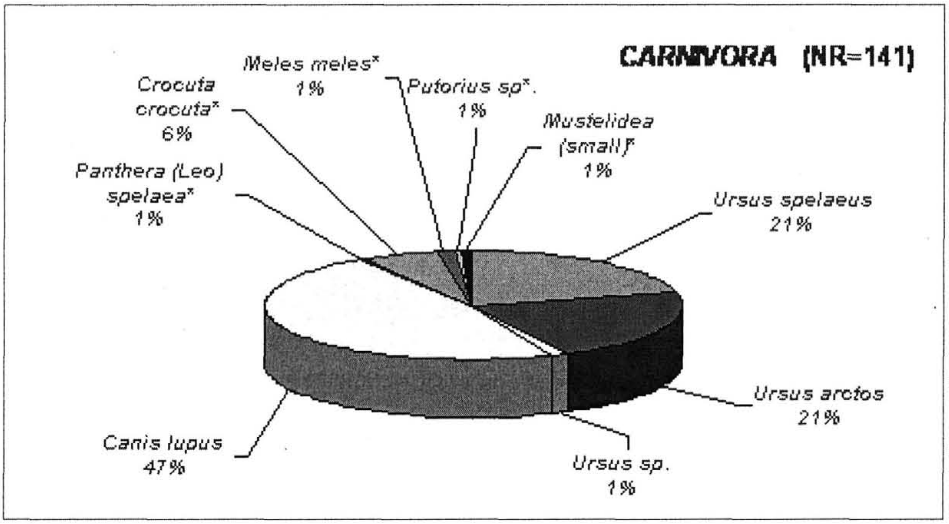

Figure 3. Pourcentages relatifs des espèces carnivores en nombre de restes
NR = Nombre de Restes ; Détermination KRETZOI, in VÉRTES 1964

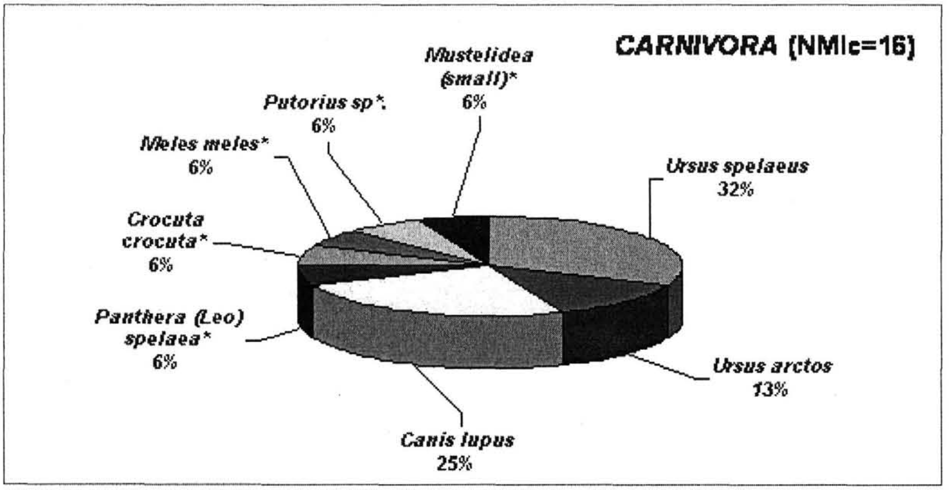

Figure 4. Pourcentages relatifs des espèces carnivores en nombre d'individus
NMIc = Nombre Minimal d'Individus obtenu par combinaison ;
Détermination KRETZOI, in VÉRTES 1964

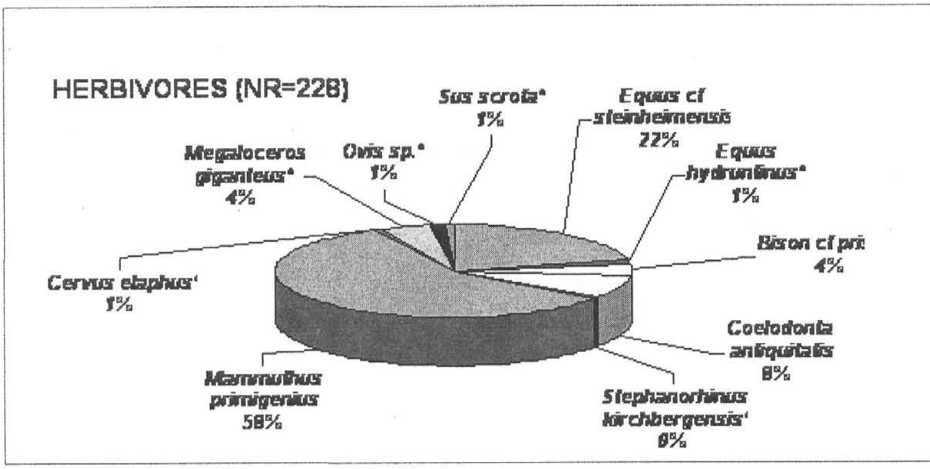

Figure 5. Pourcentages relatifs des espèces herbivores en nombre de restes
NR = Nombre de Restes ; Détermination Kretzoi, in Vértes 1964

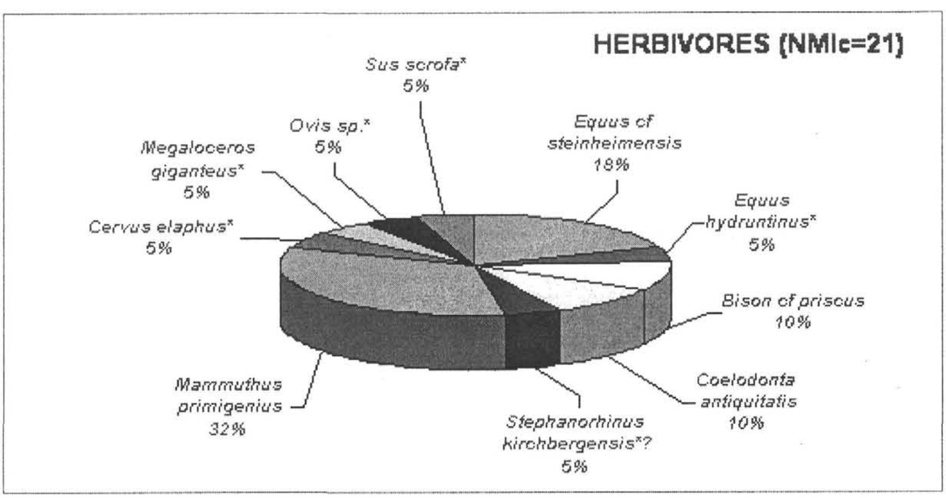

Figure 6. Pourcentages relatifs des espèces herbivores en nombre d'individus
NMIc = Nombre Minimal d'individus obtenu par combinaison ;
Détermination Kretzoi, in Vértes 1964

The Middle Palaeolithic settlements at the Skalka mound at Hôrka-Ondrej near Poprad (Slovakia)

Ľubomíra Kaminská

Abstract

Settlement from the older phase of the Middle Palaeolithic in Hôrka-Ondrej, Vyšné Ružbachy, Hranovnica and Beharovce was documented by numerous materials, stone tools, and remnants of fire-places. They were assigned to the early Mousterian.

A continuation of the settlement in the middle phase of the Middle Palaeolithic is documented by research in Hôrka-Ondrej, area C and Gánovce. The chipped stone industry belongs to the Taubachian from the last interglacial (Eem), and its authors were pre-Neanderthal, as it was documented by the travertine cast of the scull from Gánovce.[1]

A settlement from the younger phase of the Middle Palaeolithic was recovered in area A in Hôrka-Ondrej. An abundant stone industry from different phases of retouch suggests production at the site. Fire-places and bones of hunted animals were recovered from the working area of the camp site.

Evidence of settlement from the older phase of the Middle Palaeolithic through the middle to the younger phase, belonging to the Mousterien, documented by the U/Th dating, and by the results of several analyses and geological observations was obtained at the locality Hôrka-Ondrej.

Topography and research of the locality

The village Hôrka, local part Ondrej, is situated 8 km to the SE from the town Poprad, in a territory which is rich in travertine mounds formed by the mineral springs. Archaeological finds come only from the mound located at the northern edge of the village, immediately at the main road Poprad-Levoča, 635 m above sea level.

This mound is in the literature known under several names, for example: Kameň or Skalka,[2] Smrečányi rock,[3] or also as no name mound.[4]

Travertine mining in the 1930's seriously damaged the travertine mound. Later the mining continued to a smaller extent. F. Prošek, E. Vlček, and V. Ložek carried out research at the mound in 1955–1960 when the quarry was active. Originally they described four overlaying cultural beds with finds of Mousterian chipped stone industry.[5]

[1] Vlček 1969.

[2] Ložek 1958, 39.; Ivan 1943, 13.; Kovanda 1971, 171.; Kovanda 1995, 113.

[3] Bárta 1974, 141.; Kaminská 1988, 74.

[4] Bánesz 1990, 50.

[5] Prošek–Ložek 1957, 57., Fig. 7, 8.

L. Bánesz carried out two weeks of research at the locality in 1961, and obtained artefacts from the profile published by F. Prošek and V. Ložek in 1957. Tough the finds from the old reconnaissance and research were often mentioned in an overview, they were published only a few years ago.[6]

Systematic archaeological research was carried out at the locality in 1987–1992, and in 1995. The locality, about 60 by 65 m in size, was divided into areas A to F (Fig. 1). New material continuously discovered in several areas permitted them to be correlated with one another. The research from the beginning was based on a broad interdisciplinary co-operation. At the beginning of the research we started with temporal and cultural determination of the travertine mound and finds in the last interglacial (R/W, Eem). During the research of the locality we changed the view of the age of the travertines and fossil soils, and of the age of the archaeological and palaeontological finds.

The Palaeolithic settlement of the locality

A repeated settlement, as an evidence of the development of a Middle Palaeolithic culture during a longer time period, was recovered by the research at the locality Hôrka-Ondrej. The oldest industry, belonging to the Middle Pleistocene interglacial, is documented in area B, and its younger phase from the period before the final stadium of Riss in area D. Finds from area C were dated to the last interglacial (R/W, Eem). The youngest, and at the same time the most abundantly represented, Palaeolithic settlement was studied in area A, and in the beds from the beginning of the Old Würm.[7]

The older Phase of the Middle Palaeolithic

Area B

At the southern edge of the researched area, in the southern section of area B, only an edge of the originally settled area was detected (Fig. 2). Substantially more finds came from the research of F. Prošek[8] and L. Bánesz, published in 1990,[9] where also finds from area A, labelled as the 'big crater', and the 'wall above the road' were included.[10]

6 Bánesz 1990.; 1991.

7 Kaminská et al. 2000.

8 Prošek 1958, 67.

9 Bánesz 1990, 50–55., Tab. VI–XIII.

10 Bánesz 1990, 53., Tab. XIV–XVI.

Only 16 indistinct artefacts were obtained during the research in 1992. There were 10 flakes in layer A, a quartz grain, and miniature pebbles of quartz, limestone, and sandstone. The flakes—5 quartz pieces—were very small, size e.g. 14 × 9 × 4 mm. The quartz flake which had its dorsal side covered by the original surface of the pebble, was larger, 37 × 22 × 8 mm, and 34 × 22 × 10 mm (Fig. 3, 3.), and a flake retouched on the right side, 38 × 36 × 16 mm.

There were two radiolarite flakes in layer C2, one of them had a smooth plarform (Fig. 3, 1.). One quartz flake was in layer D (Fig. 3, 6.), the other two were in layer VII, and one of them had a partially preserved original surface. Another small quartz flake was obtained during the cleaning of the profile (Fig. 3, 2.).

This indistinct industry, composed basically of small flakes, is not sufficient for a precise cultural determination. The chipped industry, published by L. Bánesz,[11] was disproportionately richer and more distinct. A different composition of the industry as the one originally described[12] is in Tables 1 to 3,[13] therefore we combine both above mentioned tables:

Type	Name	Amount
1.	Levallois flake	3
2.	Atypical Levallois flake	12
3.	Levallois point	3
5.	Pseudo-Levallois point	1
10.	Convex side-scraper	3
23.	Transversal side-scraper	1
32.	Burin	1
35.	Atypical perforator	2
36.	Side knife	1
41.	Mousterian knife	1
42.	Notched flake	4
43.	Denticulate flake	4
45.	Flake retouched on the lower side	1
Total		37 pieces

Table 1: Hôrka-Ondrej, area B. Typological composition of tools

[11] Bánesz 1990, 50–55.; 1991, 55–57.

[12] Bánesz 1990, 50–55.

[13] Bánesz 1991.

Cores:		Amount
	Levallois	6
	Pyramidal	1
	Spherical	3
	Polyhedral	2
	Remains	8
Total:		20

Table 2: Hôrka-Ondrej, area B. Type of cores

Striking surface:		
	retouched	29
	smooth	24
	keel	14
	straight	29
	coarsely retouched	1

Table 3: Hôrka-Ondrej, area B. Arrangement of the striking surface

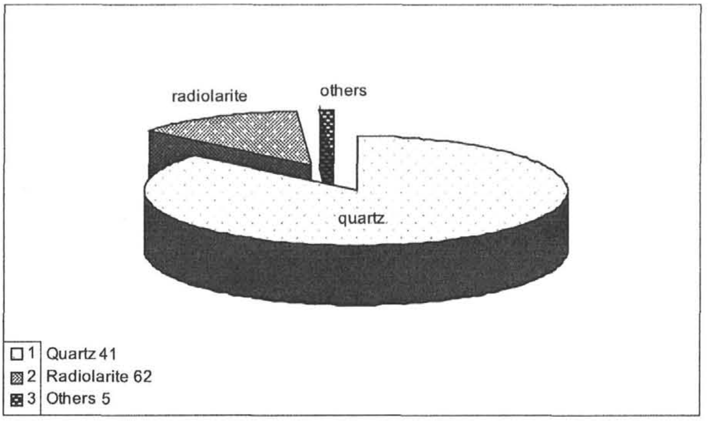

Table 4: Hôrka-Ondrej, area B. Raw material structure

The chipped stone industry from Hôrka-Ondrej, area B carries the typical features of the Levallois technique on core types, flakes, and finished tools, where Levallois and atypical Levallois points are dominant. Other tool types such as side-scrapers, knives, denticulate, and notched flakes are common in the Middle Palaeolithic Mousterian layers as well. The finds were assigned to microlithic industries, made dominantly from quartz, and chronologically belonging to the last interglacial. The average dimension of individual types of artefacts was the following: 35, 95 × 27,25 × 10,75 cm. The finds from Hôrka-Ondrej are distinguished from the Taubachien, or other microlithic Middle Palaeolithic industries of the last interglacial by a high portion of the Levallois technique,[14] but mainly by the age obtained by the U/Th dating.

The age of the layers with the chipped stone industry from area B with the most numerous finds, close to layer C (a dense porcelaneous travertine layer situated above the initial rendzinna soil), originally labelled as layer 2,[15] was dated by the U/Th to 160 000 ± 10%.[16] Charcoals of Pinus sylvestris were common in cinder layers D, B and A, with Betula sp. in the very bottom layer D. The layer C contains also Picea abies / Larix decidua. Species present in these imprints suggest that during the sedimentation of this part of the mound, its close surrounding was open, and a coniferous forest grew in a further distance.[17]

The finds belong to the Middle Pleistocene interglacial, together with the industry from area D, in layers from the continuing travertine deposition that began before the end of Riss. The finds of the chipped stone industry can be assigned to the Early Mousterian with a Levallois technique.

Area D

89 artefacts were found in the loose layers 1 and 2, and in the firm travertine layers in the immediate vicinity of the main mineral water spring. Layers 1 and 2 were detected only in a small area immediately at the original mineral water spring, layer 3 in the top upper part of the remains of the mound. Compact travertine in layer 3 contained mainly leaf imprints of Salix caprea. Fossilized trunks and pine cones of Pinus cf. sylvestris were also present, and rarely, grasses Poaceae were found.[18]

Layer 1 contained only a blade-shaped quartz flake, and a side-knife with a natural side, size: 37 × 32 × 21 mm (Fig. 4, 7). Layer 3 contained tools, remains of cores, and flakes.

[14] Valoch 1984, 195.

[15] Prošek–Ložek 1957, Fig. 2.

[16] Ford 1995, 127.

[17] Hajnalová–Hajnalová 2000, 161.

[18] Hajnalová–Hajnalová 2000, 161.

Type	Name	Amount
10.	Convex side-scraper	1
32.	Burin	1
38.	Side-knife with a natural side	1
37.	Atypical side-knife	1
43.	Denticulate flake	1
45.	Flake with a lower retouch	1
49.	Flake with an alternating and low retouch	1
Total:		7 pc.

Table 5: Hôrka-Ondrej, area D. Typological composition of the tools

Cores:	disc shaped	2
	chipped pebble	1
	Broken pebble	2

Table 6:_Hôrka-Ondrej, area D. Types of cores

Type	Amount	With original surface	Total
wide	3		3
oval	1		1
pointed	2		2
tetrangular	2		2
platy		1	1
small	22		22
irregular	39	5	44
Total	70	6	76

Table 7: Hôrka-Ondrej, area D. Flake shapes

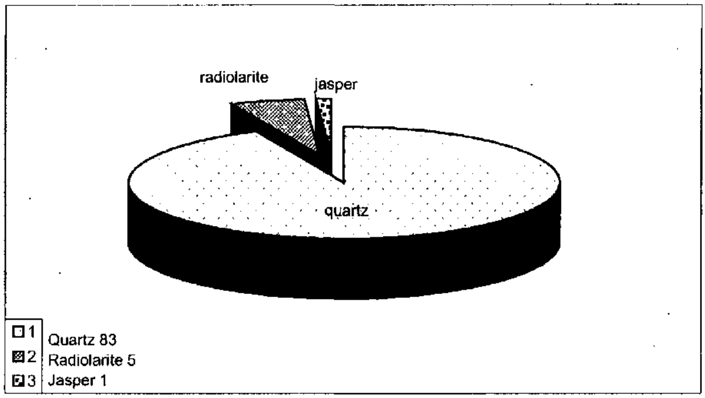

Table 8: Hôrka-Ondrej, area D. Raw material composition

The chipped stone industry has a flake character. Preserved remains of the cores show that they were disc shaped, size 26 × 25 × 16 mm and 34 × 66 × 30 mm (Fig. 4, 12.), without a prepared striking platform. The majority of the flakes are amorphous, and only some had a preserved cortex. Retouched forms (Fig. 4, 1), and a tetragonal flake (Fig. 4, 2., 9.) are also present.

The tool types, with the exception of a flake and a side-knife from layer 2, are represented only by one piece each. All of them are made on quartz. A flake with a lower retouch from layer 3 is pointed with a partially preserved cortex, size: 33 × 23 × 14 mm (Fig. 4, 3.). A convex side-scraper is made on a narrow flake, size: 38 × 14 × 13 mm (Fig. 4, 5.). A wedge-shaped burin is on a flake with a part of the cortex preserved (Fig. 4, 6.). A side-knife is made on a citrus slice shaped quartz flake (Fig. 4, 7.). An atypical side-knife has the cutting edge modified on the lower side by a retouch, size: 45 × 28 × 12 mm (Fig. 4, 10.). A denticulate flake is retouched from the upper, and partially also from the lower part, size: 38 × 21 × 14 mm (Fig. 4, 8.), another denticulate flake has an alternating and low retouch, size: 39 × 23 × 16 mm (Fig. 4, 11.).

The tool composition of the chipped industry is common for Mousterian industries. Only the basal part of a radiolarite blade is an exception, size: 37 × 23 × 5 mm (Fig. 4, 4.) which was found on the northern slope, on the boundary of the bed and the trash deposit. The way of striking is almost Upper Palaeolithic, and it does not correspond to the other finds from area D. It is more comparable with the industry from area A.

The chronological position of the early Mousterian from area D is determined by the age of the firm travertine in area C (profile C, layer 13), which forms one layer together with layer 3 from area D. The U/Th dating for the layer gives an age 143 500 ± 7%,[19] corresponding to the younger phase of the penultimate glacial (Riss). The industry from area D is the more recent continuation of the early Mousterian settlement documented in area B.

[19] Ford 1995, 127.

Layers with finds from travertine mounds in the Spiš region dated by the U/Th method to an older period than the last interglacial are the following: Vyšné Ružbachy 204 000 and 231 000, and Beharovce-Sobocisko more than 206 900, and Hranovnica more than 264 700 years.[20]

The middle phase of the Middle Palaeolithic

The middle phase of the Middle Palaeolithic at Hôrka-Ondrej is represented by the small sized Taubachian industry uncovered in beds from the last interglacial in area C (Fig. 5.). Area C was studied in three profiles (Table 9.).

Profile	Layer	Amount of pieces
C1	9	1
C1	12	5
C1–C3		10
C3	12	4
C2	4	3
C2	8	1
Total		24 pc.

Table 9: Hôrka-Ondrej, area C

The finds were concentrated in the lower part of the C1 and C2 profiles in layer 12, where the presence of charcoal and burnt animal bones indicated a possible existence of a fireplace. Charcoals of Pinus sp. found at the bottom of the fireplace document the presence of man on this site at the time of travertine sedimentation (layers 10–12) in this part of the travertine mound.[21]

The chipped stone industry was made on quartz. It was composed mainly of flakes of average size 27,8 × 21,8 × 10 mm. Small flakes were the majority but larger pointed pieces (Fig. 6, 3–4.), spindle-shaped flakes often with quartz cortex (Fig. 6, 5.), a wider tetrahedral flake (Fig. 6, 9.), a flake with cortex on both ends (Fig. 6, 7.), and flakes from an edge of a core (Fig. 6, 8., 11.) appeared as well. Only one core without a prepared striking platform was preserved, size: 34 × 33 × 25 mm (Fig. 6, 6.).

Finished tools in layer 12 of profile C1 comprised a short straight transversal side-scraper, size: 19 × 23 × 9 mm (Fig. 6, 1.), and in profile C3 one denticulate flake, size: 26 × 32 × 15 mm (Fig. 6, 2.). In the upper layers there was a small flake in layer 9 of profile C1, a burin type 32 in layer 8 of profile C2, (Fig. 6, 10.), and three flakes in layer 4.

20 Hausmann–Brunnacker 1988, 49.

21 Hajnalová–Hajnalová 2000, 163.

The chronological position of the finds from layer 12 is delineated by an underlying firm travertine layer (layer 13) with a U/Th date 143 500 ± 7%,[22] and in a hanging wall in layer 10b by malacofauna from the end of the last interglacial.[23] A flake from layer 9 of profile C1 and a burin from layer 8 of profile C2 belong probably to the same industry from the last interglacial. Layer 4 of profile C2 is younger.[24] The chipped stone industry from area C at Hôrka-Ondrej can be assigned to the Taubachien from the last interglacial (Eem).

The majority of the travertines with archaeological materials in the Spiš region is older than it was originally assumed, and there are only materials from the last interglacial in Gánovce-Hrádok and Hôrka-Ondrej, area C. In the Liptov region such finds are known from the travertine mound in Bešeňová, and in Central Slovakia from Bojnice III.

The younger phase of the Middle Palaeolithic

The most intensive settlement of the travertine locality Hôrka-Ondrej is documented in the younger phase of the Middle Palaeolithic in area A. The materials were concentrated in differently labelled layers of fossil soil sediments (G–C), delineated from below by the lower travertine, from above by a layer of loessy loam B, and partially they were found also in the layers of the younger travertine on the southern side of the uncovered area (Fig. 7.). After the deposition of layer C, when the sedimentation of layer B began, as result of freezing, a movement of the body of the lower travertine body occurred, resulting in its further fracturing and pushing to the south. These movements caused folding of the layers with the archaeological finds, their faulting, and their uplifting in the southern part in such a way that the upper part of the already deposited layer C was faulted over the depositing layer B.

During this movement a tearing and deformation of the layer with an oval fireplace in sectors A–D and a 4–7, occurred (Fig. 8.), as well as the faulting of a part of the stone industry and the animal bones (Fig. 9.). A high proportion of side-scrapers and knives, and occurrence of points belong to the traditional inventory of a hunter's camp which existed at the mineral water spring.

The period of the formation of the layers with archaeological finds is assumed to have been in some interstadial of the beginning of the Old Würm,[25] based on palaeopedology of fossil soil sediments[26] and geological observations.

The composition of the fauna from the above mentioned layers corresponds to societies belonging to the beginning of the Old Würm.[27] Particularly the small form

[22] Ford 1995, 127.
[23] Ložek 1993, 109.
[24] Smolíková 1993.
[25] Kovanda 2000.
[26] Smolíková 1993.
[27] Horáček 1995.

of the steppe-fox (Vulpes gr. corsac), and the porcupine (Hystrix vinogradovi), but other species as Arvicola terrestris, Cricetus cricetus, Ursus cf. spaeleus – denningeri, Coelodontus antiquitatis, Equus cf. germanicus etc. are numerous as well. The layers of loamy fossil sediments are sterile in respect of malacofauna.[28]

From the area of the fireplace, in sectors a 4–7, layer D, charcoal was determined as coming from alder (Alnus sp.), common hornbeam (Carpinus betulus), and forest pine (Pinus silvestris) indicating a cooling of the climate.[29]

In 1988 a fragment of a female skull of Homo sapiens sapiens has been revealed in Hôrka-Ondrej, area A. A high age of the skull was proved by analyses of amino acids and microanalyses of bones from the skull as well as animal ones. Fluoric analyses and mainly C^{14} dating realised in Oxford indicated the contemporary age of the skull. In 2003 three former workers, which had participated in the excavations, declared the find of skull to be a deceit. The problem of the skull´s disputable age has been solved by this way and so I beg you further not to concern the find to be a Palaeolithic one.

The chipped stone industry

The chipped stone industry in area A presents a relatively abundant collection, consisting of 4088 pieces. There were only 112 finished tools, 2.73%. Cores and their remains comprise 79 pieces, 1.93%. The most abundant group were flakes and debitage, which present 3,897 pieces, 95.32%.

Technological groups	no	%
Cores	79	1.93
Flakes	3890	95.17
Blade	7	0.17
Tools	112	2.73
Total	4088	100.00

Table 10: Hôrka-Ondrej, area A. Major technological groups

A substantial part of the industry was made on quartz of various colours (pink, green, milky, transparent, dark grey to black), and quality (very fine-grained, coarse-grained with a firm little eyes, cracked), a total of 3580 pieces—87.57%. The second most widely utilised raw material was chert, 484 pieces (11.83%) with a few colour varieties. The most common was reddish brown radiolarite (247 pcs.), followed by grey-green (125 pcs.), yellow-green (110 pcs.), and one of each in orange-pink and black. Besides

[28] Ložek 1993.

[29] Hajnalová–Hajnalová 2000, 164.

these raw materials also 14 pieces of silicates (hornfels or flintstones), 2 pieces of jasper, and 8 pieces of quartzite were identified.

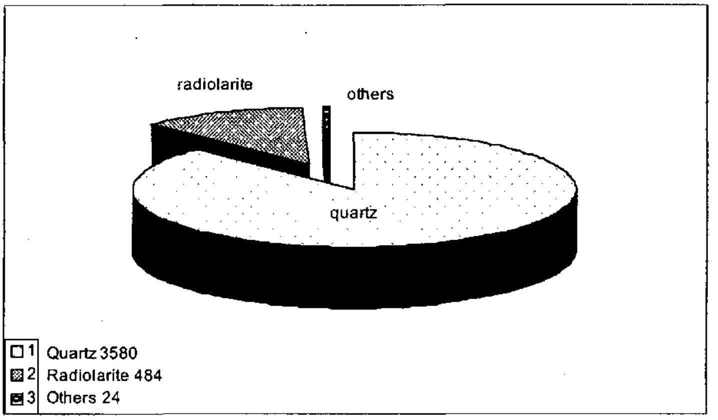

Table 11: Hôrka-Ondrej, area A. Raw material composition

The industry had a flake character, common in the Mousterian. Utilisation of a Levallois technology was low. The way and the quality of the stone tool production were influenced by the type of the raw material, which were mainly quartz pebbles.

The cores came from different stages of production (Fig. 10.). This and the amount of flakes and debitage suggest local production of the stone industry. Only one hammerstone was found but numerous cores have marks on the cortex, indicating that they were hammerstones before they were used as cores.

Cores:	no	%
With one striking platform	22	27,85
Disc-shaped	20	25,32
Hemispheric	6	7,60
Spherical	1	1,26
Prismatic	1	1,26
Pyramidal	1	1,26
Core remnants	27	34,19
Hammerstone	1	1,26
Total	79	100,00

Table 12: Hôrka-Ondrej, area A. Types of cores

Flakes composed the most numerous part of the industry—3897 pc (95, 32%), representing different phases of core production. During the platform preparation flakes were produced that had cortex on dorsal side and the platform. The flakes were mostly short, obtuse triangular shape, and some were retouched to form tools. Flakes with partially preserved cortex and flakes with cortex on the platform were produced as well. Four hundred and five flakes and tools (9.90%) had a preserved cortex. The flakes had various shapes, they were mostly short, wider, some were elongated, pointed, or struck from the edge of a core. The majority of flakes was amorphous, as a result of the low quality quartz material.

Flakes prepared for further processing were often citrus-slice-shaped with preserved cortex on the side. The cutting edge opposite the side was not retouched, and depending on the raw material quality, it was more or less straight.

The striking was done in most cases by hard hammerstones. The more distinct traces of such striking were visible on flakes and tools from higher quality raw materials, such as chert, hornfels, and flint. It was barely possible to follow these processes on the most frequently used raw materials. The striking angle was obtuse. Platforms were most frequently smooth, with cortex or without it. Wedge-shaped platforms, platforms with a rim, or pointed platforms were present in a few cases.

Striking surface:	no	%
Smooth	69	77.5
With cortex	7	7.9
Faceted	5	5.6
Pointed	3	3.4
With a rim	3	3.4
Wedge-shaped	2	2.2
Total	89	100.00

Table 13: Hôrka-Ondrej, area A. Platform preparation

Use intended portions of the tools were retouched. Most frequently it was a scalar, semi-steep retouch on edges, completed by fine retouch. In some cases a part of the tool was partially retouched, on dorsal or ventral side. Flakes created by flat retouch were distinguishable only in cases when they were on better raw material, e.g. radiolarite.

There were 112 pcs of tools (2,73%) classified into 32 types. The number pieces belonging to individual types was very variable (Table 14.).

Type	Name	Amount	%	Dimensions (mm)
1.	Levallois flake	1	0,89	32 × 26 × 9
2.	Atypical Levallois flake	2	1,78	20 × 20,5 × 4,5
5.	Pseudo-Levallois flake	4	3,57	34,7 × 29 × 10
6.	Mousterian point	1	0,89	33 × 24 × 11
9.	Straight side-scraper	6	5,35	51,3 × 35,5 × 13
10.	Convex side-scraper	11	9,82	37 × 30,4 × 16,5
11.	Concave side-scraper	3	2,67	24 × 22,3 × 11,6
15.	Double-convex side-scraper	2	1,78	39 × 32,5 × 11,5
17.	Convex-concave side-scraper	1	0,89	22 × 10 ×9
19.	Pointed side-scraper convex	1	0,89	38 × 20 × 14
21.	Angle side-scraper	2	1,78	25,5 × 37 × 13
23.	Transversal convex side-scraper	3	2,67	28,3 × 40 × 17
24.	Transversal concave side-scraper	2	1,78	22,5 × 35 × 21
25.	Side-scraper with a lower retouch	1	0,89	50 × 34 × 18
27.	Side-scraper with a thinned edge	3	2,67	36 × 23,8 × 9,8
30.	Side-scraper	1	0,89	27 × 30 × 10
31.	Non-distinct side-scraper	1	0,89	49 × 20 ×10
32.	Burin	6	5,35	25 × 19,4 × 11,1
35.	Atypical borer	1	0,89	34 × 24 × 13
36.	Side-knife	10	8,92	35,6 × 22,6 × 12
37.	Atypical side-knife	3	2,67	54 × 38,6 × 21,3
38.	Side-knife with cortex	20	17,85	41 × 29 × 15,6
40.	Flake with diagonal. retouched end	1	0,89	38 × 24 × 16
41.	Mousterian knife	1	0,89	23 × 17 × 8
43.	Denticulate flake	11	9,82	29 × 25,6 × 9,2
45.	Flake retouched on lower portion	3	2,67	45 × 32 × 16
46.	Steeply high retouched flake	1	0,89	76 × 75 × 36

48.	Steeply low retouched flake	3	2,67	31 × 21 × 4,6
49.	Alternately low retouched flake	1	0,89	21 × 17 × 5
50.	Bi-facially retouched flake	2	1,78	30 × 19 × 9
62.	Blade with retouched edges	1	0,89	60 × 19 × 6
63.	Leaf point	3	2,67	46 × 24 × 9,6
	Tools	112 pcs	2,73%	of the industry

Table 14: Hôrka-Ondrej, area A. Typological composition of tools

Important indices and groups of tools:

IL^{ty} = 2,67	IL^{ess} = 3,03	IR = 31,25	IR^{ess} = 35,35	IQ = 1,00
IB = 0,00	Ilam = 0,001			
I = 7, 14%	II = 31,25%	III = 8,03%	IV = 41,07%	V = 8,92%
VI = 0,87%	VII = 2,67%			

The basic feature of the industry was its flake character, common in the Mousterian of the Middle Palaeolithic, with a slight increase of Upper Palaeolithic types.

The dimensions of the industry were mainly medium (length 30-50 mm) and small (length: 20-30 mm), even though larger artefacts were present as well. The size was related first and foremost to the choice and size of the raw material. In the case of the industry from area A, the raw material used was quartz, which dominates the other kinds of raw materials. It was accessible in sufficient amount, however with varying quality. The nearest large river from which the riverbed quartz pebbles could come, was Hornád, its distance from the locality was only a few km to the south.

The large size of the pebbles can be estimated from the preserved whole pieces, and from the artefacts. A single preserved whole piece was a pebble that was utilised as a hammerstone, measuring 97 × 83 × 63 mm. Quartz cores from different phases of production had average dimensions 44 × 42 × 30 mm. Also cores with greater dimensions, e. g. 82 × 58 × 25 mm, 80 × 83 × 47 mm, 68 × 54 × 33 mm, 60 × 59 × 64 mm were preserved. The smallest preserved cores measure 23 × 17 × 18 mm, 24 × 32 × 24 mm, 27 × 18 × 18 mm. Cores that had only first flakes removed were small as well: 25 × 24 × 28 mm, 31 × 23 × 17 mm.

Quartz flakes had average dimensions 31 × 26 × 12 mm. Some pieces among them went significantly over this boundary (69 × 31 × 25 mm, 69 × 41 × 18 mm, 62 × 27 × 26 mm), however, the majority of flakes had smaller or small dimensions (6 × 10 × 2 mm, 18 × 24 × 12 mm, 14 × 19 × 5 mm, 11 × 15 × 5 mm, 10 × 13 × 6 mm).

Radiolarite cores were preserved only in two instances. These cores were exhausted, classified as disc shaped cores, with average dimensions 29 × 29 × 16, 5 mm.

Flakes on radiolarite and from others silicates had an average size 24 × 21 × 6 mm. This was a consequence of an effort to fully utilise the raw material, as it was of a higher quality, and was less accessible. Flakes on weathered surfaces of chert were also utilised. Retouch of these materials was done also in the area of the settlement, this was documented by utilised cores, flakes resulting from retouch, among them also flakes produced by flat retouch.

Radiolarite resources were present in a distance of several tens of kilometres, in the area of the Tatras, in the Polish Pieniny mountains, and also in the karst belt of Eastern Slovakia, the more remote were in karst belt of Western Slovakia.[30]

In the case of the others artefacts (14 pcs), it was not possible to determine more precisely the raw material as they were burnt. They were probably radiolarite or flintstone, foreign raw materials in the territory of Slovakia, the nearest sources were in the area of Poland.[31]

Jasper (2 pc) and quartzite (8 pc) were also present among the raw materials, and these can be regarded as local.

Blade-shaped flakes and blades were represented in the industry as well. The most regular was a blade with retouched edges made on radiolarite, classified as type 62 (Fig. 13, 9.). Most of them were flakes with parallel edges, thicker, often with wide platforms, struck using a Middle Palaeolithic technique. Besides the blade classified as type 62, all others were preserved only in fragments.

Artefacts classified as individual tools types, had average dimensions 37 × 28 × 13 mm. The most common were artefacts with length 30 to 50 mm, but numerous were also deviations in both directions. Microlithic artefacts from Hôrka-Ondrej were an anomaly, considering the large size of the used raw material. More radiolarite artefacts, but also some quartz pieces, reach dimensions typical for other Mousterian cultures.

Scalar retouch, sometimes completed by a small pearl retouch on the margin, was mostly utilised in the retouch of the working edges of the tools. To a relatively smaller extent also denticulate and notched retouch were used. A pointed shape was also a characteristic feature of the industry.

A very important feature of the industry from Hôrka-Ondrej was the use of a flat retouch on several types of artefacts (15 pc): a) on the ventral side of side-scrapers: straight (Fig. 11, 9.), convex (Fig. 12, 5.), angular (Fig. 14, 7.), on two side-scrapers with a thinned edge (Fig. 11, 5.), on a side-knife (Fig. 11, 8.), on a flake with a lower retouch, and in a flake with a bifacial retouch; b) on the dorsal side of a pointed convex side-scraper (Fig. 12, 4.), sharp-edged side-scraper with a thinned edge, and on a side-knife; c) on both sides of a side-knife (Fig. 13, 1., 3.) and on three leaf points (Fig. 11, 4., 6–7.).

[30] Kaminská 1991, 20.

[31] Ginter–Kozłowski 1975, 18–23.

Chipped stone industry from Hôrka-Ondrej, area A represents the youngest phase in development of the Middle Palaeolithic. An uninterrupted continuation of the development of the industry in travertine mounds from the last interglacial into the Old Würm was documented besides Hôrka-Ondrej also in Gánovce and Bojnice.

A genetic connection of the industries from the last interglacial with those from the Old Würm of the Spiš region was evident in their raw material and typological composition, and in the production technology. Quartz was the dominant material complemented by chert.

Common types of Middle Palaeolithic artefacts, with a dominance of side-scrapers, were repeated in the inventories. Denticulate and notched flakes did not reach more distinct proportions. Mousterian points were present in Gánovce[32] and in Hôrka-Ondrej, and flat retouch was documented already on side-scrapers from Gánovce.[33] A radiolarite blade was found in layer 3 in Gánovce, and in layers 1 and 4 blade-shaped flakes.[34]

The chipped stone industry corresponds to finds from the Mousterien of the Old Würm. The closest to Slovak travertine localities were finds from Bojnice I – Prepoštská cave, belonging to the final stage of W 1.[35] Approximately the same age and the same typological composition are industries from the open settlement localities in Prievidza,[36] and from Žiarska basin in Central Slovakia. In Eastern Slovakia there were finds from the middle part of the valley of Topľa, Torysa, and Ondava rivers.

Other analogies to the Mousterian industry from Hôrka-Ondrej were found at the Hungarian localities Tata[37] and Érd[38] dated to the interstadial Brörup. A similar industry comes from caves Raj[39] and from layer XIII in Obłazowa[40] in Poland.

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[32] Bánesz 1991, Tab. 1, 3.
[33] Bánesz 1990, 49.
[34] Bánesz 1990, 48–49.
[35] Bárta 1966, 16–22.
[36] Bárta 1980, 31–51.
[37] Kretzoi–Vértes 1964, 262.
[38] Gábori-Csánk 1968, 110.
[39] Kozłowski 1990–91, 611.
[40] Valde-Nowak 1991, 601.

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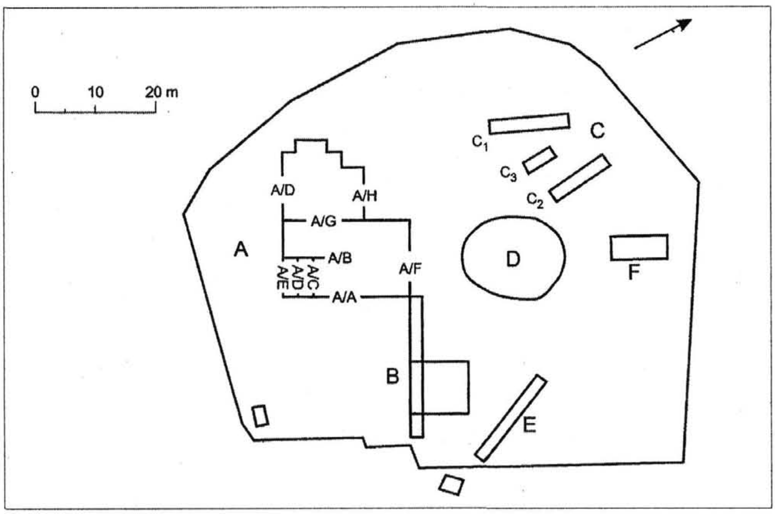

Fig. 1. Hôrka-Ondrej. Plan of the research, indicated profiles in worked areas

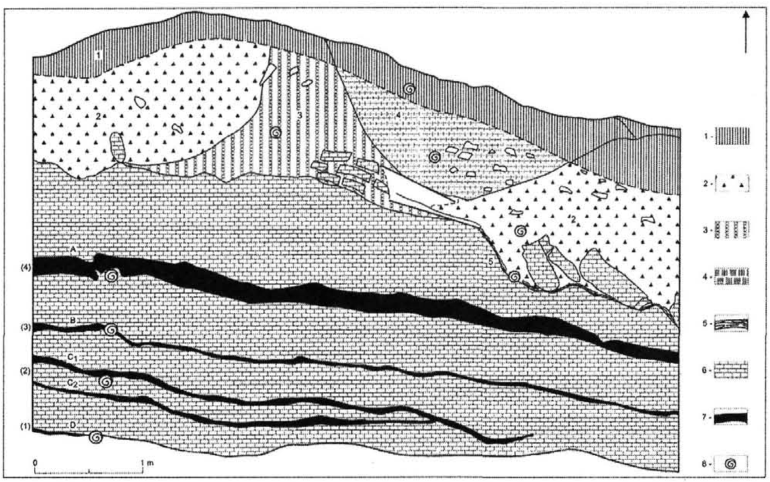

Fig. 2. Hôrka-Ondrej. Area B, a profile from 1992
1 – black-grey rendzina soil 2 – light brown ochre loess, deluvial sediment containing big travertine blocks and small corroded travertine fragments 3 – light brown ochre loam sand deluvial sediment with travertie fragments 4 – a descended Slavic object 5 – irregular brown-green clay loam 6 – layers of pramenite 7 – dark grey to black layers of rendzina soils A–D with finds of chipped stone industry 8 – locations of malacofauna sampling

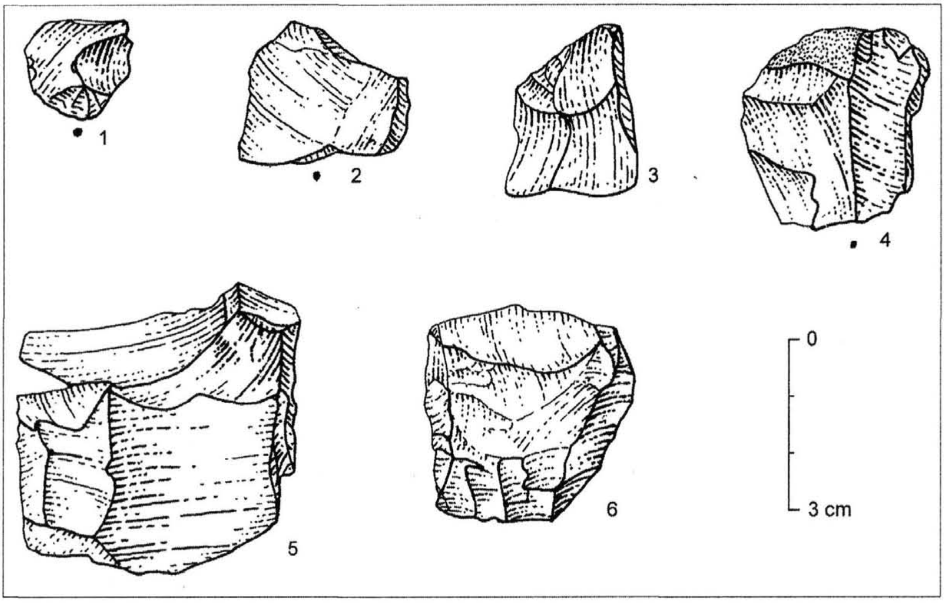

Fig. 3. Hôrka-Ondrej. Chipped stone industry
1–3, 6 – area B, Early Mousterian 4 – profile F 5 – area A, sector F2 1, 5, 6 – radiolarite, 2–4 – quartz

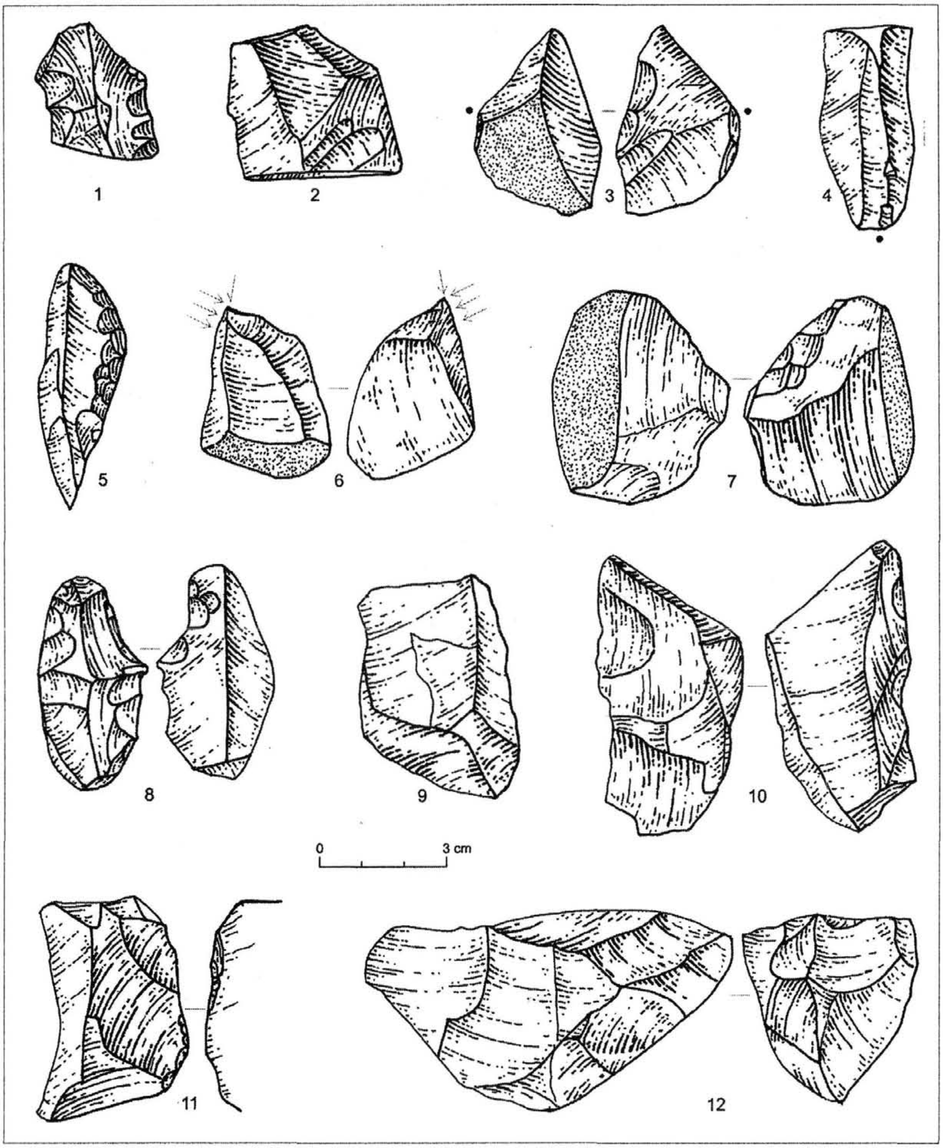

Fig. 4. Hôrka-Ondrej. Area D. Chipped stone industry
1, 3, 11 – retouched flakes 2, 9 – flakes 5 – convex side-scraper 6 – burin 7 – side-knife 8 – denticulate flake 10 – atypical side-knife 12 – disc shaped core
1–3, 5–12 – quartz, Early Mousterian 4 – blade, radiolarite, Mousterian

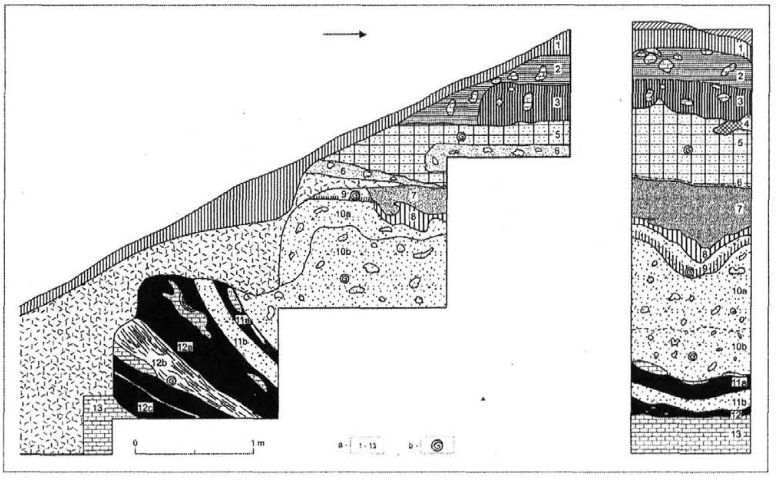

Fig. 5. Hôrka-Ondrej. Area C, profile C1
1 – layers of the profile: 1–4 – covering deluvial beds 5–12 – layers of the youngest travertines, on the bottom with spring mud 13 – firm bedded older travertine
2 – locations of malacofauna sampling

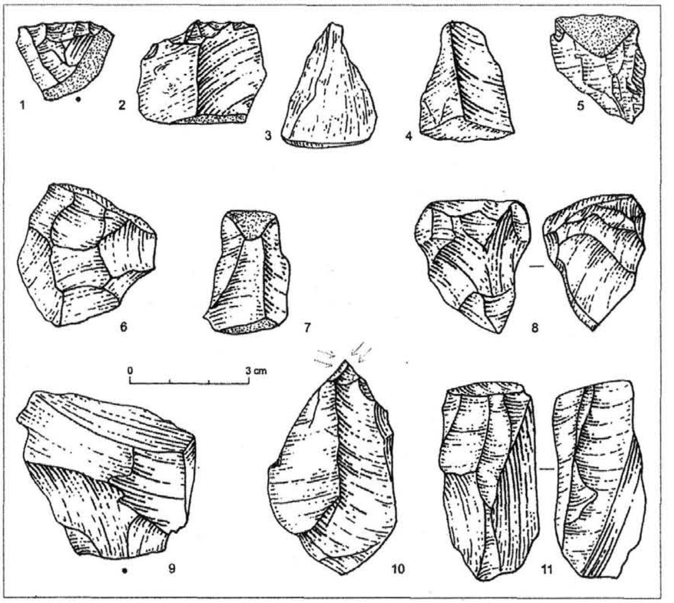

Fig. 6. Hôrka-Ondrej. Area C. Chipped stone industry of the Taubachian
1 – straight transversal side-scraper 2 – denticulate flake 3–5, 7–9, 11 – flakes
6 – core without a prepared striking platform 10 – burin 1–11 – quartz

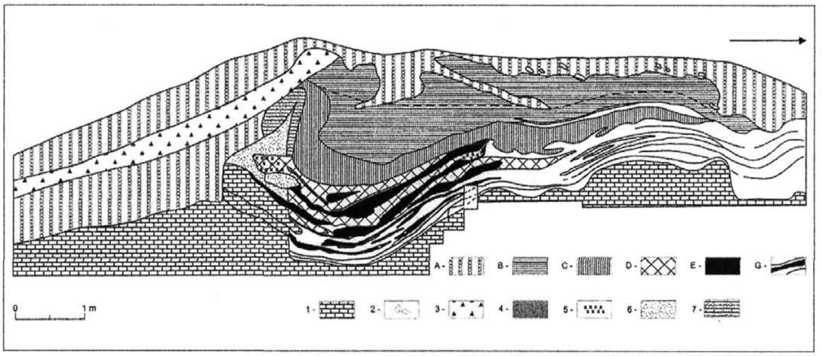

Fig. 7. Hôrka-Ondrej. Area A, profile A/B
1 – the older part of the lower travertine 2 – travertine fragments 3 – trash deposit after the travertine quarry 4 – burnt layers 5 – charcoal pieces 6 – the younger part of the lower travertine 7 – the youngest travertine
A – layer A, trash deposit B–C – loamy deluvium and fossil soil sediments, layers B, C, D E and G

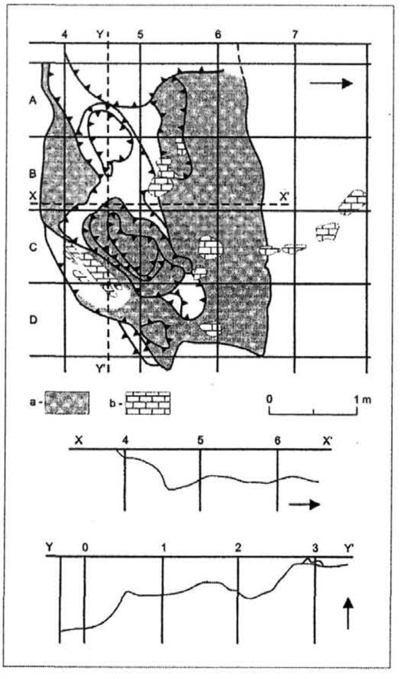

Fig. 8. Hôrka-Ondrej. Area A, ground plan profiles of the hearth in sectors A–D 3–7. a – burnt area b – pieces of travertine

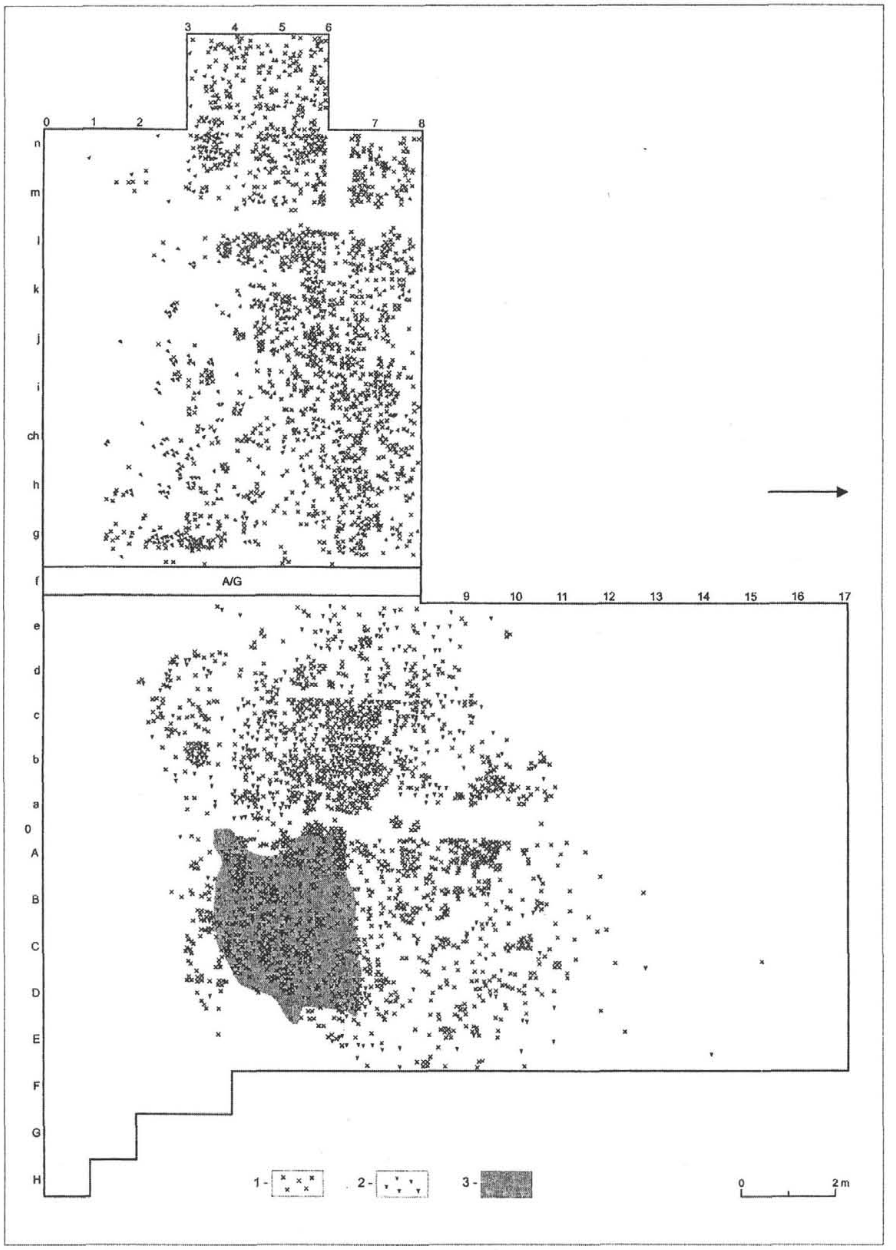

Fig. 9. Hôrka-Ondrej. Area A. Spatial distribution of finds
1 – chipped stone industry 2 – animal bones 3 – hearth

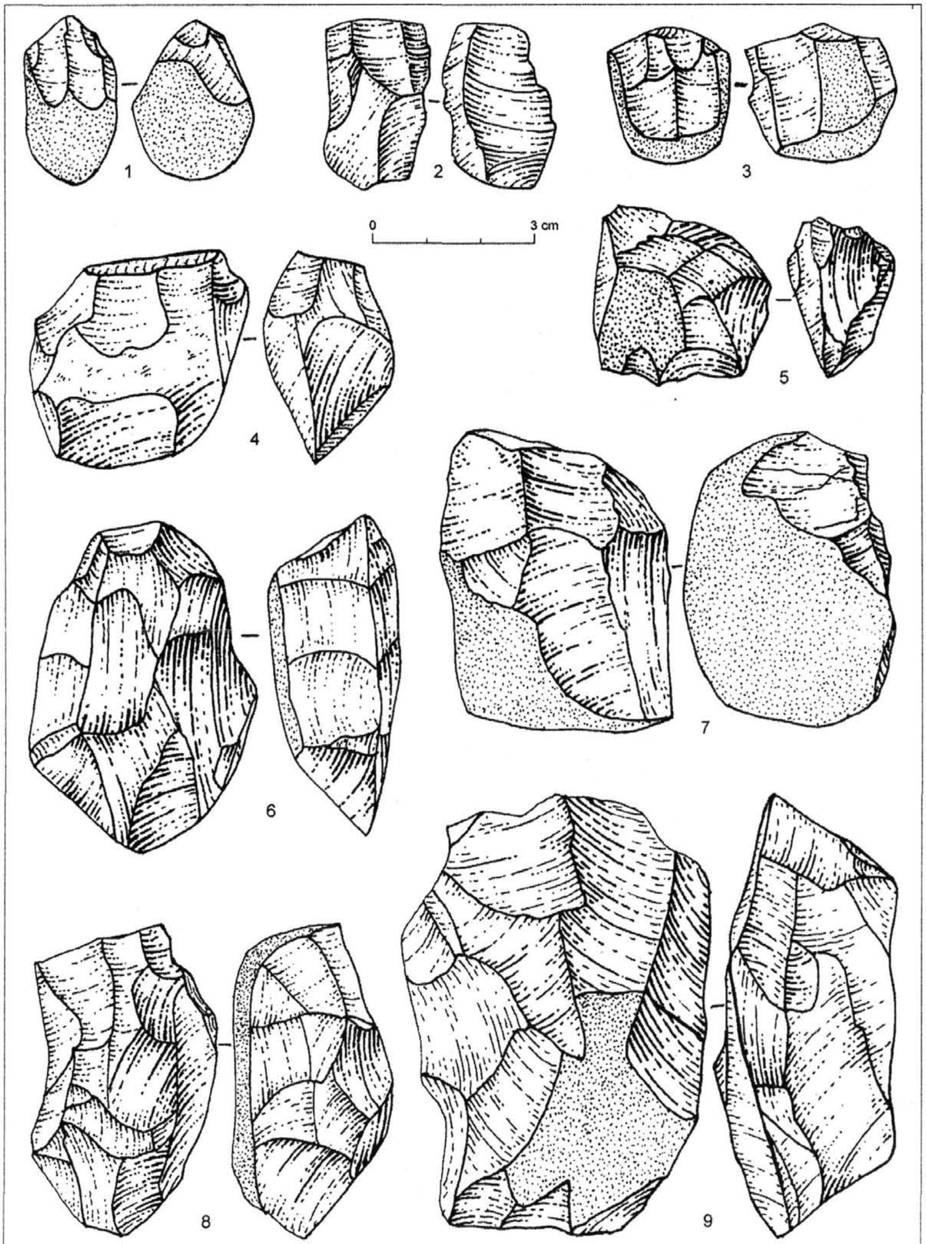

Fig. 10. Hôrka-Ondrej. Area A. Mousterian chipped stone industry
1–4 – cores with one striking platform 5–7, 9 – disc-shaped cores
8 – hemispheric core 1–9 – quartz

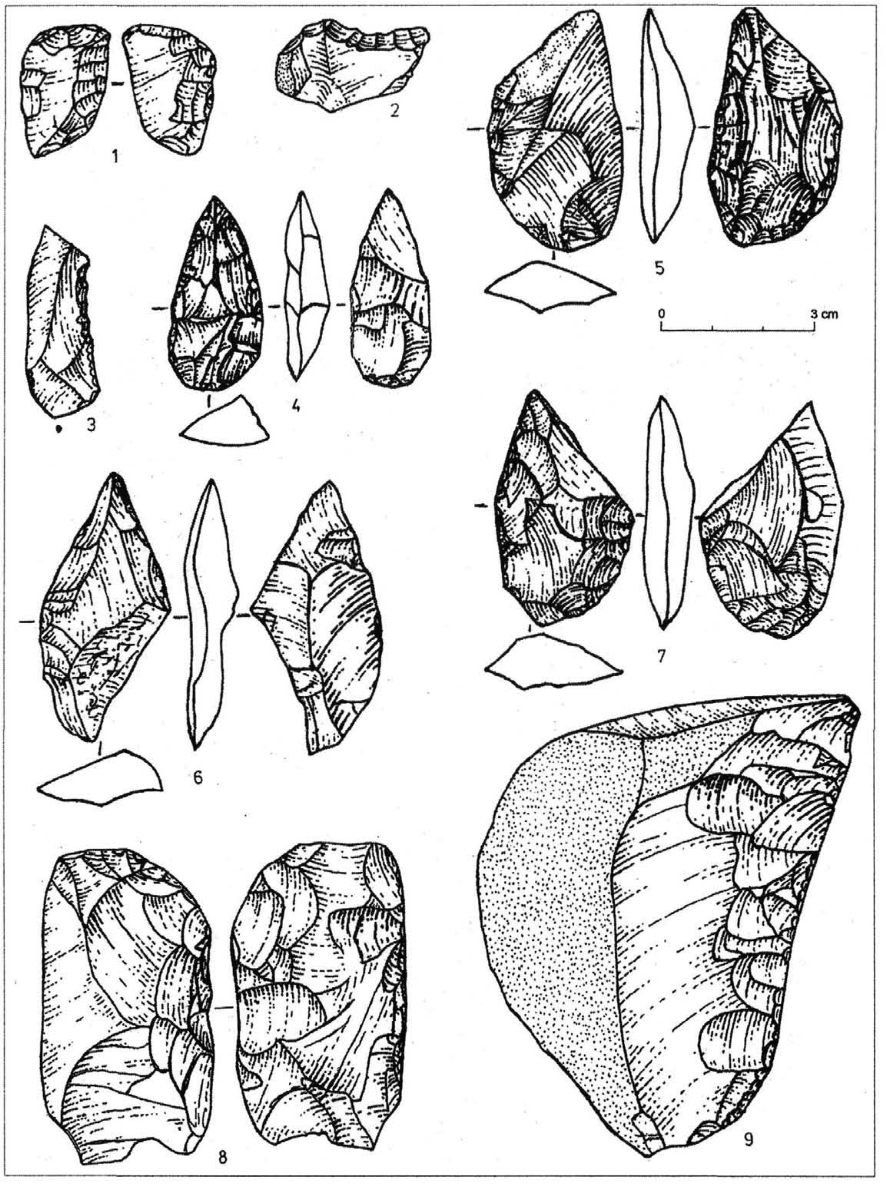

Fig. 11. Hôrka-Ondrej. Area A. Mousterian chipped stone industry
1 – trapezoid knife 2 – transversal concave side-scraper 3 – denticulate blade 4, 6, 7 – leaf points with flat retouch 5 – convergent side-scraper with the flat retouch on the ventral side 8 – side-knife with flat retouch on the ventral side 9 – straight side-scraper 1 – quartz 2–9 – radiolarite

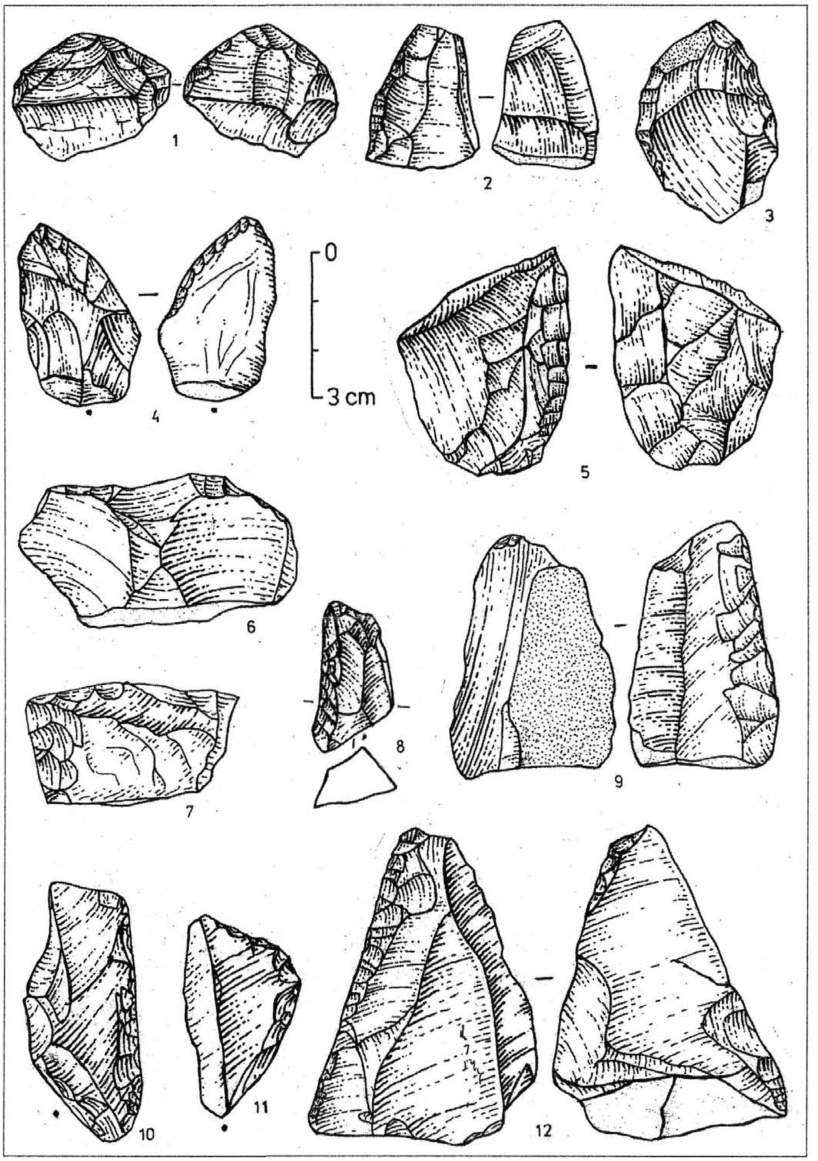

Fig. 12. Hôrka-Ondrej. Area A. Mousterian chipped stone industry
1 – transversal side-scraper 2, 5, 11 – convex side-scrapers 3 – double convex side-scraper 4 – sharp-edged side-scraper with thinned edge 6 – transversal concave side-scraper 7 – angle side-scraper 8 – concave side-scraper 9 – straight side-scraper with lower retouch 10 – straight side-scraper 12 – straight side-scraper
1–5, 7–9, 11 – quartz 6 – quartzite 10, 12 – radiolarite

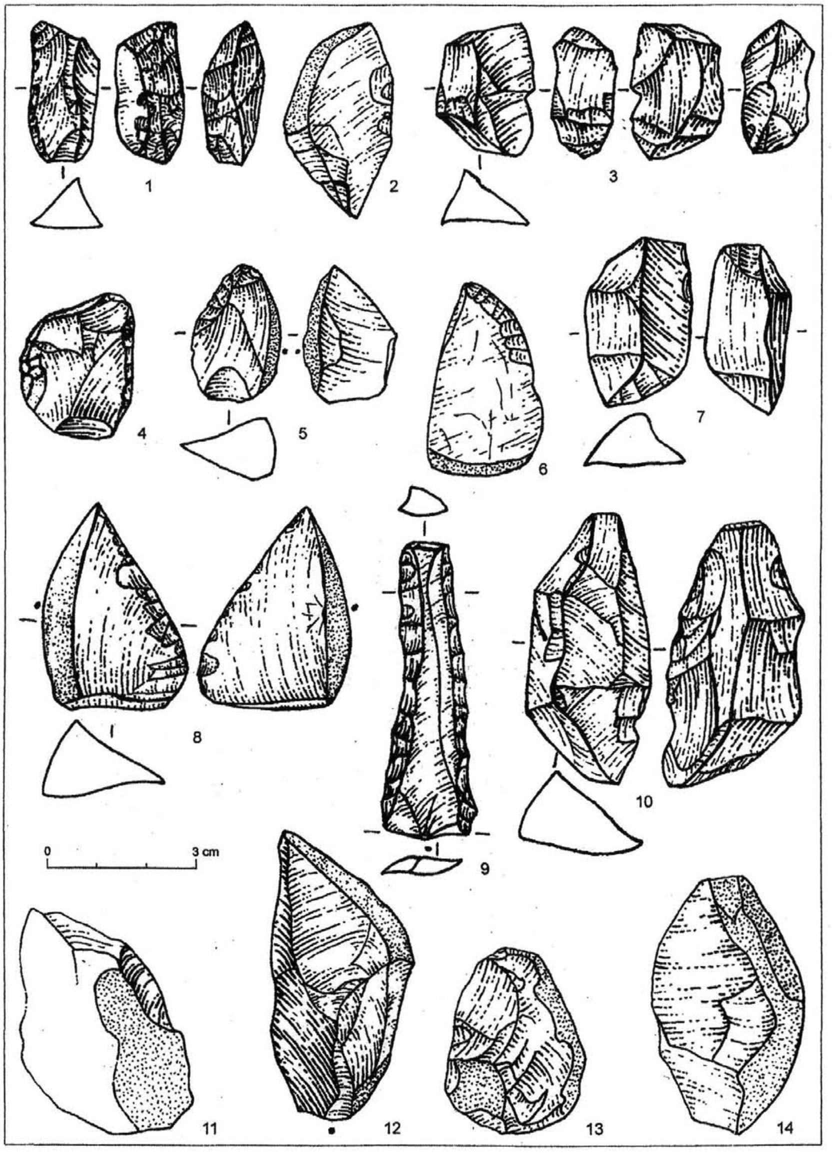

Fig. 13. Hôrka-Ondrej. Area A. Mousterian chipped stone industry
1, 3, 4, 7, 10 – side-knives 2, 5, 6, 8, 11–14 – side-knives with cortex 9 – blade with retouched edges 1, 3, 4, 7, 9,10 – radiolarite 2, 5, 6, 8, 11–14 – quartz

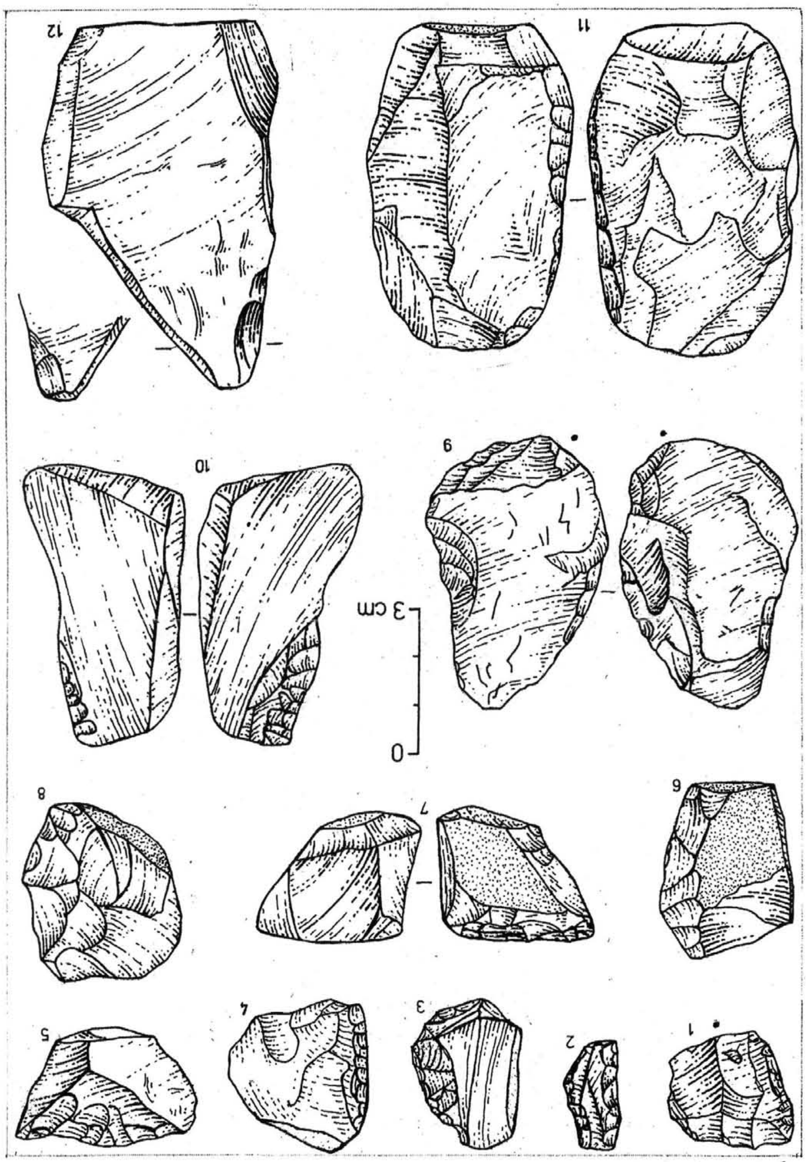

Fig. 14. Hôrka-Ondrej. Area A. Mousterian chipped stone industry
1 – concave side-scraper 2 – convex-concave side-scraper 3, 4, 6, 8 – convex side-scrapers 5 – transversal side-scraper 7 – angle side-scraper 9–12 – side-knives
1, 2, 7 – radiolarite 3–6, 8–12 – quartz

Le paléolithique moyen tardif en Roumanie

MARIN CÂRCIUMARU – MARIANA PLEŞA

En ce qui concerne le Moustérien de la grotte Bordul Mare de Ohaba Ponor, en 1955 C. S. Nicolăescu-Plopşor invoquait M. Roska qui plaçait le Paléolithique de cette zone à un Moustérien moyen, à l'encontre de O. Kadiè et du paléontologue M. Mottl qui l'avait attribué au Moustérien supérieur. De son côté, le paléontologue St. Gaál considérait le Moustérien de la grotte Bordul Mare un «moustérien chaud», quoique la présence du mammouth et du rhinocéros sibérien au niveau 1 d'habitat et le renne du niveau 3 représentait des témoignes indiscutables d'un climat froid et humide. En même temps C. S. Nicolăescu-Plopşor[1] exprimait non seulement la certitude de l'existence de Moustérien supérieur dans la grotte Bordul Mare, mais soulignait avec conviction le caractère retardataire de celui-ci, en le considérant même comme un Moustérien *«prolongé»*. L'auteur mentionne aux niveaux 1 et 3 l'existence de *«deux petites haches manuelles bifaciales»* et d'une *«pièce bifaciale taillée selon la technique proto-solutréenne au niveau 3»*, ce qui approcherait les découvertes de cet endroit de celles de Baia de Fier de la grotte Muierilor dont elles seraient contemporaines.

L'apparition en 1932, à la suite des fouilles archéologiques dues à J. Mallász, de certaines pièces dans les grottes de Nandru (Peştera Spurcată), attribuées au ProtoSolutréen et au Szeletien par C. S. Nicolăescu-Plopşor, Al. Păunescu et Al. Bolomey,[2] a déterminé la réouverture des fouilles en 1955 dans les grottes Curată et Spurcată.

Dans le profil du mur d'ouest de la section I de la grotte Peştera Curată, publié en 1957, les couches moustériennes supérieures étaient marquées de M I et celles inférieures de M II a–b.

Dans la couche moustérienne I, on mentionne des éclats et fragments non-typiques de quartzit et de silex et des *«pointes de main»* caractéristiques à côté des racloirs. On mentionne qu'il y aurait des différences entre la préparation du plan de frappe de la grotte Curată et celui des grottes Bordul Mare de Ohaba Ponor et Muierilor de Baia de Fier, dans le sens que celui-ci apparaît ici réalisé par trois facettes, l'une droite et centrale et les deux autres latérales obliques.

Après une couche stérile, on a coupé une deuxième couche de culture, dénommée Moustérien II a–b, caractérisée par la présence de haches manuelles, dont l'une en technique bifaciale.

A l'occasion des fouilles de cette campagne, à 3,87 m, on n'a pas atteint le lit de la grotte.[3]

La reprise des recherches de la grotte Curată en 1956 par C. S. Nicolăescu-Plopşor et Al. Păunescu avait pour but déclaré *«de rendre faciles certaines*

[1] NICOLĂESCU-PLOPŞOR 1955.
[2] NICOLĂESCU-PLOPŞOR et al. 1957.
[3] NICOLĂESCU-PLOPŞOR et al. 1957.

observations stratigraphiques concernant le problème de la naissance du szeletien issu du moustérien».[4] C'est à ce moment-là qu'on a atteint le lit de la grotte à une profondeur d'approximativement 5 mètres.

La parution, à cette occasion, du profil sud de la section I allait nous offrir une autre numérotation des couches de culture à l'opposé de la publication précédente. La couche Moustérien I a–b gisait directement sur le lit de la grotte et, après une couche stérile, était représentée la couche Moustérien II.

La grotte Spurcată a offert à J. Mallász la récupération des premières pièces façonnées par la technique bifaciale ce qui a déterminé la reprise dans ces endroits en 1955 des fouilles et,[5] de surcroît, la découverte de *«deux pointes de lance en forme de feuille»*[6] en quartzit *«coupées net dans la partie inférieure»*, étant façonnées par la technique bifaciale, comparables à celles de la grotte Szeleta.

En 1956, on a repris les recherches dans la grotte Spurcată et, dans le profil publié, on mentionne même l'existence d'un niveau szélétien[7] quoique, parmi les pièces découvertes, ne soit mentionnés que des éclats et des fragments non-caractéristiques et une pointe de main typiquement moustérienne retouchée sur les deux côtés.[8]

On affirme que *«les deux pointes moustériennes découvertes en 1955 dans la terre rejetée des fouilles effectuées par Mallász peuvent être attribuées, à coup sûr, à la couche szélétienne»*,[9] vu que dans la grotte Spurcată il n'y a qu'une seule couche de culture paléolithique. Dans la grotte Gura Cheii de Râşnov, les fouilles archéologiques ont été reprises par C.S. Nicolăescu-Plopşor, Al. Păunescu et I. Pop,[10] un seul niveau d'habitat, à une épaisseur de 0,45-0,63 m est attribué au Moustérien, considéré comme appartenant à l'étape finale du Paléolithique moyen, plus précisément au Moustérien final et il se serait déroulé pendant la période glaciaire Würm II.

En ce qui concerne les grottes du sud-ouest de la Transylvanie, en 1973, l'un de nous faisait paraître les premières estimations chrono-climatiques fondées sur l'étude du pollen fossile, sans pour autant bénéficier à ce moment-là de la moindre datation d'absolue.[11]

A partir de la corrélation des phases climatiques précisées pour le territoire de la Roumanie avec celles de l'Europe de l'Ouest, nous avancions les premières estimations climatiques qui étaient très différentes des appréciations faites par C. S. Nicolăescu-Plopşor.[12]

C. S. Nicolăescu-Plopşor affirmait que le Moustérien des grottes carpatiques, se référant notamment aux grottes Muierilor de Baia de Fier, Bordul Mare de Ohaba

[4] Nicolăescu-Plopşor–Păunescu 1959, 22.
[5] Nicolăescu-Plopşor et al. 1957.
[6] Nicolăescu-Plopşor et al. 1957, 36.
[7] Nicolăescu-Plopşor–Păunescu 1959.
[8] Nicolăescu-Plopşor–Păunescu 1959, 26.
[9] Nicolăescu-Plopşor–Păunescu 1959, 26.
[10] Nicolăescu-Plopşor et al. 1962.
[11] Cârciumaru 1973.
[12] Nicolăescu-Plopşor 1961.

Ponor, Curată et Spurcată de Nandru[13] dépasse *«en forme et quasiment avec la même faune le stade Würm I–Würm II»* (p. 15). Dans les sédiments de l'interstade Würm I–Würm II de la grotte Spurcată de Nandru, dans un milieu purement moustérien, il mentionnait les premières formes foliacées, appartenant selon certains archéologues à la culture szélétienne. C. S. Nicolăescu-Plopşor les attribuait à une étape plus avancée *«dans l'évolution de la technique de la taille bifaciale du moustérien supérieur évolué, qui gardait encore par tradition la technique de la taille bifaciale abbevilo-achéuléenne qui a repris l'apparition de la technique szélétienne»*.[14] Des considérations d'ordre stratigraphique et de faune fossile ont poussé C. S. Nicolăescu-Plopşor à attribuer la couche Moustérien II de la grotte Curată et la couche moustérienne aux formes façonnées par la technique szélétienne de la grotte Spurcată, toutes les deux de Nandru, à la période glaciaire Würm II.

Nous n'insisterons que sur la fin des niveaux considérés comme moustériens pour relever le caractère très retardé de quelques-uns d'entre eux.

Comme on le mentionnait, on précisait en 1973 que dans la grotte Bordul Mare de Ohaba Ponor le Moustérien IV cesse en même temps que la fin du complexe interstadial Ohaba. Vu que l'oscillation climatique Ohaba B était parallélisée à Stillfried B, nous supposons la fin du Moustérien de ces endroits vers 26 000 B. C. La situation ne semble pas différente dans la grotte Curată de Nandru, tandis que la couche paléolithique de la grotte Spurcată de Nandru est contemporaine de la période glaciaire qui précède le complexe interstadial Ohaba.

Quoique les critiques faites par certains archéologues roumains et même étrangers à l'occasion des réunions scientifiques internationales (dans le sens que l'on ne peut parler de paléolithique moyen à une âge tardif) les datations ^{14}C obtenues ultérieurement ont pleinement confirmé nos évaluations. Il est suffisant de rappeler que dans la grotte Bordul Mare pour la partie supérieure de l'habitat moustérien il existait une datation ^{14}C de 28 780±290 B. P. (GrN-14 627).

Dans la grotte Gura Cheii de Râşnov où nous placions la fin du moustérien au début de l'oscillation climatique Ohaba B (Stillfried B ou Kesselt), deux datations ^{14}C indiquent les de 29 700+1700/-1600 B. P. (GrN-11 619) et 28 900+2400/-1800 B. P. (GrN-14 620).

En ce qui concerne la couche moustérienne à formes foliacées attribuées aux influences szélétiennes,[15] que nous avons intégrée au stade glaciaire qui précède le complexe interstadial Ohaba (Arcy-Kesselt), à savoir à une étape antérieure à 30 000 B. P., cela s'appuie maintenant sur la datation GrN-14 622 : 30 000+1900/-1500 B. P.

En 1977, dans un article publié en roumain, nous lancions pour la première fois l'idée que le complexe interstadial Ohaba représente une période de coexistence du Paléolithique moyen et du Paléolithique supérieur en Roumanie. En 1979, pour que cette hypothèse devienne accessible aux collègues d'autres pays, nous faisons

[13] Nicolăescu-Plopşor 1961.

[14] Nicolăescu-Plopşor 1961, 15.

[15] Nicolăescu-Plopşor 1961.

paraître un autre article en français dans la revue d'archéologie Dacia de l'Institut d'archéologie de Bucarest.[16]

Mieux encore, en 1980, au Colloque International *«L'Aurignacien et le Gravettien (Périgordien) dans leur cadre écologique»* nous osions avancer cette supposition envisagée avec bienveillance par quelques collègues étrangers, pour lesquels nous aurons toujours un respect profond, et considérée comme une aberration par une partie des participants de cette réunion scientifique internationale très réussie.[17] Pour des raisons faciles à comprendre, nous avons décidé de garder l'anonymat de tous quel que fût le camp où ils se sont situés.

La situation des perceptions de nos résultats n'était guère différente de la part des mêmes collègues à l'occasion du Colloque international *«El Cuadro Geocronologico del Paleolitico superior inicial»*.[18] Il nous semble impossible de ne pas mentionner les noms des trois grands spécialistes de la recherche du paléolithique qui ont accepté nos idées : Arlette Leroi-Gourhan, Jean-Philippe Rigaud et Marcel Otte, lesquels nous remercions une fois de plus.

Par cette succincte rétrospective, nous avons souhaité attirer l'attention sur la priorité de certaines idées lancées à un moment donné parce que, dernièrement, on parle beaucoup et avec insistance sur la possibilité de la survie de l'homme de Neandertal dans certaines régions. Il ne faut pas oublier que nos hypothèses (présentées ci-dessus) étaient, à ce moment-là, sur le point d'être cataloguées comme des hérésies scientifiques et, en ce moment, elles sont tombées dans l'oubli, peut-être, avec trop d'aisance, quelques-uns d'entre nous préférant découvrir des choses connues depuis belle lurette. Si à cette époque-là on avait du mal à accepter la survie du Moustérien à approximativement 25 000 ans B.P., ayons du moins la décence de nous informer et, éventuellement, de citer ceux qui, grâce à une intuition ou convaincus par des arguments adéquats, ont eu le cour de devancer l'âge de cette culture et, implicitement, la survie de l'homme de Neandertal, beaucoup plus au dessus des limites admises.[19]

Pour M. Gábori,[20] les analogies les plus appropriées pour les outillages des grottes carpatiques se trouvent dans le Charentien, à savoir la variante d'Europe sud-orientale proposée par V. Gábori-Csánk.[21] Il faut se rappeler qu'en introduisant cette notion pour caractériser l'industrie lithique d'Érd, V. Gábori-Csánk précisait plusieurs points quant aux limites entre lesquelles la dénomination de Charentien devait être adoptée pour cette partie de l'Europe et aux complications engendrées par les caractères régionaux. Ces recommandations impliquaient dès le départ un compromis : *«s'il nous était possible de faire abstraction de la valeur de l'indice Quina, cette identité signifierait que notre civilisation appartient au Charentien»*.[22] De même, elle parle

[16] Cârciumaru 1985.

[17] Bitiri–Cârciumaru 1980.

[18] Cârciumaru 1994.

[19] Cârciumaru 1999.

[20] Gábori 1976.

[21] Gábori-Csánk 1968.

[22] Gábori-Csánk 1968, 168.

à plusieurs reprises *«d'une technologie analogue à celle du Pontinien»*,[23] étant donné que l'industrie d'Érd se caractérise typologiquement par des *«segments de galets»*, en forme de *«quartier d'orange»*, souvent recouverts de restes de cortex, des *«racloirs sur tranches ou segments de galets (cf. le Pontinien)»*.[24] Enfin, elle affirme que l'industrie d'Érd *«appartient probablement à l'un des faciès du Charentien pris au sens large, tout comme le Pontinien duquel, peut-être, elle est relativement la plus proche quant à sa technique. Selon notre hypothèese, elle est une émanation très modifiée du Pontinien, devenue fort autonome rien que par suite de sa situation géographique»*.[25]

Le facteur commun rapprochant les grottes carpatiques du Pontinien[26] est l'utilisation de galets et la technique de leur traitement. La différence vient du fait que, dans le Pontinien italien, l'utilisation du silex est prédominante, alors que celui-ci est faiblement représenté dans certaines grottes des Carpates ou fait totalement défaut. Il s'ensuit une typologie pauvre pour les grottes carpatiques, étant donné le débitage anarchique qu'impose la prépondérance du quartz et du quartzite comme matière première. Ces grottes ont en commun une multitude de racloirs, surtout droits, qui conservent le dos avec cortex (couteaux à dos naturel), un petit nombre de bifaces, un indice Levallois très faible ou nul, des pointes généralement atypiques et sommairement retouchées conservant partiellement du cortex.

Soulignons le fait que, dans la grotte Cioarei, par exemple, la retouche Quina ou demi-Quina, typique du Pontinien, est inexistante.

M. Taschini[27] rapproche typologiquement le Pontinien du Moustérien du groupe charentien de type Quina, et considère qu'il s'est développé entre le premier stade würmien et l'interstade II–III.

Les habitats des grottes carpatiques, attribués jusqu'ici au Paléolitique moyen, exigent une étude plus approfondie de la position chronologique qui leur imprime des caractères spécifiques, afin de permettre une compréhension plus claire des rapports de ces habitats paléolithiques avec le Charentien et le Pontinien, invoqués lors de la définition des faciès culturels, de la part d'influence d'autres faciès de régions plus proches et, bien sûr, de l'apport original à la constitution éventuelle de certains caractères régionaux.

A la suite de recherches interdisciplinaires, nous avons publié les résultats obtenus dans les habitats du Paléolithique : nous y avons relevé le fait que de nombreuses couches qualifiées de «moustériennes» étaient contemporaines d'une période prolongée, typique chronologiquement plutôt d'un Paléolithique supérieur.[28] En ce qui concerne les grottes des Carpates, certains aspects doivent être clarifiés : tout d'abord, il faut distinguer les grottes à deux niveaux principaux d'occupation moustérienne et séparés par une couche stérile (les grottes Curată, Bordul Mare, Muierilor

[23] Gábori-Csánk 1968, 161.

[24] Gábori-Csánk 1968, 162.

[25] Gábori-Csánk 1968, 182.

[26] Lai Pannocchia 1950. ; Taschini 1979.

[27] Taschini 1979.

[28] Cârciumaru 1973.

et Gura Cheii), des grottes caractérisées par un seul niveau d'occupation moustérienne (les grottes Hoţilor et Spurcată). En ce qui concerne la première catégorie, la couche inférieure d'occupation moustérienne s'intercale entre la fin du complexe de réchauffement Boroşteni et la fin du complexe interstadiaire Nandru, bien qu'il cesse d'exister avant 35 000 B. C. L'habitat moustérien de la grotte Cioarei est également contemporain de cette période. Quant aux couches d'occupation supérieures («moustériennes»?) des grottes Curată, Bordul Mare et Gura Cheii, elles appartiennent à une période assez tardive – le complexe interstadiaire Ohaba et la majeure partie du stade glaciaire précédant cette période de réchauffement. Comme cela a été précisé ci-dessus, un niveau d'occupation paléolithique a été mis en évidence dans plusieurs grottes du bassin carpatique ; leur l'évolution chrono-climatique a commencé pendant le complexe de réchauffement Boroşteni pour se terminer avant la fin du complexe interstadiaire Nandru. Nous rangeons dans cette catégorie le Moustérien II de la grotte Curată, le Moustérien I–II de la grotte Bordul Mare, le Moustérien I de la grotte Gura Cheii, la couche inférieure de la grotte Muierilor et l'habitat moustérien de la grotte Cioarei (couches A–J). Nous prenons aussi en compte le fait que ces occupations se sont déroulées durant une période unique comprise entre le complexe de réchauffement Boroşteni et le complexe interstadiaire Nandru, épisode donc véritablement spécifique du Moustérien sur le continent européen dans son entier.

Étant donné toutes ces complications, on pourrait conclure à une solution de compromis et considérer ces habitats du Paléolithique moyen naissant des Carpates roumaines comme appartenant à un Moustérien de tradition charentienne de technique pontinienne. Les aspects typologiques et technologiques, ainsi que la réévaluation chrono-climatique du Paléolithique propre aux grottes carpatiques[29] ont amené M. Bitiri et M. Cârciumaru à attirer l'attention sur la nécessité *«de détacher les complexes moustériens, qui représentent le Paléolithique moyen proprement dit, des complexes tardifs attribués au Moustérien supérieur prolongé mais contemporain des cultures du Paléolithique supérieur».*[30]

Ainsi donc, les niveaux supérieurs des grottes carpatiques, contemporains du complexe interstadiaire Ohaba et du stade glaciaire l'ayant précédé, contituent une période de transition vers le Paléolithique supérieur, que l'on peut qualifier de faciès carpatique. Son individualisation comme faciès à part repose sur le caractère techno-typologique de l'inventaire lithique avec sa combinaison de caractères d'éclatement, lamelaires et bifaciaux, sa position chronologique transitoire du Paléolithique moyen vers le Paléolithique supérieur, la prédominance des roches locales (quartzite, diorite, etc.) comme matières premières.

[29] Cârciumaru 1980. ; 1985. ; 1988. ; 1989.

[30] Bitiri–Cârciumaru 1980, 71–72.

Le faciès carpatique a indubitablement reçu des influences du Szélétien, son voisin à l'ouest et au nord-ouest. Nous relèverons les discussions et opinions contradictoires les plus importantes enregistrées à ce propos.

Les premières pièces foliacées découvertes en Roumanie ont été attribuées au Solutréen. Il s'agit des pièces provenant de la vallée du Chirchirău,[31] de celles qui furent découvertes par N. N. Moroşan[32] à Ripiceni, ou par M. Roska[33] à Sita Buzăului et Iosăşel, ou bien par J. Mallász[34] à Nandru, etc. C. S. Nicolăescu-Plopşor[35] démontre ensuite qu'on ne saurait parler de Solutréen en Roumanie et attribue les pièces de la grotte Spurcată et de Iosăşel au Szélétien ; simultanément, il inclut une série de bifaces dans des faciès qu'il appelle moustériens-szélétiens ou szélétiano-aurignaciens. A. Păunescu[36] affirme que le Szélétien n'est pas entré en Roumanie, toutes les pièces foliacées et bifaciales étant à ses yeux d'origine moustérienne locale, issues d'une technique particulière de taille qui serait apparue pendant le Moustérien et aurait perduré à l'Aurignacien et au Gravettien sous la forme d'influences affaiblies. Récemment, il réitère ce point de vue révisé par endroits, car il ne s'agit plus du territoire entier du pays : «on ne peut toutefois pas parler de pointes foliacées de type szélétien dans les industries du Paléolithique supérieur naissant qui ont évolué en territoire est-carpatique».[37]

Les critères en vertu desquels A. Păunescu démontre le fait qu'à l'est des Carpates *«le Paléolithique supérieur naissant se caractérise par des technocomplexes (aurignacoïdes ou aurignaciens) dont les industries présentent aussi quelques pièces et pointes bifaciales qui cependant diffèrent, du point de vue technique et morphologique, des bifaciales szélétiennes, celles-ci ayant une tout autre origine»*[38] nous restent inconnus. Finalement, dans une note infrapaginale, A. Păunescu laisse entendre que les bifaces de Transylvanie n'auraient rien de commun, eux non plus, avec le Szélétien centre-européen.[39]

A son tour, M. Bitiri[40] affirme que, dans l'ouest et le nord-ouest de la Roumanie, les couches archéologiques ayant livré des formes bifaciales appartiennent à une phase de transition du Moustérien vers le Paléolithique supérieur. Elles peuvent représenter soit une tradition du Moustérien supérieur carpatique, soit une influence de Szélétien.

31 Teutsch 1914. ; Breuil 1925.

32 Moroşan 1938.

33 Roska 1927. ; 1928. ; 1929.

34 Mallász 1934.

35 Nicolăescu-Plopşor 1957.

36 Păunescu 1970.

37 Păunescu 1993, 202.

38 Păunescu 1993, 202.

39 Allsworth-Jones 1986.

40 Bitiri 1965. ; 1967.

Enfin, B. Jungbert[41] accepte l'idée d'une évolution locale de la technique de taille bifaciale dans certains gisements moustériens, qui aurait permis la production de formes bifaciales et même foliacées pendant le Moustérien final tardif. Il rejette en revanche la généralisation de ce phénomène au territoire roumain tout entier. Il estime, à juste titre, qu'il en va autrement des pointes foliacées découvertes à Iosăşel, dans la grotte Spurcată et à Remetea-Şomoş qui – il suffit de les regarder – n'ont aucun rapport avec le restant de l'outillage d'origine locale.

La connaissance plus exacte de la chronologie des couches archéologiques éclaire d'un jour nouveau la réalité objective des Carpates et du bassin de Transylvanie. Les faits ne permettent désormais plus de nier l'influence du Szélétien dans cette région. On se rappelle d'ailleurs que les caractéristique techno-typologiques ont, dès le début, porté les spécialistes à y voir au moins une influence szélétienne.

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[41] JUNGBERT 1977.

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La production lithique à la station d'Érd (Hongrie)

Zsolt Mester

A la mémoire de Veronika Gábori-Csánk

Introduction

Grâce aux publications de V. Gábori-Csánk,[1] le site en plein air d'Érd est un des gisements les mieux connus au niveau international du Paléolithique moyen de la Hongrie. Il a fait l'objet d'une grande monographie,[2] bien complexe et riche, qui présente les résultats des analyses du matériel archéologique de tous les points de vue.

Ce que notre intérêt s'est tourné vers l'industrie de la station d'Érd c'est pour une double raison : l'une typologique et l'autre technologique. L'étude des assemblages lithiques de la grotte Suba-lyuk (montagne de Bükk), gisement classique du Moustérien en Hongrie, nous a conduit à réinterpréter les outillages et à les attribuer à deux faciès différents du Moustérien : un Moustérien typique riche en racloirs et un Moustérien type Quina.[3] L'analyse statistique par la méthode Bordes de ce dernier a démontré une composition typologique étonnemment identique à l'industrie d'Érd.[4] Cette ressemblance paraît contredire l'aspect tout à fait différent des deux outillages. L'explication en est à chercher certainement dans les productions des outils. Au cours de notre séjour à Nanterre, c'est Jacques Tixier qui a attiré notre attention à la nécessité d'une étude technologique détaillée du matériel d'Érd qui aurait pu révéler nombreux problèmes intéressants quant à la production lithique et au comportement technique de ce groupe humain préhistorique. Il nous est agréable de le remercier ici.

Nous avons commencé cette étude technologique dans le cadre d'une recherche appuyée par la Bourse de Recherche «János Bolyai» de l'Académie des Sciences de Hongrie à laquelle notre gratitude ira également. L'analyse du matériel est encore en cours, nous en présentons ici certains résultats.

1 Gábori-Csánk 1967.; 1968a.; 1968b.; 1968c.; 1971.

2 Gábori-Csánk 1968b qui comprend les études d'autres spécialistes: I. Dienes (pétrographie), M. Kretzoi (paléontologie), P. Kriván (stratigraphie), E. Krolopp (malacologie) et J. Stieber (paléobotanique).

3 Mester 1989.; 1990.

4 Mester 1989, 29.; 1990, 113.

Le site

Le site se trouve sur le territoire de la ville d'Érd, dans le voisinage de Budapest, dans la vallée Fundoklia. Les hommes préhistoriques se sont installés dans deux vallons conjoints s'ouvrant sur la vallée. Les deux vallons étaient remplis de sédiments provenant de l'effritement du calcaire sarmatien de la roche mère et de loess.[5] La série des couches représente le Pléistocène supérieur. Ce remplissage contenait deux couches archéologiques dont la position stratigraphique correspond au Würm ancien (phase initiale de la dernière glaciation). Les données faunistiques et floristiques ont appuyé cette datation.[6]

Les fouilles du site furent entreprises en 1963 et en 1964 sous la direction de V. Gábori-Csánk (Fig. 1). Les couches archéologiques comprirent un remplissage de 120 cm d'épaisseur. La couche supérieure fut subdivisée en 5 niveaux d'occupation (niveau a–e). A part certaines modifications dans les proportions des espèces animales et des types d'outils, le matériel des couches archéologiques était homogène. Il existe quatre dates au ^{14}C concernant les niveaux inférieurs : l'échantillon de la couche archéologique inférieure (horizon A) était hors de la limite inférieure de datation (>50 000 B. P.),[7] l'âge du niveau e de la couche archéologique supérieure est 44 300±1400 B. P. (GrN-4444), tandis que le niveau d est daté de 35 300±900 B. P. (GrN-4443) et de >38 100 (GXO 200)[8]. Ces dates semblent trop récentes par rapport à la position chronologique mentionnée ci-dessus.

Le matériel archéologique se composait des ossements d'animaux, chassés pour la plupart, et des objets de pierre taillée. Les ossements ont formé des amas dans les niveaux d'occupation ce qui a donné la possibilité d'une étude palethnologique.[9] La faune est prédominée par l'ours des cavernes ce qui est l'une des particularités du site. La proportion de cet animal varie entre 69,2% et 96,5% selon les niveaux. L'industrie lithique ne présente pas de différences selon les niveaux, ni du point de vue typologique, ni technologique. Sa particularité est l'utilisation prédominante des galets de quartzite (76,2%) pour la confection des outils. D'après la composition typologique de l'outillage, l'industrie fut rapprochée du groupe des Moustériens type Quina au sens large et fut déterminée comme Charentien d'Europe sud-orientale.[10]

[5] Kriván, P.: Division paléoclimatique et stratigraphique de la station. In: Gábori-Csánk 1968b, 33–38.

[6] Kretzoi, M. Étude paléontologique. In: Gábori-Csánk 1968b, 59–104. Stieber, J. Étude paléofloristique. In: Gábori-Csánk 1968b, 39–55.

[7] Gábori-Csánk 1970, 5.

[8] Gábori-Csánk 1968b, 107.

[9] Gábori-Csánk, V. et Kretzoi, M.: Zoologie archéologique. In: Gábori-Csánk 1968b, 223–244.

[10] Gábori-Csánk 1968b, 182., 274.

L'étude actuelle de l'ensemble lithique

V. Gábori-Csánk a effectué une étude technologique très bonne à l'époque,[11] elle a même fait des observations avant-coureurs. Elle a considéré que la technologie de l'industrie est définie «en premier lieu et de manière décisive» par la forme et la qualité de la matière première utilisée, et elle a conclué que «c'est un mode d'éclatement spécifique de galets couverts de cortex, de forme ronde ou irrégulière».[12] En guise de comparaison, elle a renvoyé au Pontinien d'Italie, tout en soulignant les différences considérables existant entre les modes d'obtention des éclats semblables des deux industries. Selon elle, le débitage à Érd consiste à produire des tranches de galets suivant des schémas assez simples.[13] Étant donné, comme éléments constants de ce débitage, la forme roulée des galets et le mode de taille, il résulte des types d'éclats constants, d'où une certaine standardisation de la production.

Au cours des quatre décennies qui se sont écoulées depuis cette étude de V. Gábori-Csánk, la technologie s'est développée en une véritable discipline au sein de la Préhistoire. Elle a établi ses notions, sa terminologie, sa méthodologie, ses manières d'investigation, ses orientations de recherches.[14] De nos jours, la technologie joue un rôle de plus en plus important dans la recherche préhistorique. Grâce à ce développement, nos connaissances sur la fabrication des outils préhistoriques se sont accumulées dans une large mesure. A la lumière de ces connaissances, il est nécessaire de reconsidérer les interprétations précédentes dans ce domaine. Cela est particulièrement valable pour ce qui concerne les débitages.

Notre recherche actuelle sur le matériel lithique de la station d'Érd concerne en premier lieu le système technique de production.[15] Nous essayons d'approcher le comportement des hommes d'Érd face à la matière première (l'acquisition, le débitage, la transformation des supports en outils, les choix appliqués, les objectifs de la taille, etc.).

Matières premières

L'analyse pétrographique, publiée dans la monographie du site, a constaté la diversité considérable de la matière première utilisée.[16] A côté du quartzite dont 5 variétés furent distinguées se rencontraient différents silex, du jaspe, du calcaire nummulithique silicifié, du bois silicifié et quelques autres roches en faible quantité. Le quartzite était prédominant, il faisait 76,2% des outils et 78,69% des pièces non trans-

[11] Gábori-Csánk 1968b, 115–125.

[12] Gábori-Csánk 1968b, 115.

[13] Gábori-Csánk 1968b, Fig. 20.

[14] Inizan et al. 1995.

[15] Geneste 1991.

[16] Dienes, I. Examen pétrographique de l'industrie. In: Gábori-Csánk 1968b, 111–114.

formées (78,05% de tout le matériel lithique). Toutes les autres roches font donc respectivement 23,8% et 21,31% (21,95%). En supposant que l'ensemble du matériel provint de la même formation géologique, comme source fut déterminé le cailloutis helvétien qui se situe sur un plateau à 500 m du site.[17] Étant donné la grande quantité des pièces portant de surface corticale, la matière première acquise aurait dû être sous forme de galets ronds ou irréguliers.

Pour notre étude de l'ensemble lithique, nous avons distingué 15 catégories de matières premières d'après les caractères macroscopiques (MP01 à MP15). Seulement 7 d'entre eux présentent de cortex, mais dans beaucoup de cas, ces cortex nous font penser plutôt à des rognons et non à des galets. Pour pouvoir bien distinguer les uns des autres, il faudrait mieux connaître l'aspect de ces roches sur les lieux d'approvisionnement. Dans un livre-guide d'excursions géologiques aux environs de Budapest, paru à l'époque des fouilles du site, nous trouvons la déscription d'un autre plateau qui se situe à une douzaine de kilomètres dans la direction Nord-est où la surface était parsemée de galets, de quartzite pour la plupart, *«de grandeur de noix, de pomme, de poigne et même plus gros»*.[18] Malheureusement, cette région est devenue très habitée depuis les fouilles à cause de l'extension de l'agglomération de Budapest.

Nous ne pensons pas que toutes les roches proviennent de la même formation géologique. Bien au contraire, il est probable que les habitants de la station ont apporté de matériaux de plusieurs endroits différents. Cela est confirmé par le fait que plusieurs catégories de matières premières ne sont représentées que par quelques pièces qui appartiennent à des phases différentes de chaînes opératoires. En plus, certaines roches ont plusieurs affleurements dans la région, comme le calcaire nummulithique silicifié[19] ou le silex corné qui semble identique à celui «de type Buda» que nous connaissons de la mine de Budapest-Farkasrét.[20] Par contre, il est sûr que les galets de quartzite (MP14) provient du plateau mentionné plus haut. C'est la catégorie largement la plus fréquente et les pièces représentent toutes les phases de la chaîne opératoire. Dans ce cas, il doit s'agir incontestablement d'une matière première locale.

Approche morphométrique des objectifs de la production

Pour estimer les paramètres des produits recherchés, nous avons analysé les dimensions des outils. Nous n'avons pas modifié les attributions typologiques des pièces que V. Gábori-Csánk avait enregistrées pour chacune dans les rubriques de l'inventaire de la collection du Musée Historique de Budapest.

17 Gábori-Csánk 1968b, 111–112., 115.

18 Schafarzik et al. 1964, 179.

19 Voir la contribution d'A. Markó dans ce volume.

20 Gábori-Csánk 1988.

L'outillage montre une homogénéité considérable du point de vue métrique aussi. Bien que les valeurs de la longueur, de la largeur et de l'épaisseur présentent un assez large éventail (Tableau I), leurs répartitions dessinent des aires de densité nettes sur les graphiques (Fig. 2). Dans l'outillage, il y a 599 pièces dont les dimensions (donc toutes les trois valeurs) sont à l'intérieur de ces aires de densité ce qui fait 74,32%. Ces données apportent une preuve métrique de l'observation concernant la degrée de standardisation de l'industrie.

Pour caractériser l'outillage du point de vue morphométrique, l'analyse des rapports des dimensions produit des résultats beaucoup plus intéressants. Pour cela, nous avons calculé, d'une part, le rapport classique de longueur-largeur :

$$R_{Ll} = L / l \quad \text{où L est la longueur et l est la largeur de la pièce ;}$$

et d'autre part, le rapport du caractère épais de la pièce que nous définissons ici :

$$R_{ép} = min(L,l) / e \quad \text{où e est l'épaisseur de la pièce.}$$

Une pièce nous donne l'impression d'être épaisse si elle est assez courte ou assez étroite par rapport à son épaisseur, donc parmi la longueur et la largeur, nous devons calculer le rapport avec celle qui est plus petite, ce que signifie l'expression min(L,l). La répartition et la corrélation de ces deux indices démontre également l'existence un choix qui correspond aux paramètres recherchés des outils finis (Tableau II). Nous remarquons que, pour R_{Ll}, les valeurs inférieures à 1,0 signifient les supports courts, les valeurs entre 1,0 et 1,9 les supports ordinaires, tandis que les valeurs supérieures à 1,9 les supports laminaires. De même, pour $R_{ép}$, les valeurs inférieures à 3,0 peuvent être considérées comme supports épais (où l'épaisseur dépasse le tiers de l'autre dimension). D'après les données présentées, il est claire que les supports des outils dans l'industrie d'Érd sont des éclats ordinaires ou courts et en majorité épais. Les supports laminaires sont très peu nombreux (environs 5%) et presque uniquement épais.

Pour comparaison, nous présentons les mêmes données des outillages des deux faciès moustériens de la grotte Suba-lyuk. L'outillage de ce Moustérien type Quina montre pratiquement les mêmes caractéristiques que celui d'Érd ce qui renforce l'attribution culturelle au même groupe des deux industries (Tableau III). La seule différence remarquable est que le premier contienne une proportion plus faible de supports épais que l'autre. Cela peut être éventuellement la conséquence de la matière première, notamment le quartzite qui n'était pas utilisée à Suba-lyuk. L'outillage du Moustérien typique dispose de caractères nettement différents (Tableau IV). Dans cette industrie, nous trouvons une proportion considérable de supports laminaires à côté des éclats ordinaires, ainsi que les supports épais y sont presque absents ou bien également laminaires. Ces données apportent un argument supplémentaire à l'appui de considérer les industries de Suba-lyuk comme faciès complètement différents du Moustérien, ce que nous avons déjà démontré également dans le domaine typologique et technologique.[21]

Sur les types de débitages à Érd

Nous avons déjà mentionné que l'ensemble des pièces en MP14, matière première prédominante, montre la présence de toutes les phases de la chaîne opératoire : blocs bruts, nucléi, produits bruts de débitage, outils retouchés, déchets de taille. Les blocs sont des galets de quartzite, plus ou moins grands, de couleurs variées, aux grains plus ou moins gros, à cortex lisse. Parmi ces galets se trouvent de formes ovalaires aussi, mais y sont plus fréquentes les formes polyèdriques ou irrégulières, aux arrêts arrondis.

Nous avons pu étudier 29 nucléi dont la majorité est déjà en état épuisé. Malgré cela, ils relèvent l'existence de débitages plus organisés que les schémas publiés[22] ne le laissent penser. Nous avons reconnu trois types de débitages (Fig. 3).

Débitage discoïde (Fig. 3 : 1)

9 nucléi présentent la configuration de ce débitage.[23] Ils disposent de deux surfaces sécantes (A et B) qui, au cours du débitage, jouent alternativement le rôle de la surface de débitage. Tenant compte de cette alternance des surfaces exploitées, les produits caractéristiques de ce débitage dans le matériel lithique d'Érd doivent être les éclats triangulaires ou subtriangulaires qui ne portent pas de cortex sur leur base. Les talons sont donc lisses, dièdres, ou rarement facettés (Fig. 4 : 1–4).

Les blocs exploités par ce débitage pouvaient être originellement de formes assez variées. Il est très probable que la chaîne opératoire correspondant avait une phase de décorticage ou d'épannelage qui servait à configurer le nucléus.

[21] Mester 1989.; 1990, sous press.

[22] Gábori-Csánk 1968b, Fig. 20.

[23] Boëda 1993.; 1994, 265–268.; Turq 2000, 28–29., 370–373.

Débitage semi-discoïde (Fig. 3 : 2)

5 nucléi présentent une configuration semblable à celle du débitage précédent, mais avec une différence remarquable. C'est que les surfaces étaient hiérachisées, c'est-à-dire, tout le long de l'exploitation du nucléus, l'une des surfaces (A) jouait le rôle de la surface de débitage, tandis que l'autre (B) était celle des plans de frappe. Cette hiérarchisation ressemble au concept Levallois mais les critères techniques de ces nucléi les rapprochent nettement du concept discoïde.[24]

Une caractéristique essentielle de ce débitage est que la surface B reste couverte de cortex, même si éventuellement le bloc a été partiellement décortiqué pendant la mise en place de la surface A. Par conséquent, la surface B doit avoir une telle morphologie qu'elle soit capable d'assurer des angles de chasse convenables pour les plans de frappe sans aucun procédé de préparation. Comme les nucléi nous montrent, les blocs initiaux choisis pour ce débitage disposaient au moins une partie «conique» qui devenait enfin la surface B. Due à cette configuration particulière, la caractéristique principale des produits recherchés, faits par ce débitage, est la base plus ou moins épaisse qui porte du cortex. La forme de ces éclats doit être aussi surtout triangulaire ou subtriangulaire, et le talon est donc toujours cortical (Fig. 4 : 5–8).

Débitage Quina (Fig. 3 : 3)

9 nucléi disposent d'une configuration qui évoque celle des nucléi du débitage Quina.[25] Le concept de ce débitage consiste à l'existence de deux surfaces sécantes qui ne sont pas hiérarchisées, de même que dans le cas du débitage discoïde. Par contre, différence fondamentale, l'une des surfaces est orientée parallèlement, et l'autre l'est obliquement à l'un des axes morphologiques du bloc initial. Le but du débitage Quina est l'obtention des supports épais, à section asymétrique.[26] Dans l'industrie d'Érd, ce sont les éclats latéralisés (Fig. 5, 1–3) et les éclats en forme de tranche (Fig. 5, 4–8) qui correspondent à cette finalité.

Pour ce débitage, idéaux sont les blocs qui présentent deux ou plusieures faces assez plates dont l'intersection forme un angle de 75° à 90°. Nous en avons rencontré non seulement parmi les nucléi mais aussi entre les blocs de matière première.

[24] Boëda 1993.; 1994.

[25] Bourguignon 1996.

[26] Bourguignon 1996, 149.; Turq 2000, 32., 374–375.

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N=806	minimum	maximum	moyenne	densité
longueur (mm)	16	108	41,87	20–55
largeur (mm)	13	100	35,53	15–50
épaisseur (mm)	3	84	14,90	5–20

Tableau I. Les valeurs de la longueur, de la largeur
et de l'épaisseur de l'outillage à Érd

R_{Ll}

$R_{ép}$	0,1–0,4	0,5–0,9	1,0–1,4	1,5–1,9	2,0–2,4	2,5–3	3,0–3,4	**total**	%
0,5–0,9		3		1	1	1	1	**7**	*0,87*
1,0–1,4		16	16	20	6	5	1	**64**	*7,94*
1,5–1,9		28	56	44	19	1		**148**	*18,36*
2,0–2,4		66	103	59	11	1		**240**	*2978*
2,5–2,9		50	109	27	1			**187**	*23,20*
3,0–3,4		21	60	12	1			**94**	*11,66*
3,5–3,9		13	21	5				**39**	*4,84*
4,0–4,4		4	12	2	1			**19**	*2,36*
4,5–4,9			2					**2**	*0,25*
5,0–5,4			2					**2**	*0,25*
5,5–5,9		1	2					**3**	*0,37*
>5,9			1					**1**	*0,12*
total		**202**	**384**	**170**	**40**	**8**	**2**	**806**	*100,00*
%		*25,06*	*47,64*	*21,09*	*4,96*	*0,99*	*0,25*	*100,00*	

Tableau II. Répartition et corrélation des rapports longueur-largeur (R_{Ll})
et de caractère épais ($R_{ép}$) des outils d'Érd

$R_{ép}$ \ R_{Ll}	0,1–0,4	0,5–0,9	1,0–1,4	1,5–1,9	2,0–2,4	2,5–3	3,0–3,4	**total**	%
0,5–0,9									
1,0–1,4			1		1			**2**	*0,93*
1,5–1,9		2	6	11	4	1		**24**	*11,16*
2,0–2,4		6	16	17	7	1		**47**	*21,86*
2,5–2,9	1	5	17	20	3	1		**47**	*21,86*
3,0–3,4		12	15	8	3		1	**39**	*18,14*
3,5–3,9		10	11	4	4			**29**	*13,49*
4,0–4,4		3	5	5				**13**	*6,05*
4,5–4,9			2	1				**3**	*1,40*
5,0–5,4		2	5	2				**9**	*4,19*
5,5–5,9			1					**1**	*0,47*
>5,9			1					**1**	*0,47*
total	**1**	**40**	**80**	**68**	**22**	**3**	**1**	**215**	*100,00*
%	*0,47*	*18,61*	*37,21*	*31,63*	*10,23*	*1,40*	*0,47*	*100,00*	

Tableau III. Répartition et corrélation des rapports longueur-largeur (R_{Ll}) et de caractère épais ($R_{ép}$) des outils du Moustérien type Quina de la grotte Suba-lyuk (couche 11)

$R_{ép}$ \ R_{Ll}	0,1–0,4	0,5–0,9	1,0–1,4	1,5–1,9	2,0–2,4	2,5–3	3,0–3,4	**total**	%
0,5–0,9									
1,0–1,4									
1,5–1,9		2	1	2	2			**7**	*5,56*
2,0–2,4		1		3	7	1	3	**15**	*11,91*
2,5–2,9	1		5	4	5	3	4	**22**	*17,46*
3,0–3,4			7	7	7		1	**22**	*17,46*
3,5–3,9			9	7	6	3		**25**	*19,84*
4,0–4,4			2	8	4	1		**15**	*11,91*
4,5–4,9	1	2	2	6	2			**13**	*10,32*
5,0–5,4		1		4				**5**	*3,97*
5,5–5,9									
>5,9			1	1				**2**	*1,59*
total	**2**	**6**	**27**	**42**	**33**	**8**	**8**	**126**	*100,00*
%	*1,59*	*4,76*	*21,43*	*33,33*	*26,19*	*6,35*	*6,35*	*100,00*	

Tableau IV. Répartition et corrélation des rapports longueur-largeur (R_{Ll}) et de caractère épais ($R_{ép}$) des outils du Moustérien typique riche en racloirs de la grotte Suba-lyuk (couche 3)

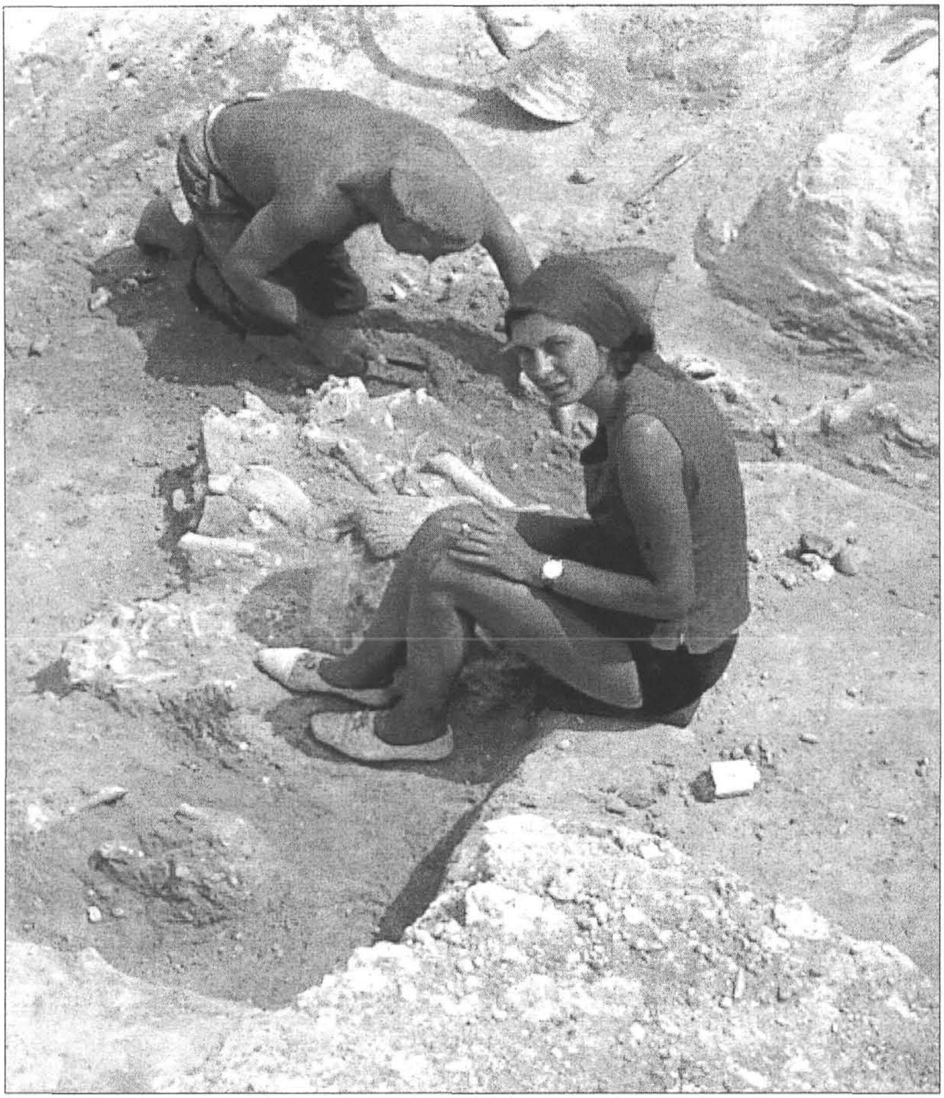

Figure 1.
Veronika Gábori-Csánk aux fouilles du site en 1964.

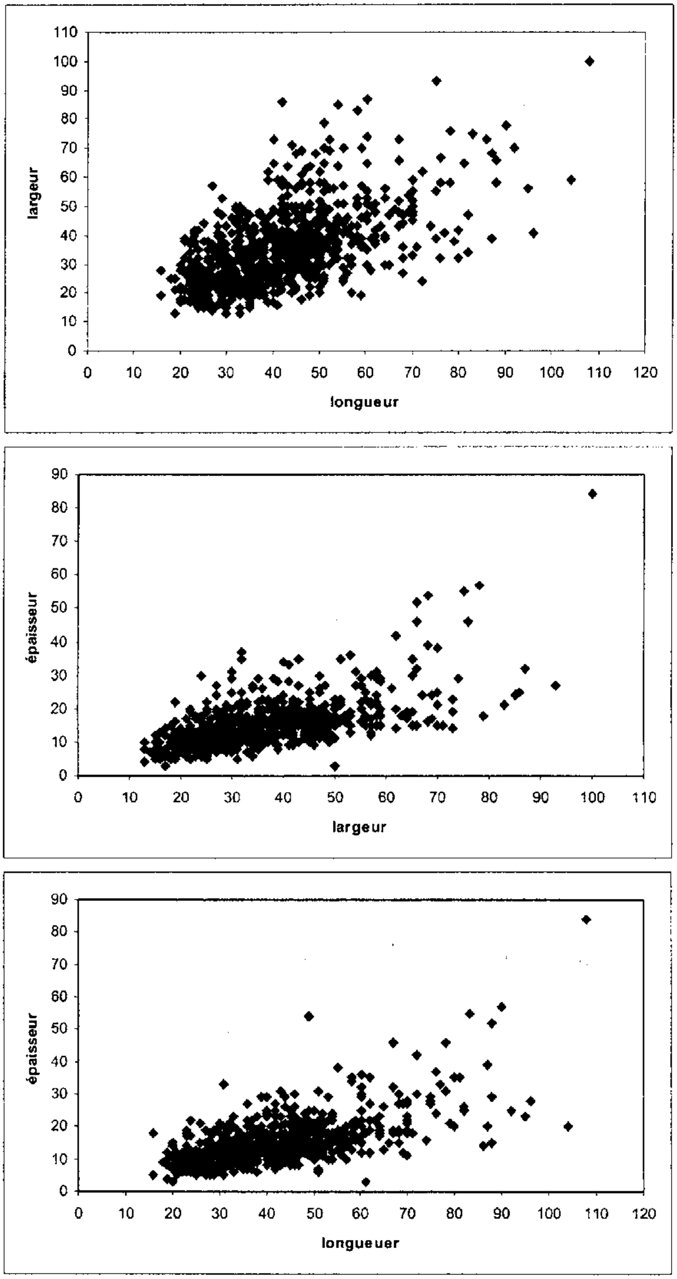

Figure 2.
Répartitions des valeurs de la longueur, de la largeur et de l'épaisseur de chaque outil (N=806)

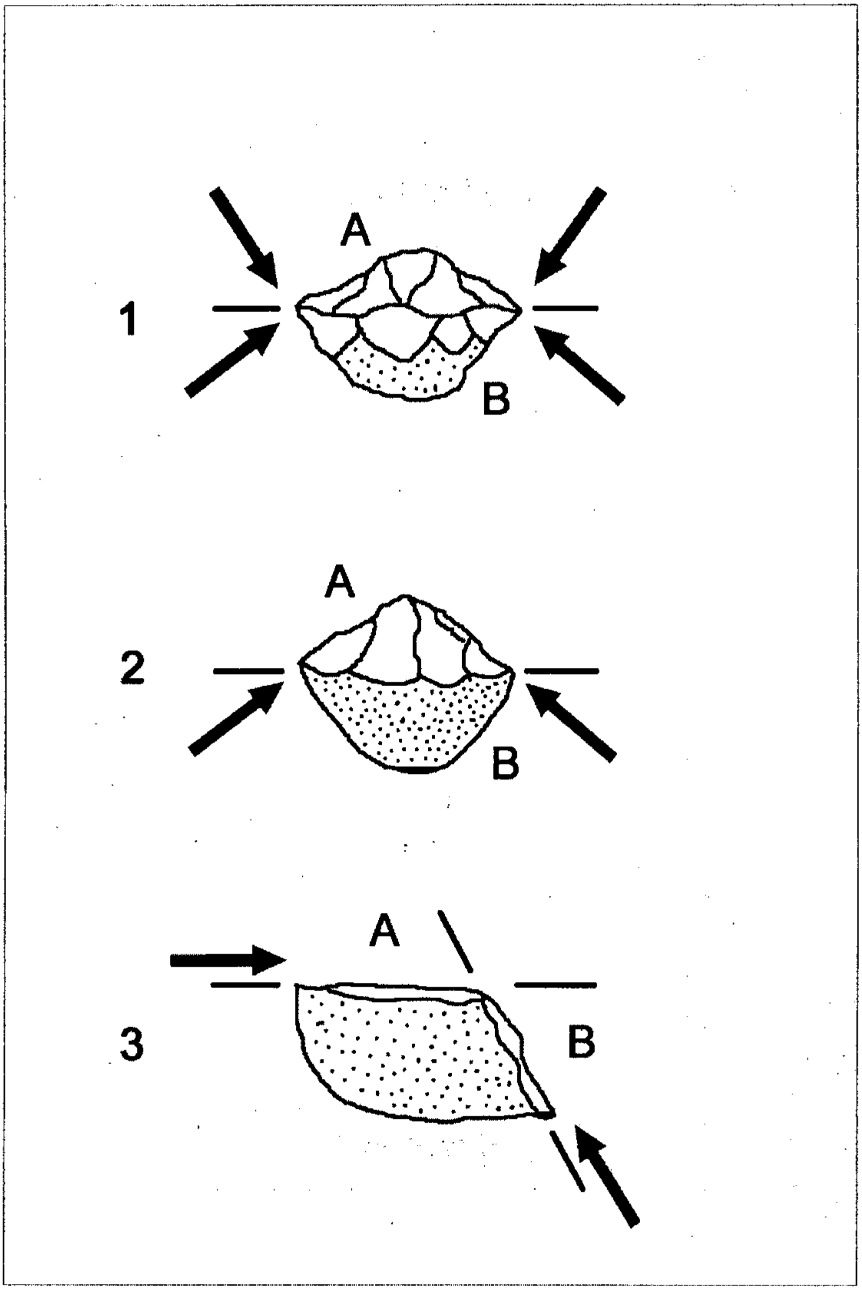

Figure 3.
Types de débitages reconnus à partir des nucléi en MP14.
1 : débitage discoďde 2 : débitage semi-discoďde 3 : débitage Quina

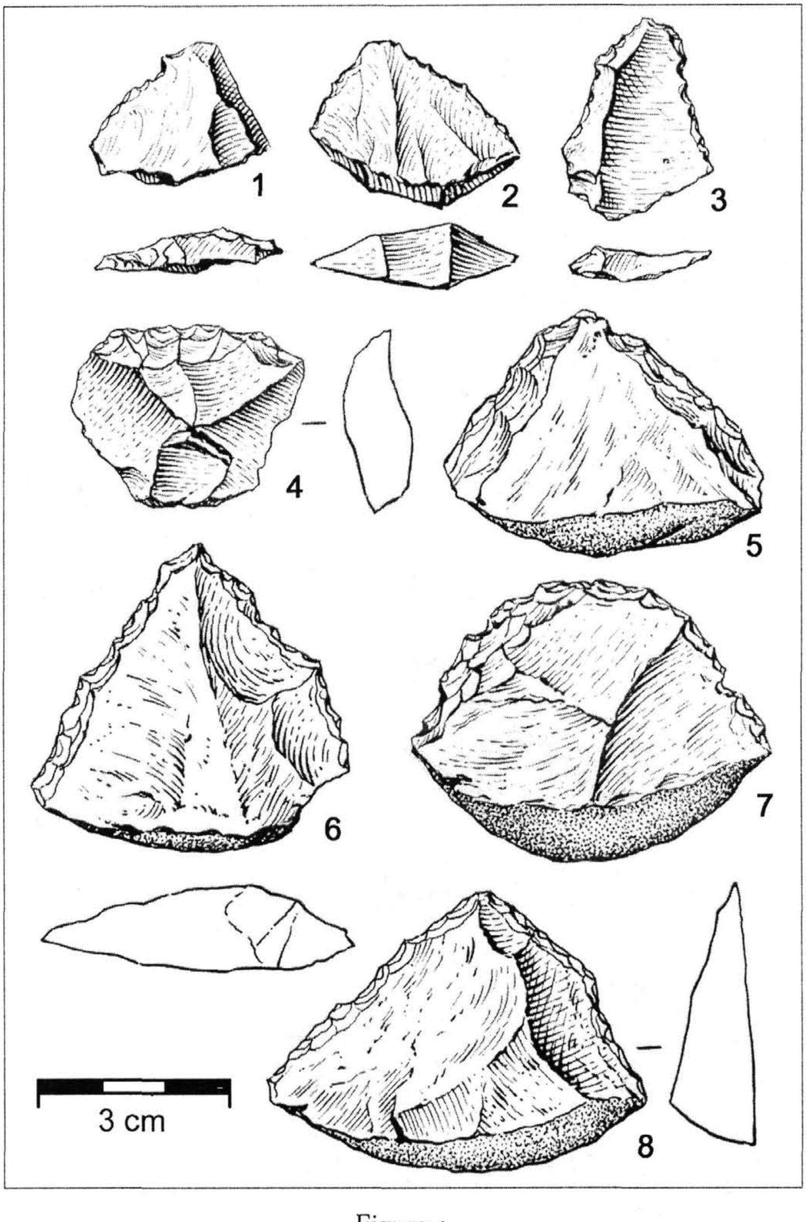

Figure 4.
Produits rattachés aux types de débitages reconnus (cf. Fig. 2)
(d'après GÁBORI-CSÁNK 1968b : planches)
1–4 : débitage discoďde 5–8 : débitage semi-discoďde
1 : pl. XXII, 6. 2 : pl. XXII, 7. 3 : pl. XXII, 8. 4 : pl. XXXIV, 1. 5 : pl. XXXI, 3.
6 : pl. XXXI, 4. 7 : pl. XXXIV, 11. 8 : pl. XXXI, 1.

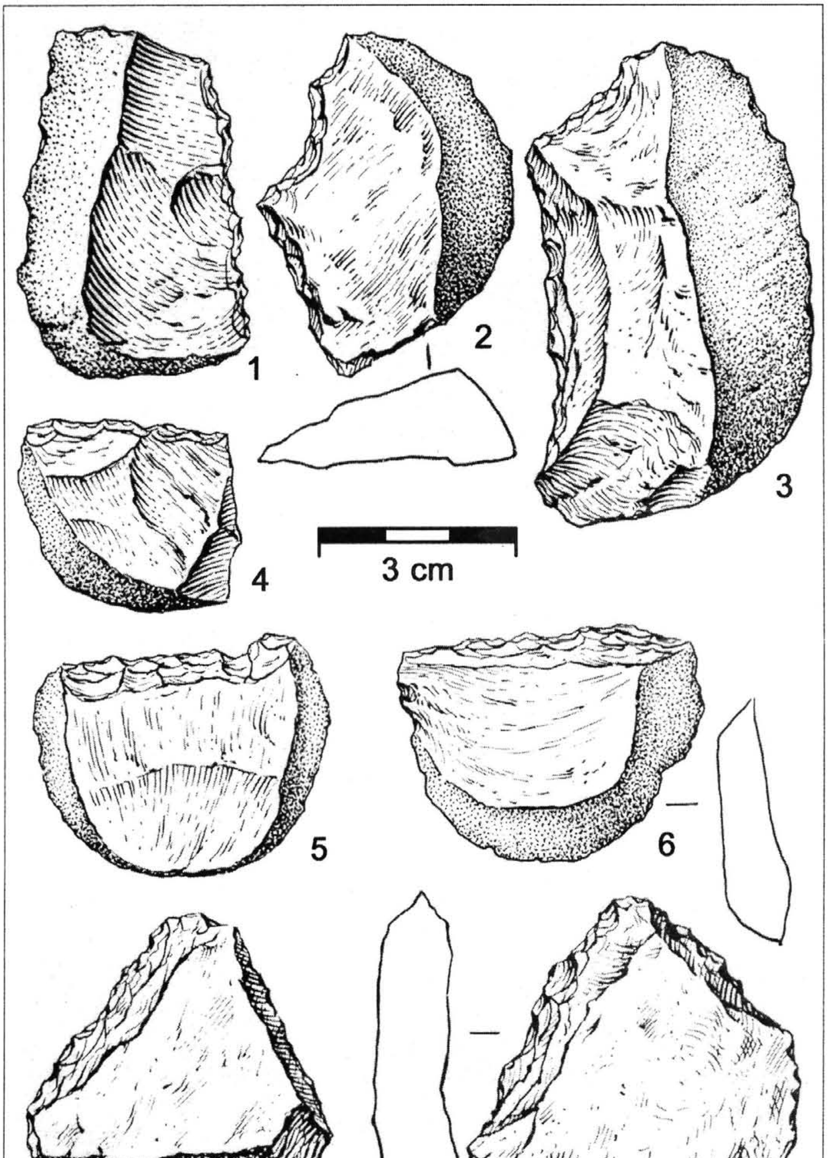

Figure 5.
Produits rattachés aux types de débitages reconnus (cf. Fig. 2)
(d'après Gábori-Csánk 1968b : planches)
1–4 : débitage Quina. 1 : pl. XXIII, 1. 2 : pl. XXXII, 8. 3 : pl. XXIX, 9.
4 : pl. XXXIII, 6. 5 : pl. XXXIII, 9. 6 : pl. XXXIII, 5. 7 : pl. XXII, 16. 8 : pl. XXII, 17.

First results of the pollen analytical investigation at Tata-Porhanyóbánya

Zsófia Medzihradszky

Introduction

The first palynological investigation of Tata-Porhanyóbánya was carried out in 1958. A 19 m long core was deepened into the travertine, the samples were analyzed at every 20 cm[1] and 19 pollen taxa were identified.

In May 2003 new pollen analytical research started at the locality. At this time we studied not the travertine itself, but the sediment which fills the hole between the two travertine layers. Eleven samples were taken for palynological investigation, seven from the northern wall (NP 1–7) and four from the southern part of the cave (SP 1–4).

The sampling was carried out based on the visible sedimentological changes. In the case of very thick units we have taken more samples from one layer.

Laboratory method

Because of the presumed low pollen concentration the maceration was started from 10 cm^3 soil. We followed the standard laboratory treatment after Ralska-Jasiewiczowa – Berglund[2] but considering to the big inorganic content of the samples the treatment was completed with the density separation technique elucidated by Zólyomi.[3]

Dating of the locality

The travertine was dated by Th-230/U-234 dating to 116–70 ka years.[4] According to this absolute age our locality could be dated based on the deep see isotope stages and the continental stratigraphy to the 5a-c isotopic stage, to the Early Weichselian, to the period of the Brörup and Odderade interstadial.

1 Járai-Komlódi 1964, 67–77.
2 Ralska-Jasiewiczowa–Berglund 1986, 455-484.
3 Zólyomi 1953, 367–430.
4 Hennig et al 1983, 1–29.

Description of the samples

The pollen concentration of the samples was low, it was not enough for statistical consideration not in a single case. Despite of the low pollen content we identified relatively high number of taxa, 33 pollen types. The pollen grains are well preserved, degradation and/or corrosion of the exine was not characteristic.

Samples of the northern wall

NP-1

The sample is poor in organic remains. Among of the trees and shrubs only pine *(Pinus sylvestris)* lime (*Tilia* sp.) and hazel (*Corylus* sp.) occur. Among of the herbs the goosefoot family (Chenopodiaceae) occurs in the largest amount, but significant the sage brush *(Artemisia* sp.) as well. In this sample reached the highest palynological richness the herbs, ten pollen types were determined.

Few charcoal fragments were present in the slides.

NP-2

Very narrow sand layer between two small travertine layers. Sterile for pollen.

NP-3

The sample is very poor in pollen, only one single *Pinus sylvestris* type, one *Ulmus* sp. and one *Tilia* sp. pollen grains among the trees, and one single Chenopodiaceae pollen grain from the herbs were identificable.

NP-4

A very characteristic change in the general effect of the slides observable between the NP-3 and NP-4 samples.

Whereas this sample is constantly poor in plant remains, the slides are dark from the very small (≈1μ) charred particles. New taxa in the pollen material are hornbeam *(Carpinus betulus)*, grape (*Vitis* sp.) and the pollen grain of the grasses (Poaceae).

NP-5.

Very similar to the NP-4 sample.

Pinus sylvestris is constantly present, *Ulmus* sp. and *Betula* sp. represent the deciduous trees and only the Chenopodiaceae family represents the herbs.

NP-6.

Significant change is observable again in the structure of the samples. There are more and large plant remains in the slides, the charcoal content is considerable. The pollen diversity is relatively high, 15 taxa were identified in this sample. Among the trees, *Pinus, Betula, Quercus, Ulmus, Fagus, Carpinus, Corylus* and cf. *Juglans* occur.

Among the herbs pollen of Poaceae, Chenopodiaceae and some *Artemisia* pollen grains were identified. In this layer appear the pollen grains of the aquatic plants, the pollen of water lily (*Nymphaea* sp.) and pondweed (*Potamogeton* sp.).

NP-7.

Very similar to the NP-6 sample. New taxa are the *Picea* and *Alnus* (Table 1.).

Samples of the southern wall

SP-1

The sample is could be closely connected according both soil structure and pollen content to the first and third samples of the northern wall although the *Ulmus* is absent and *Betula* occurs among the trees. New taxa for the herbs the knappweed (*Centaurea* sp.) and spurge (*Euphorbia* sp.).

SP-2

Very similar to the SP-1, but the pollen of Carpinus are present already.

A medium content of charcoal is observable.

SP-3

In this sample reached the palynological richness of trees the highest value from the southern sequence. The charcoal concentration is high as well.

SP-4

There are a lot of big plant remains in the in the microscope slides. The charcoal concentration is very high (Table 2.).

Results

By the investigation of the palynological richness of herbs from the northern wall the NP-1 sample shows the greatest diversity, the NP-3, NP-4, and NP 5 samples are very poor. The NP-6 and NP-7 samples have the same value (Fig. 1.).

Despite of herbs the group of arbor pollen shows another picture. The diversity of trees in the first four samples is low, but in the NP-6 sample a significant increase of this diversity is observable (Fig. 2.).

According to the northern wall, the palynological richness of herbs relatively high in the upper level of the southern wall (SP-1), and low in the other three samples (SP-2, SP-3, SP-4). The trees have the highest value in the SP-3 sample (Fig. 3., Fig. 4.).

Conclusions

Comparing the pollen data of the samples from the northern wall we determined three pollen assemblages, which review three stages of the changes in biotic pattern. The diversity of the southern wall is more balanced, we could determine only two assemblages and there is only a small difference between them (Fig. 5., Fig. 6.).

The bottom layer of the sediment shows a diversified picture of the pollen spectrum, high value of trees. The middle part of the soil is poor in pollen the vegetation become impoverished. In the upper assemblage the pollen richness is low, but the diversity of herbs increases.

The first results of the palynological investigations show a deciduous „forest" in the lower layers (NP-6, NP-7, SP-3, and SP-4) with a small lake at the locality (presence of *Potamogaton* and *Nymphaea* pollen). The sediment is rich in microscopic charcoal fragments. Maybe the traces of Prehistoric Man?

The upper part (NP-1–NP-5, SP-1, SP-2) consists the pollen assemblage of a „dry-cold" steppe vegetation but with few pollen grains of a warmer microarea (presence of *Tilia, Corylus* and *Vitis* pollen). Further sampling and pollen analysis is necessary to reconstruct more precisely the vegetation changes.

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	Pinus	Picea	Alnus	Betula	Quercus	Ulmus	Tilia	Fagus	Carpinus	cf. Juglans	Corylus	Vitis	Poaceae	Chenopodiaceae	Artemisia	Caryophyllaceae	Cruciferae	Rosaceae	Ranunculaceae cf. Trollius	cf. Plantago	Plantago lanceolata	Polygonum cf. aviculare	Nymphaea	Sparganium	Potamogeton
NP-1	1						1				1			19	8	1			1	1	1	1			
NP-3	1					1	1							1											
NP-4	1								1			1	1	1											
NP-5	1			3		1								6											
NP-6	2			5	3	1		2	1	1	1		2	1	7		1						1		1
NP-7	3	1	1		1	2				1			5	1	2			1						1	

Table 1. Pollen content of the northern wall

	Pinus	Picea	Alnus	Betula	Quercus	Ulmus	Tilia	Carpinus	cf. Juglans	Corylus	Poaceae	Chenopodiaceae	Artemisia	Aster type	Centaurea sp.	Rosaceae	Ranunculaceae cf. Trollius	cf. Plantago	Euphorbia	Lycopodium
SP-1	1			1			1			1	1	5	2		1	1		1	1	
SP-2	2						2	2				2	1						2?	2
SP-3	5	1	1	1	1				1	1		2	2	1						1
SP-4			1	1		1		1				2	1				1			

Table 2. Pollen content of the southern wall

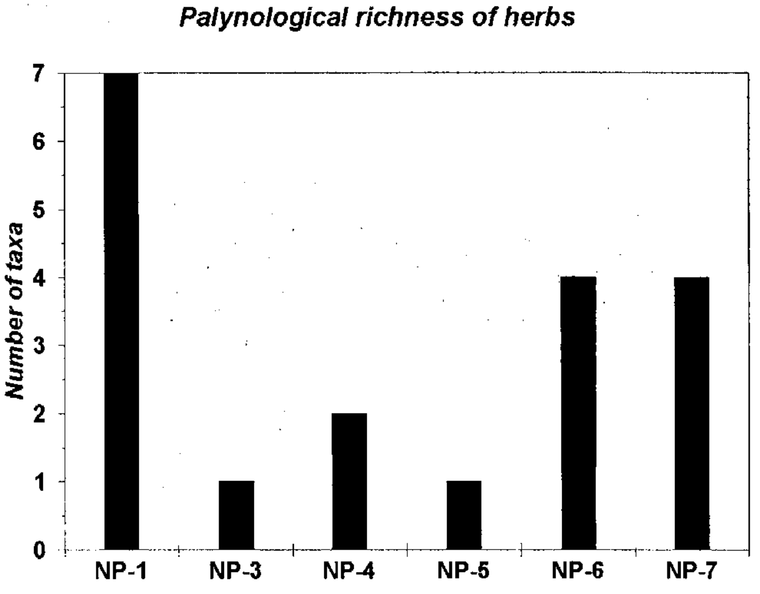

Fig. 1. Palynological richness of herbs

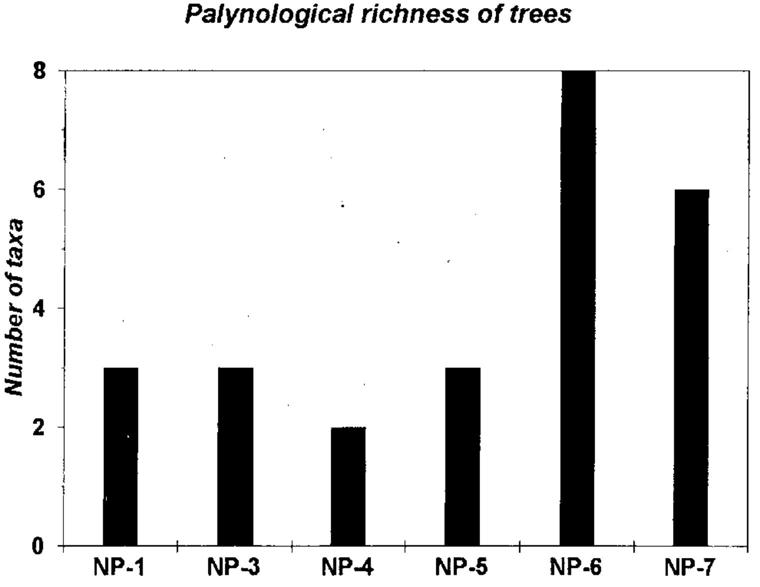

Fig. 2. Palynological richness of trees

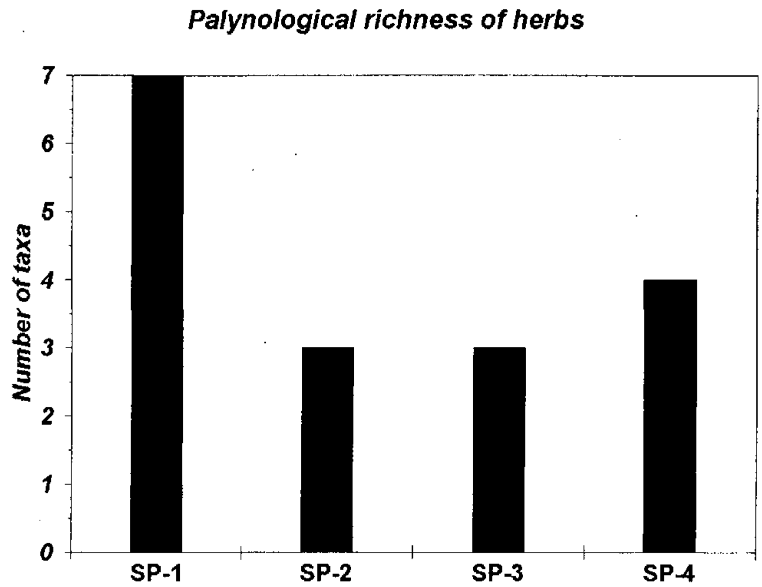

Fig. 3. Palynological richness of herbs

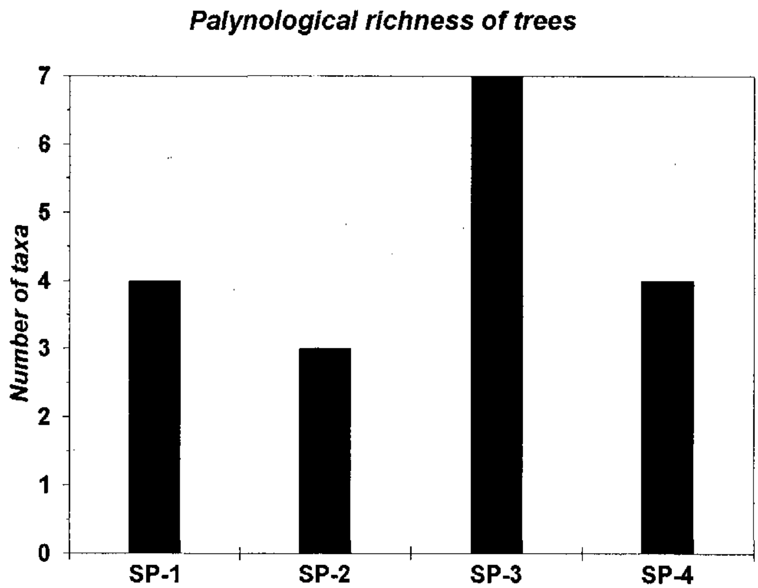

Fig. 4. Palynological richness of trees

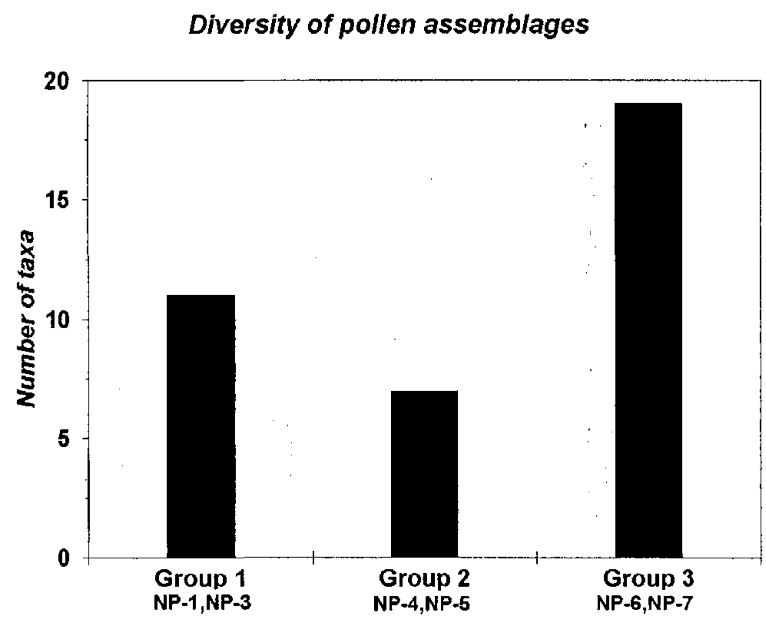

Fig. 5. Diversity of pollen assemblages

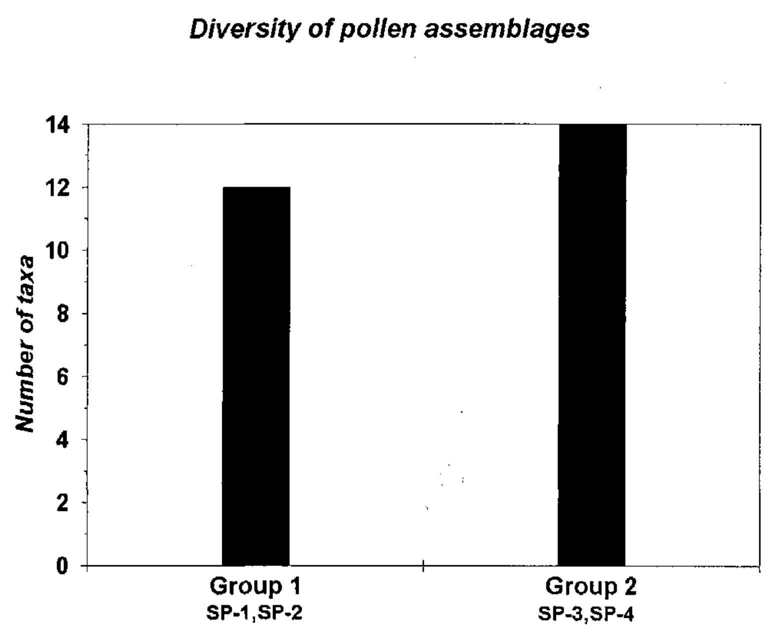

Fig. 6. Diversity of pollen assemblages