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ORIGIN AND EVOLUTION OF BLADE TECHNOLOGIES IN THE MIDDLE AND EARLY UPPER PALAEOLITHIC

JANUSZ K. KOZLOWSKI

Uniwersytet Jagiellonski
Instytut Archaeologik
31007 Kraków

e-mail: kozlowski@argo.hist.uj.edu.pl

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ABSTRACT

The origins of blade technology used to be located at the beginning of the Upper Palaeolithic and identified with the emergence of Anatomically Modern Humans. The paper points to earlier appearance of blade technology, earlier than the beginning of the Upper Palaeolithic, in the form of a number of episodes that occurred starting from the early phase of the Middle Palaeolithic. Such episodes took place in Africa, the Near East as well as in Europe. However, it is interesting that the early emergence of blade technology in Europe is not recorded in the western Mediterranean. At the beginning of the Upper Palaeolithic we can see the emergence of a blade technology on the base of Levallois concept and, independently, of the Levallois tradition at late technology as the fully-fledged Upper Palaeolithic Aurignacian. The distribution range of these two units: Levallois stemmed "transitional" industries and the Aurignacian covers the Near East, south-east Europe and the Danube basin to the west and Central Asia to the east. The paper discusses the possibilities of the identification of the range of these units with the diffusion of the Anatomically Modern Humans in Eurasia.

KEYWORDS: Blade, Palaeolithic, Levallois, Eurasia, Aurignacian

INTRODUCTION

The measure of technological advance in the Middle Palaeolithic was, first of all, the evolution of debitage techniques, whereas techniques of *façonnage* of bifacial tools underwent changes to a lesser degree, consisting mainly in the replacement of bifaces by leaf point and bifacial knives-side-scrapers *(Keilmesser)*. In the evolution of debitage techniques, on the other hand, two revolutionary innovations were of vital importance namely: the introduction of core preparation which enabled to obtain a pre-determined shape of flakes (Levallois

technique), and – secondly – mastering the skill of blade removal and, in the consequence, the possibility of fully exhausting the volume of raw material available in the so-called volumetric core. The latter innovation, which did not become wide spread until the Upper Palaeolithic, has received considerable attention of archaeologists who frequently regarded blade technique as the index of the appearance of anatomically and behaviorally Modern Humans.

The consequence of the introduction of pre-determined blanks was progress in the techniques of tool hafting, notably the elaboration of composite tool hafts. Pre-determined blanks production had, moreover, essential behavioral consequences, namely: the division of the operational chain into several stages (core preparation, the removal of blanks and their retouching, and the use itself). The stages were not necessarily carried out at the same time, at the same spot, or executed by the same individual. This required means of communication (language) and a level of planning that has often been attributed only to Modern Humans.

The introduction of the two innovations, i.e. Levallois technique and blade technique, was related to the search for better raw materials that were available in sufficiently large concretions. This means that raw materials procurement systems were created, which in terms of production organization is manifested in the occurrence of first workshops of raw materials processing. In turn, the consequence of a greater labour investment into procurement and blanks production was the diversification of patterns of reduction on the site, and more frequent curation of stone tools of which here is a greater evidence.

In this paper I would like to discuss the origins of production techniques of pre-determined blanks, secondly focus on the evolution of blade technique in the Middle and the beginning of the Upper Palaeolithic. I would also like to test the hypotheses about the mono- or policentric introduction of this technique, its continuity versus independent episodes of its appearance in the Middle and the Early Upper Palaeolithic i.e. in isotope stages (OIS) 9 to 3 (300 000-30 000 years ago).

APPEARANCE AND EVOLUTION OF LEVALLOIS TECHNIQUE

Levallois technique was a component of the package of technological innovations which appeared together as early as the second stage of the migration of Homo Out-of-Africa, the package whose most important component was Acheulian technique of bifacial tools production. The earliest, outside Africa, this package of innovations appeared in the corridor that constituted a continuation of the rift extending towards the Near East. The discoveries in Gesher Benot Ya'aqov in Israel (Goren-Inbar, Saragusti 1996; Goren-Inbar *et al.* 2000) suggest that massive basalt Levallois flakes were used simultaneously with Kombewa flakes as blanks for biface production already at the beginning of the geomagnetic Bruhnes period (ca 740 000 years ago). A similar package of technological innovations that combined Acheulian *façonnage* and the production of preferential Levallois flakes appeared in western Europe somewhat later, most probably at the beginning of isotope stage 12, about 500 000 years ago. The western European range of distribution of this technological package restricted by the river Rhein and the Alps, shows that the second stage of the "Out-of-Africa" migration to Europe took place without any connections with the Near East, in all likelihood via Gibraltar. Indeed, we can risk an assumption that the Near East Acheulian centres had no influence on Europe as they did not cross the barrier of the Taurus and the Caucasus mountain ranges. Consequently, pebble tool traditions and production of randomely shaped flakes from non-structured cores still dominated in central Europe, even in OIS 11 to 9 (Kozlowski 1998).

The presence of sites from isotope stage 10 in central-eastern Europe which contained Levallois technique without the context of the Acheulian (Korolevo layer VI, Transcarpathian Ukraina – Gladiline, Sitlivy 1990) would indicate that in Europe the technological innovation of centripetal preparation of the flaking surface in order to detach a single, flake, occurred independently of Africa. An argument in support of the existence of separate centres which introduced Levallois technique is its variability in Europe, beginning with isotope stages 10/9. This variability is manifested in the various directions of removals that prepared the flaking surface (unipolar, semi-centripetal, parallel/centripetal). As the result we are dealing with cores which were prepared by means of a method similar to the Victoria-West method known in the Middle Pleistocene in Africa, with cores defined as proto-Levallois (robust, with one scar on the flaking surface of – usually – a fairly short and robust flake), and with classical Levallois cores or, technologically even more advanced, recurrent type cores.

Further development of Levallois technique continued until the end of the Middle Palaeolithic extending not only to Africa, the Near East and Europe, but also to central Asia. This can be seen first of all in the attempts at fuller exploitation of cores by detaching numerous flakes from each core. The knapper achieved this, among others, by detaching flakes that removed the edges of a prepared flaking surface – the so-called éclats debordants. Simultaneously, in the consequence of the diversification of methods and directions of removal of preparatory flakes the products of debitage, too, became varied. These were sub-rectangular flakes, oval flakes, triangular flakes (Levallois points), and elongated specimens with parallel sides (Levallois blades).

Levallois technique was known both to Homo erectus/ergaster as well as to archaic Homo sapiens – as the discoveries in the Near East suggest – and to the Preneanderthal men in Europe where further evolution of Levallois technique is the achievement of the Neanderthals.

BEGINNINGS OF BLADE TECHNIQUE (ISOTOPE STAGES 9–6)

Blade technique was invented a long time before the beginning of the Upper Palaeolithic (Bar Yosef, Kuhn 1999). Its development took place in various centres and in a number of aborted episodes in the Middle Palaeolithic. Blade production was the outcome of different operational chains, both deriving from Levallois technique as well as from unrelated to it methods of core preparation. This

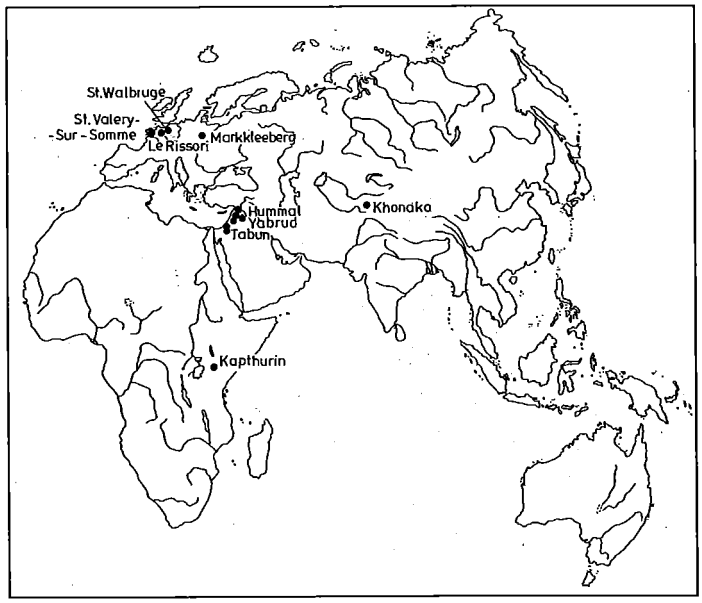

Fig. 1 . Sites with blade technologies dated between OIS 9 and 6.

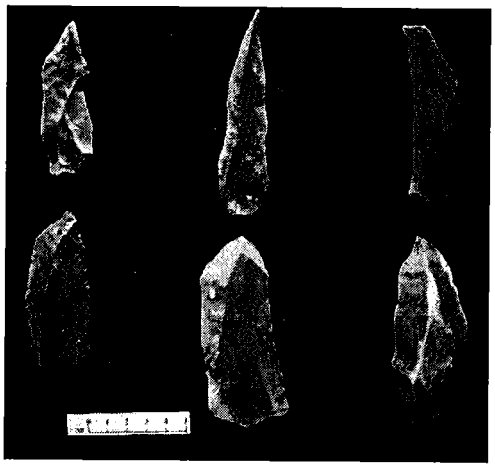

Fig. 2. Hayonim E, Israel. Elongate points and blades (phot. by O. Bar-Yosef).

complexity of technological roots of the process of blade production, together with the discontinuity of the evolution of blade technique provides evidence in support of policentric origin of this technique.

The earliest manifestations of blade technique were recorded in several, independent regional centres (Fig. 1). In the territory of eastern Africa prismatic (linéal and sub-volumetric) cores for blade production occur within the Kapthurin formation, in the context of post-Acheulian industries dated to isotope stage 8 (Carnelissen 1995). In the Near East, too, in isotope stages 8/7 we can see the appearance of Tabun D inventories with abundant blades and elongate points (Fig. 2). The technique of these inventories is based on *linéal* Levallois cores (Meignen 1994; Bar-Yosef 1992, 1994). At the same time, Hummalian technique was also used in the Near East, in which blade production based on non-Levallois cores whose flaking surfaces were shifted from the convex surfaces into core sides and – in this way – the volumetric effect was achieved (Boëda, Muheisen 1993). Both in Tabun D assemblages and in the Hummalian blades were laterally-convergently retouched which resulted in a kind of elongate points (Fig. 3) (Boëda 1995). Within the temporal frame of OIS 8, or even in OIS 9, one more industry with blade technique occurs in the Near East, namely: the Amudian (Jelinek 1990; Meignen 1994). In this industry the transformation of blades into Upper Palaeolithic tool types encouraged the researchers to refer to this unit as the "Pre-Aurignacian". However, in reality the "Amudian" represents several episodes with blade technique that took place within the local evolution of the Yabrudian, and demonstrates the flexibility of technology within the framework of a post-Acheulian units such as the Yabrudian. It should be added that the blades in the "Amudian" did not originate from Levallois cores but were made from, basically, unprepared – except for the platform – sub-volumetric cores. For example, the stratigraphical sequences from Yabrud 15, 13, Tabun Bed 75 units I2 and I1, Abri Zumoffen levels 21–11 and Maslukh layers A and B suggest that blade technique appeared

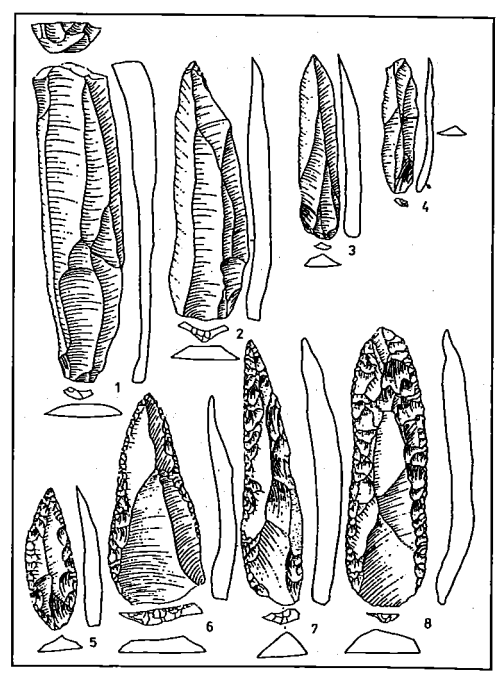

Fig. 3. Hummal, layer Ib, Syria. Blades (1-4) and blade tools (5-8). Acc. to E. Boëda.

as a response to satisfy specific demands of population groups who, usually, produced Mousterian and bifacial tools (Ronen 1992). The hypothesis which maintains that blade episodes can be ascribed to a different population who arrived alternatively at Yabrudian sites (Vishnyatsky 2000) seems unrealistic.

In Europe blade technique appeared in OIS 9–6, that is: at the end of the Holstein Interglacial and during the pen-ultimate glaciation. It is interesting that industries with blade technique are recorded exclusively in north-western Europe, whereas they are absent in the southern part of Europe. In terms of technological evolution there were – as V. Sitlivy (1995) pointed out – two important directions of advance: the transition from Levallois *linéal* technique to the technique of the prismatic volumetric core with parallel preparation ,and, secondly, from non-Levallois technique to the unprepared core with parallel and longitudinal scars, initially flat, subsequently semi-volumetric or even volumetric. The former of these evolutional tendencies is typical of assemblages where the *recurrente* Levallois technique had already been known, mainly the Biache type (Rissori, lower layer in the Helin quarry, St. Walbruge in Belgium – Adam 1991; Tuffreau 1983; Tuffreau, Somme ed. 1988). In this technique lateral crests were removed which enabled the flaking surface extension, often reduced from two opposite platforms, onto the core sides. In the second of the two evolutional tendencies blades were obtained by selecting concretions of suitable shape and repeating parallel blade removals from one platform. A good example of cores reduced in such a way are the specimens known from Coquelle, Etaple, St. Valery-sur-Somme, Tourville-la-Rivière and others in northern France (Heinzelin, Haesaerts 1983; Révillion 1995). We should add, that a similar technique of blade production is sometimes found in Epi-Acheulian assemblages with Levallois technique such as, for example, at the site of Markleeberg near Leipzig. It is interesting that the second evolutional tendency correlates with the appearance of Upper Palaeolithic tool types in the assemblages that in fact belong to the Early Phase of the Middle Palaeolithic.

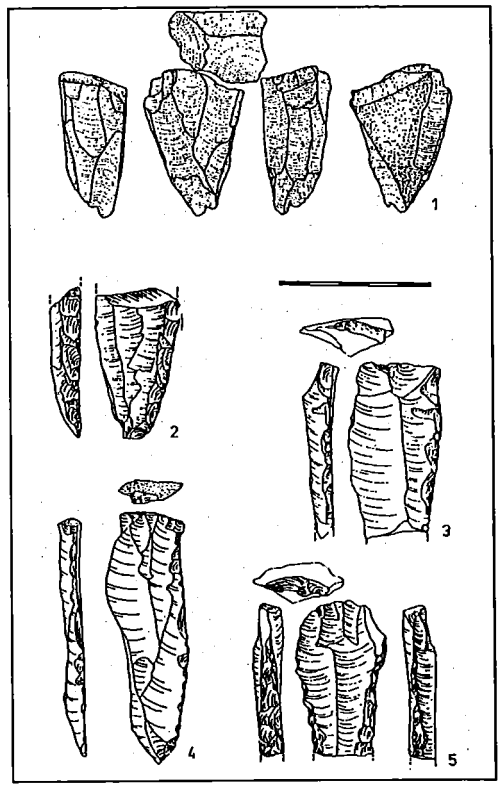

Fig. 4. Khonako III, Tadjikistan. Blade core (1) and blade tools (2-5). Acc. to J. Schäffer et al.

The early appearance of blade technique, as early as OIS 7, has also been registered in the territory of Central Asia at the site of Khonako III, within the fossil soil dated by palaeomagnetism to about 240 000 years. The blade production at Khonako was based on non-Levallois, single-platform cores whose flaking surfaces were initially flat and – as reduction continued – were extended onto core sides. The preparation of these cores was restricted to platforms only; they were, in reality, proto-prismatic, sub-volumetric cores (Fig. 4) (Schäffer *et al.* 1998).

Some researchers would wish to see early blade episodes also in the Caucasus, in the Djrutchula type Mousterian. It seems, however, that this industry, whose technological base is Levalloisian, could not be earlier than OIS 5.

BLADE TECHNIQUE IN ISOTOPE STAGES 5 AND 4

In isotope stages 5 and 4 corresponding to the late phase of the Middle Paleolithic, blade technique was known first of all in the northern part of Europe (Fig. 5). Again, it appeared as episodes which were parallel with other technologies most importantly Levallois and Mousterian ones. These episodes are very well evidenced in a group of sites in northern France (Seclin, Riencourt-les-Bapaume, St. Germain des Vaux/Port Racine – Révillion, Truffeau ed. 1994), and in Belgium. At these sites Levallois technique co-occurs with the blade production from volumetric cores: both unprepared – such as are used in the early phase of the Middle Palaeolithic – and prepared by shaping central crests removed before the reduction was undertaken. The production of blades on these sites was, sometimes, accompanied by the occurrence of Upper Palaeolithic tool types (e.g. at Riencourt -les-Bapaume) represented by burins, truncations or even backed pieces (Fig. 6).

In the Rhein basin, too, assemblages with well-developed blade technique were recorded in OIS 5a–5d (Rheindalen B1, Tonschesberg 2B and Wallertheim D – Conard 1990). The sites with blade technique in the Rhein basin were brief summer hunting camps where the carcasses of bovidae, cervidae or equidae were brought to be divided and consumed. It is

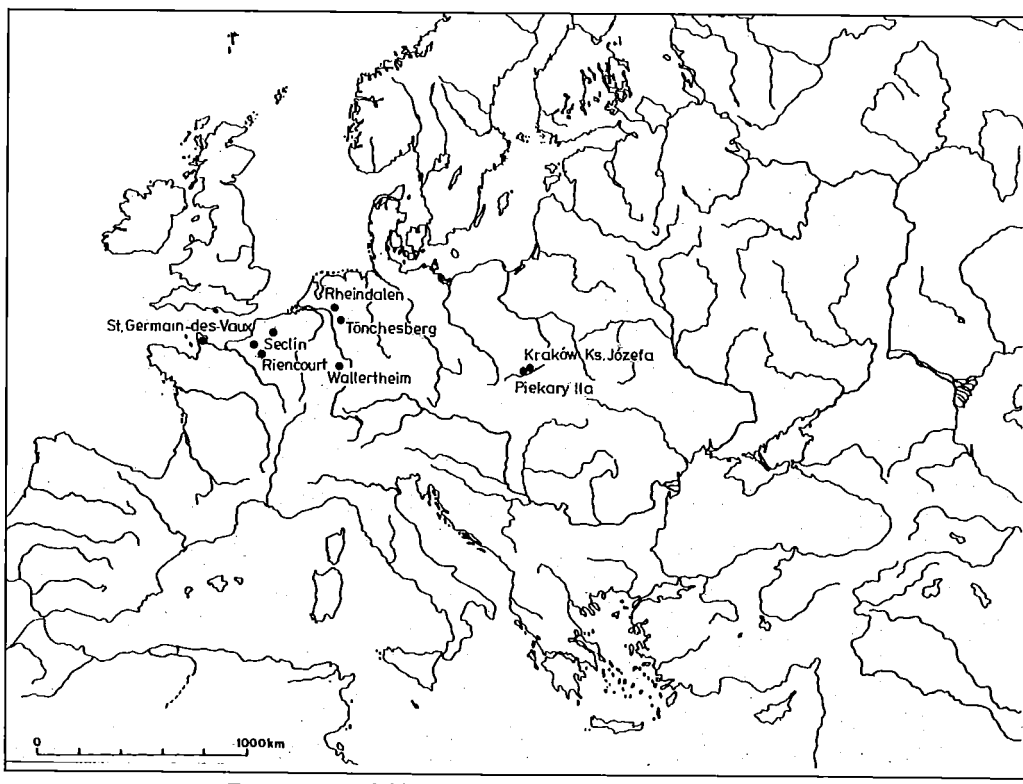

Fig. 5. Sites with blade technologies dated between OIS 5 and 3.

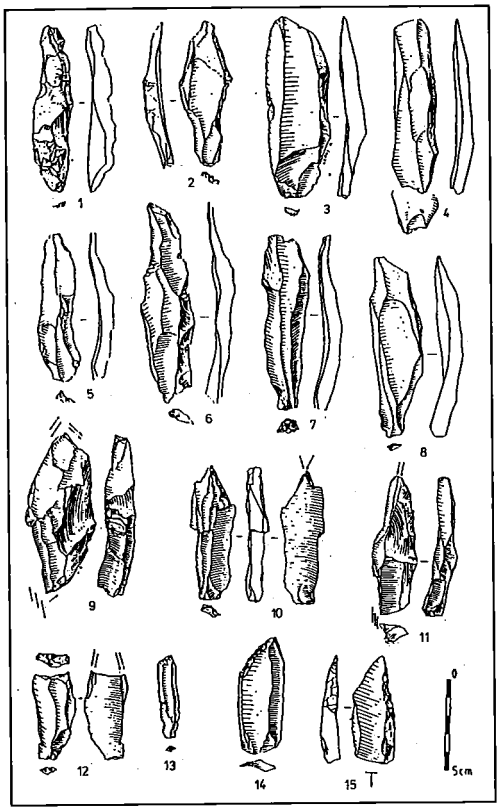

Fig. 6. Riencourt-les-Bapaume, France. Blades (1-8) and blade tools (9-15). Ac. To N. Amelot-Van derHeijden).

important that on the site of Wallerthein D blade technique was used to work raw material on the site (grey-green andesite) as well as off site. The raw material from outside the site (red-brown rhyolite) was supplied to the site as blades and blade tools. These are mainly blades with bilateral retouches, possibly with unilateral retouch, sometimes resembling backed implements.

Just as in north-western Europe also in the territory of Poland blade technique appeared in the Late Middle Palaeolithic, on open-air loess sites exclusively. It is not known at cave sites. The sites in the Vistula valley near Kraków are of particular importance as in the stratigraphical sequences at these sites assemblages with blade technique co-occur or are interstratified with Levallois and Mousterian techniques. An important site like this is Księcia Józefa Street in Kraków where three culture levels were uncovered beneath younger Pleniglacial loess within channel deposits of the Vistula alluvia. covered by an overbank of silty muds with organic material (Fig. 7) (Sitlivy *et al.* 1999a). The youngest of these levels revealed the presence of the Levallois method of obtaining preferential flakes from *linéal* cores which – on the basis of the presence of several blades and a trimming blade – could have been accompanied by the Upper Palaeolithic technique of the volumetric core. The middle level on this site yielded a rich assemblage with numerous refits which well documented the use of blade technique based both: on volumetric, one- and less often double-platform cores with

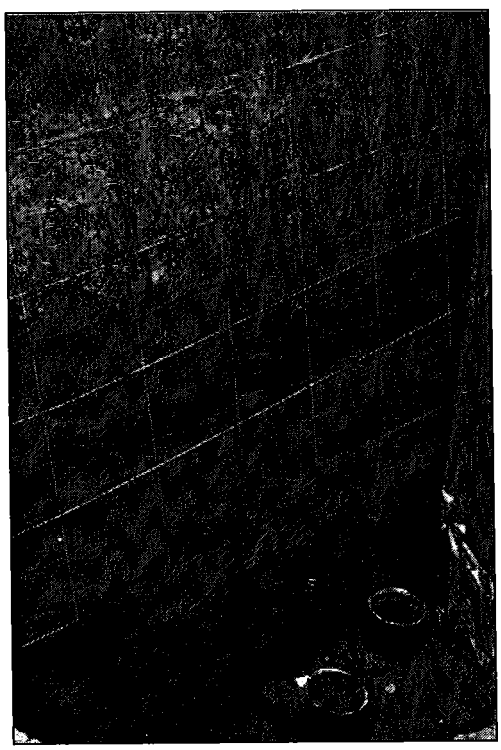

Fig. 7. Kraków, Ksiecia Jozefa street, Poland. Position of three archaeological levels in the Vistula alluvial deposits covered by LGM loess.

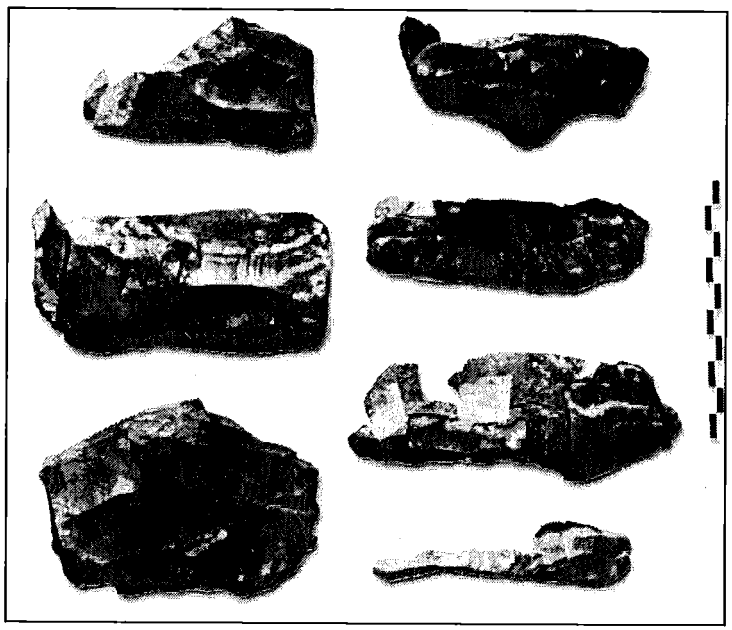

Fig.8. Kraków, Ksiecia Jozefa street, Poland. Refitted blade cores from the middle level. Phot. V. Sitlivy.

unprepared platforms, and on cores with preparation from central and postero-lateral crests (Fig. 8). The lowest level at Księcia Józefa Street site is a typical Mousterian assemblage with biconical-centripetal and centripetal flake technique. The three assemblages all display features of a workshop where local Jurassic flint was processed, which is evidenced by the occurrence of full operational chains and by almost total absence (except in the oldest assemblage) of tools. The technological differences between these assemblages seem to point to the interstratification of occupational levels, representing various traditions but invariably connected with the exploitation of local flint deposits – probably in spring. Until TL dates for this site have been obtained we can only speculate that the alluvia and the overbank deposits can be placed at the end of OIS 4, possibly the beginning of OIS 3.

Another site in the vicinity of Kraków is Piekary IIa situated high, on a rocky hill above the Vistula. Initially it was believed that the loess on this site which contained artefacts (layer 7c) could be placed at OIS 6. This loess contained a blade industry with volumetric cores with central crests or without preparation, which distinctly dominated over Levallois cores and their products. The blades were partially retouched to make truncations and backed blades. The assemblage in layer 7c yielded only about 180 artefacts, but on the basis of refits we can assume that it was fairly homogeneous (Fig. 9) (Sachse-Kozlowska ed. in press). Overlying the blade industry layer 7b was at first interpreted as OIS 5e soil (Nietulisko palaeosol). Later analyses of the profile at Piekary IIa revealed, however, that layer 7c had been displaced by solifluxion processes, distinctly visible in the floor and top of this layer. At the same time, the TL determinations for the artefacts from the concentration in layer 7c have proved to be much younger, corresponding to the very beginning of OIS 3a (60 – 49 Kyr B.P.). Recent investigations into Piekary IIa have enabled us to distinguish a series of occupational levels placed in the first half of OIS 3 (in the period from > 60 to 36 Kyr B.P.) which contained coexisting techniques: Levallois *linéal* and *recurrent*, Mousterian and non-Levallois blade technique with both unprepared cores as well as cores with central crests. The frequency of cores and debitage products associated with these techniques changes laterally and vertically. Because the refits suggest that, despite slope-washing, the material had not been intensively displaced, we can assume that the population groups who inhabited the

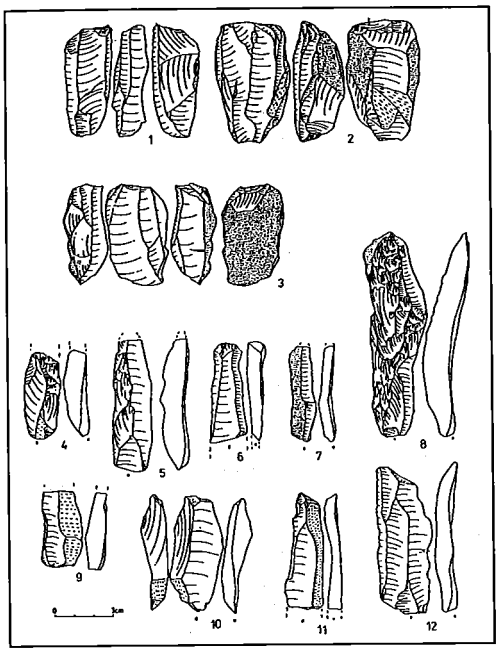

Fig. 9. Piekary IIa, layer 7c, Poland. Blade cores (1-3), crested blades (4, 5, 8) and blades (6, 7, 9-12).

site in the first half of OIS 3 commanded a flexible technology which they employed to produce a variety of flakes and blades to meet concrete needs as they arose (Sitlivy *et al.* 1999b).

The situation in north-western and central-north Europe in the period of OIS 5 and 4 until the beginning of stage 3 allows us to assume that the technological development of Mousterian groups was demonstrated in the ability of smoothly switching from Levallois and Mousterian techniques to sub-volumetric and volumetric blade techniques. The use of a given technique was dictated by current situational needs. As the result, we can see in the stratigraphical sequences either interstratification of the various methods of blank production, or lateral variability within the camp area which is the evidence of different knapping episodes. The lateral differentiation may have become obscured because the products of different kanpping episodes were superimposed on the same spot. In the outcome of such a situation we recover assemblages with products of different operational chains.

In OIS 5 blade technique appeared in south Africa as an episode associated with the Howiesons Poort industry. Unfortunately, we know little about the method of blade production in this industry, although its association with early remains of *Homo sapiens* gave grounds for speculations that the blade episode in question might have been the real beginning of Upper Palaeolithic blade techniques. The tools made from blades in the Howiesons Poort facies – first of all arched backed blades – would, then, provide an argument in support of continuity between this early blade episode, dated to OIS 5b/5a, and the blade industries of African LSA (Deacon 1989). However, we have to take into account the chronological hiatus that, especially in southern Africa, separates the Howiesons Poort episode and the early LSA stage (McBrearty, Brooks 2000). This hiatus is not filled even by the earliest LSA sites that occur in central-east Africa at the beginning of OIS 3 (Enkapune Ya Muto near Lake Naivasha in Kenya – Brooks *et al.* 1995).

Even less clear is the problem of the blade technique that appears in northern Africa, in lower layers of the Haua Fteah Cave in Libia, attributed by Ch. Mc Burney (1967) to isotope stage 5. Analysis of the blade debitage products from this site suggested that it was an accidental outcome of reduction of unprepared flake cores, but – it appears – that an even bigger part of this debitage comes from cores on flakes resembling macroburins. This means that at Haua Fteah there is no technological continuity between the so-called Pre-Aurignacian from spits 170–174 and the early Dabbian from levels XXV–XXIV (the middle phase of OIS 3).

To sum up, in the late phase of the Middle Palaeolithic blade technique is characteristic, first of all, for the northern part of Europe, neighbouring with the European Lowland. In southern Europe, in contrast with this, blade

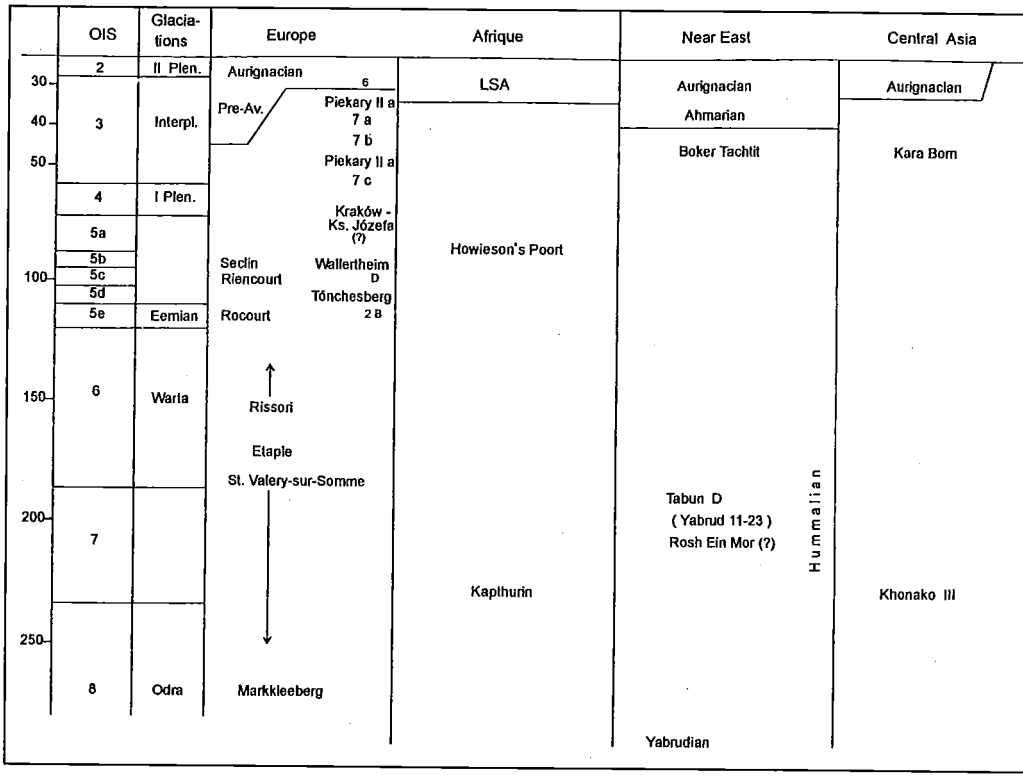

Fig. 10. Chronology of the most important blade episode during the Middle Palaeolithic.

technique was unknown. Also in the Near East, in OIS 5–4, this technique was basically unknown, where within Levallois technique (unlike in Tabun D) dominated ovaloid flakes (Tabun C) and broad-based points (Tabun B). In Africa blade episodes had a unique character and exhibit no clear continuity with the local Upper Palaeolithic (LSA) (Fig. 10).

BLADE TECHNIQUE AT THE MIDDLE/UPPER PALAEOLITHIC BOUNDARY (OIS 3)

At the boundary of the Middle and the Upper Palaeolithic two processes of autonomous origin and, subsequent, broad diffusion of blade technique can be seen which do not seem to be a continuation of the blade episodes from OIS 5 and 4, and which remain in contrast with the generally increasing importance of flake blanks in the late Middle Palaeolithic industries in western and central Europe. These two phenomena are:

a) the blade technique that derived from Levallois technique, based on the technological transformation of Levallois preferential *(linéal)* and *recurrent* cores into volumetric cores with central crests. This phenomenon is characteristic for the period between 50 to 38 Kyr and embraced the territories from the Near East to the west as far as the Balkans and the Danube basin, to the east as far as Central Asia. This technique occurs in the "transitional" industries developed on the Moustero-Levalloisian base.

b) the volumetric type blade technique such as appears in a fully-fledged form, without local antecedents, in the context of Aurignacian tools in the period between 45/43 to 30 Kyr. It was distributed from the Balkans,

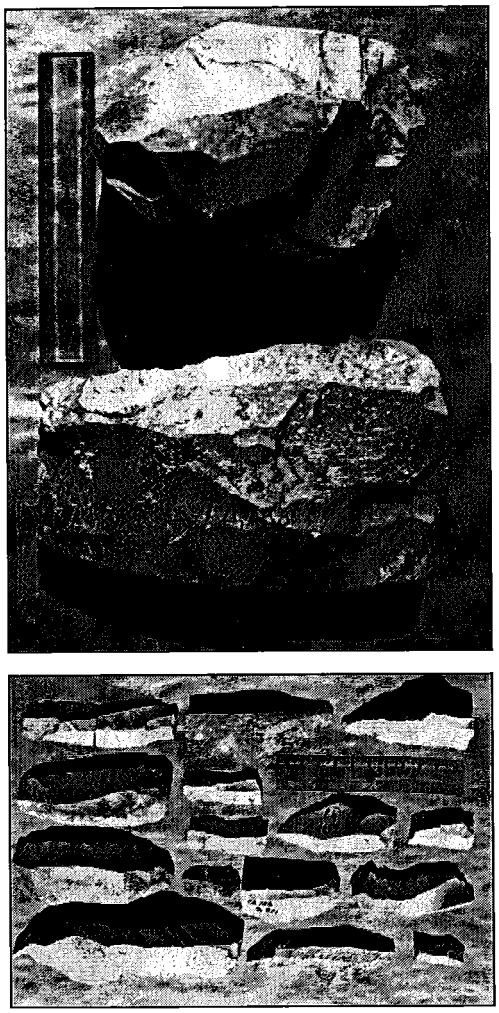

Fig. 11. Temnata Cave, sector TD-II, layer VI. A. Bidirectional cores; B. cores.

across the Danube basin as far as the north Mediterranean countries, to western and – later – also to eastern Europe, and from the northern part of the Near East as far as Central Asia.

It is interesting that the pattern of distribution of the two phenomena is similar and could suggest a diffusion from the Near East to Europe and Central Asia. This, in turn, may suggest the temporal and spatial concurrence of both technologies with the diffusion of the first Cromagnons – in accordance with the "Out-of-Africa" hypothesis. Let us try and evaluate the plausibility of a hypothesis interpreting the two phenomena of technological diffusion of blade technique in terms of migration.

The phenomenon of blade technique sprouting from Levallois technique embraces the Emirian/Ahmarian sequence in the Near East (47–42 Kyr B.P. at Bokher Tachtit – Marks 1988; Marks, Volkman 1983), the industry from layer VI in the Temnata Cave in Bulgaria (50–45 Kyr TL B.P. – Ginter et al. 1998) (Fig. 11), the industry from layer II at the site of Korolevo II in Transcarpathian Ukraina (38.5 Kyr C–14, 60 Kyr TL – Gladiline, Demidenko 1989, Demidenko, Usik 1993) (Fig. 12), the Bohunician industry in southern Moravia (42–38 Kyr B.P. C–14 – Svoboda, Skdrla 1995) in Europe, and in Central Asia the Kara Bom sequences in the Altai Mts (43–30 Kyr C–14 – Derevianko 2001). As regards technology all these assemblages exhibit complexity of operational chains documented by refits. The sequences of removals can be executed from the Levallois type preparation of the flaking surface, followed by reduction by means of *recurrent* method and, as the flaking surface becomes rounder – the modification of the core structure (also by preparing a new crest), and continuation of blade removals on the core side. In the Bohunician the opposite sequence can also be recorded: first the core has a volumetric structure and is reduced by blade removals, subsequently, after re-preparation, it is used as a *Levallois recurrent* core to

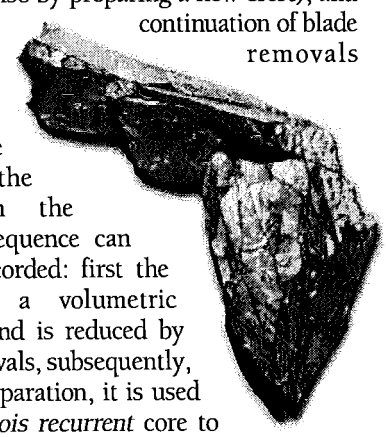

Fig. 12. Korolevo II, layer II, Ukraine. Refitted blade core.

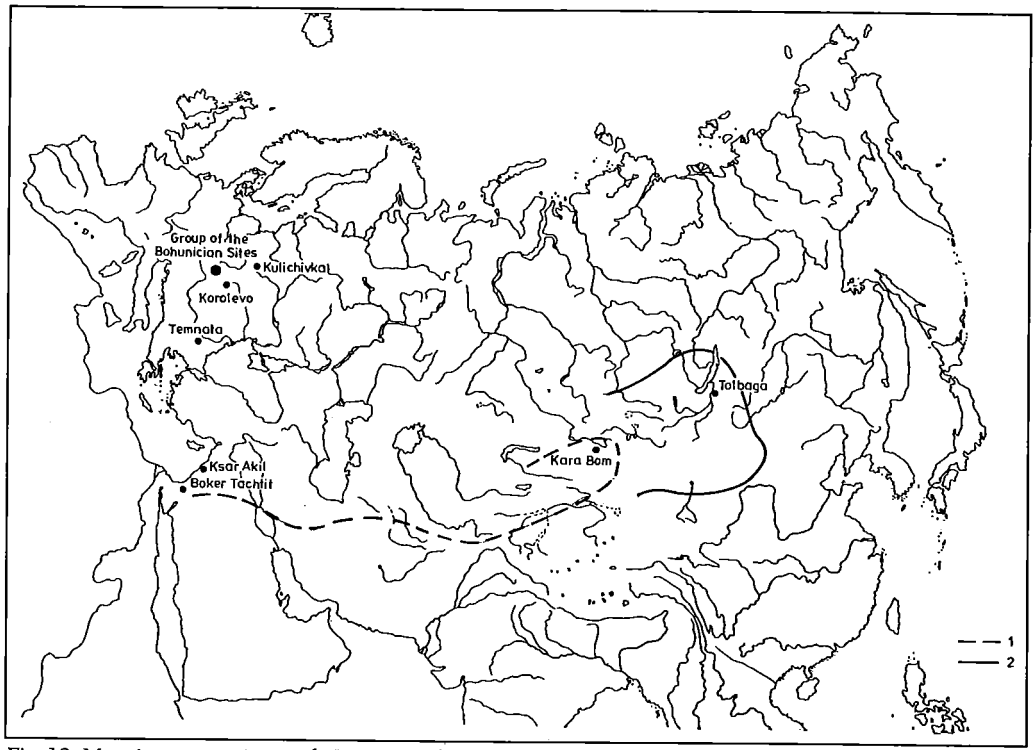

Fig. 13. Most important sites with "transitional" Levallois-Upper Palaeolithic blade industries. 1 - limit of the extension of Neandertals, 2 - eastern limit of Levallois stemmed blade industries.

detach series of Levallois points (Fig. 13).

Comparison of the debitage and tools from the sites enumerated above (except Kara Bom), based on a broad list of attributes, is the subject of a recent work by G. Tostevin (2000) who has found a high degree of similarity in between the assemblages from those sites. Its should be added, that the similarity of the various assemblages within, for example, the Bohunician was not greater than the similarity between the lower levels of Bokher Tachtit and the Bohunician. Another major conclusion that Tostevin has formulated is that the comparison of "transitional" industries in central Europe and – older from them – Moustero-Levalloisian assemblages in south-east Europe (e.g. Molodova I – layer 11) shows, supposedly, absence of antecedents for the "transitional" industries in both regions. However, this conclusion is the weakest element in Tostevin's reasoning because he based it on too few analysed assemblages. This local evolution of Levallois reduction method towards the blade technology can be seen in Balkans in the sequence of the Theopetra Cave, Thessaly (Panagopoulou 2000). In this case lithic industry of layers II4 – II8 dated between 36 and 33 Kyr B.P. shows "a shift within the existing technological base (i.e. Levallois unipolar reduction) towards a greater intensification and efficiency in the production of laminar blanks by bidirectional core reduction" (Panagopoulou 2000)

The interpretation of the phenomena of the post-Levalloisian blade techniques as a diffusion related to the migration in the direction of Europe and the Central Asia from the Middle East has two shortcomings (Fig. 14):

a) a lack of sufficiently precise chronology (notably, the broad range of dates for layer VI, the Temnata Cave and layer II, Korolevo II)

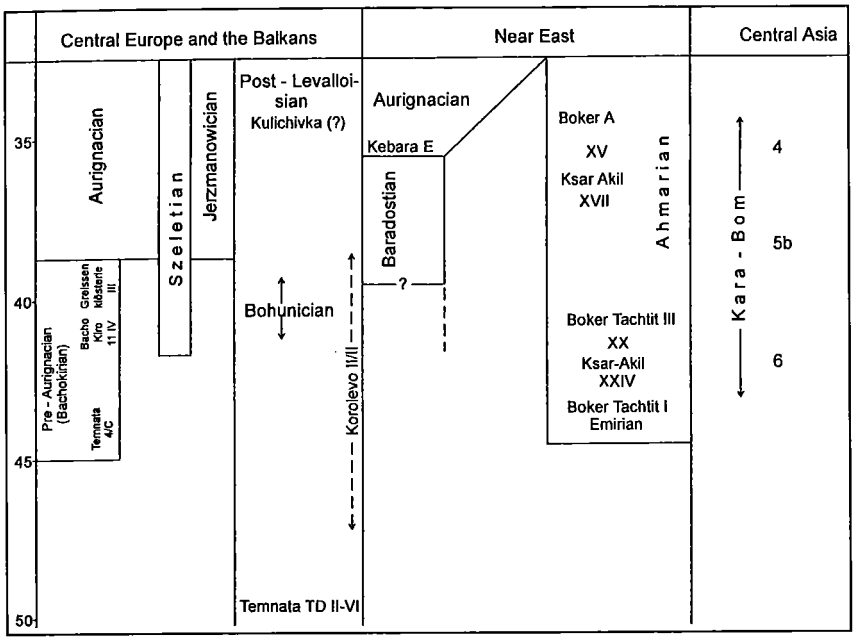

Fig.14. Chronology of the "transitional" industries with Levallois-Upper Palaeolithic blade technologies (Bohunician, Post-Levalloisian, Ahmarian) other "transitional" industries with non-Levallois technology (Szeletian, Jerzmanowician) and the Aurignacian.

which does not allow to justifiably argue that the Emirian/Ahmarian sequence in the Near East is earlier than the Epi-Levalloisian industries in south-east Europe.

b) the multi-regional origin of post-Levalloisian blade industries can be proved not only in the Near East where the Kar Akil sequence in Lebanon (layers XXV–XIV) provided the evidence of the continuation of Levallois technological tradition within the blade industries of the "Ahmarian line". In Europe, too, some of the Mousteroid-Levalloisian facies seem to exhibit continuation (for ex. industries of Samuilitsa and Temnata Caves in Bulgaria). The most convincing instance of such continuation are the sequences of layers 5–6 and 4–1 at the site of Kara Bom in Central Asia.

In the present state of knowledge of the problem it seems more justified to interpret the similarities of technological evolution in "transitional" Levallois-stemmed industries as the manifestation of convergence rather than the effect of migration from the Near East.

The possibility of convergent appearance of blade technique in the initial phase of the Upper Palaeolithic has a bearing on other "transitional" industries with distinctly Middle Palaeolithic technological tradition such as the industries with backed points (the Chatelperronian, Uluzzian) and leaf points (Szeletian, Streletskian). Blade technique in these industries has often been believed to have been the effect of contacts of the population with these "transitional" industries (the discovery at St. Cesaire shows that these were the Neanderthals) with the first Cromagnon population (Aurignacian). J. Zilhao and F. d'Errico (1999) questioned this hypothesis using a rather complicated reasoning which led to the "rejuvenation" of the Aurignacian (to as late as 36.5 Kyr). In this way the Aurignacian was made too late to have been able to pass on blade technique to "transitional" industries. In may opinion, the large number of blade episodes in the Mousterian, in the period of isotope stages 5–3, also the convergent appearance of the volumetric blade core concept – on the Levallois and non-Levallois base – prove that the Neanderthals, the creators of "transitional" industries, did not need to take advantage of

the high skills of the Cromagnon people, but commanded sufficient store of their own technological innovations.

The different nature of the phenomenon of the Aurignacian as compared to the "transitional" post-Levallois assemblages rests in the total absence of technological and morphological continuation between the Middle Palaeolithic and the Aurignacian in the entire territory of Europe. The earliest Aurignacian assemblages that occur in the Balkan-Danubian zone described as the Pre-Aurignacian are dated at 45–38 Kyr B.P. (Kozlowski, Otte 2000). In the western Mediterranean zone such assemblages are described as the Proto-Aurignacian and are dated to 40–35 Kyr B.P. Both the former and the latter show a complete hiatus in relation to the Mousterian and the Micoquian, and in relation to "transitional" units. The pattern of distribution of the Aurignacian in Europe suggests diffusion from the Balkans along two routes: the Balkan-Danubian and the Mediterranean – just like the diffusion of the First Neolithic. The blade technology of the Aurignacian was, from the very beginning, based on the volumetric core with a central crest used for the production of large blades, and on carenoidal microlithic cores used for the manufacture of bladelets. The whole Aurignacian tool-kit exhibits Upper Palaeolithic features (including microlithic inserts) and a lack of Mousterian type tools. Indeed, it is significant that flake tools are more numerous in the later phases of the Aurignacian. The Aurignacian was the only industry that mastered a highly advanced technique of bone working for the production of points which evolved in the same way in the entire territory of the distribution of the Aurignacian. These were, at first, split-base points later Mladec type points, and finally conical points. We should remember, moreover, that it is only in the Aurignacian that we can see incipients of sculpture and figural painting.

In contrast to the blade industries with Levallois tradition that began to decline about 38–35 Kyr (their only continuation might be the Ahmarian in the Near East) the Aurignacian solely lasted until the middle phase of the Upper Palaeolithic. This fact emphasizes even more strongly the association of the Aurignacian and the first anatomically and behaviorally Modern Humans. We should stress, however, that also one of the groups with "transitional" industry persisted until the middle phase of the Upper Palaeolithic, namely: a group with leaf points (Szeletian, Jerzmanowician, also the late phase of the Streletskian-Sungirian – Kozlowski 2000). The whole situation becomes puzzling when we add that it is leaf points industries precisely that gave rise – in all likelihood – to one of the most important cultura complexes of the middle phase of the Upper Palaeolithic: the Gravettian. In order to account for this phenomenon from the point of view of anthropology we would have to assume that the mixing of the Neanderthal population with Modern Humans did – after all – occur in the various regions of Europe, especially in central Europe where the beginnings of the Gravettian were created. Consequently, these populations would have become wholly sapiens (Zilhao 2001).

Such scenario may, possibly, be confirmed by the recent discoveries of an individual who exhibits transitional features of a Neanderthal and a *Homo sapiens*, within a Gravettian context in Portugal (Lagar Velho I) which has been dated to about 25 Kyr B.P. Although Lagar Velho is situated outside the "Ebro frontier" that is: in the regions that were probably refuge areas of Neanderthals, yet the significance of this discovery rests in that it provides an argument against the hypothesis which maintains that between the Neanderthals and Homo sapiens were no hybrids and cultural interaction.

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