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JOÃO ZILHÃO, FRANCESCO D'ERRICO, eds.

The Chronology of the Aurignacian and of the Transitional Technocomplexes

Dating, Stratigraphies, Cultural Implications

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The early Upper Paleolithic occupations of Willendorf II (Lower Austria): a contribution to the chronostratigraphic and cultural context of the beginning of the Upper Paleolithic in Central Europe

■ PAUL HAESAERTS ■ NICOLAS TEYSSANDIER

ABSTRACT Willendorf II is one of the rare sites to offer a good chronostratigraphic framework for the period between 45 000 and 25 000 BP in Central Europe. Located in the Wachau on a lower terrace of the Danube, it has yielded nine archeological layers classically ascribed to the early Upper Paleolithic, the Aurignacian and the Gravettian.

This paper deals with the chronostratigraphic and cultural background of the lowest layers 1-4 of the Willendorf sequence. With good ^{14}C dating and chronostratigraphic observations, it is now possible to better document this key-period for the understanding of the appearance of Upper Paleolithic industries in Central Europe.

Introduction

Willendorf II belongs to a set of Upper Paleolithic sites occurring on the western bank of the Danube along the Wachau, some 70 km to the west of Vienna (Fig. 1). Known for its complex archeological succession, the Willendorf II site was excavated from 1908 to 1927 by the Museum of Natural Sciences of Vienna (Bayer, 1930) and in 1955 by the University of Vienna (Felgenhauer, 1956-1959). These excavations have revealed the existence of at least nine distinct Paleolithic layers in the upper

half of a loamy cover about 20 m thick (units B to G) preserved on top of a lower terrace of the Danube (Brandtner, 1956-1959). Cultural layers 9 to 5 were ascribed to the Gravettian and layers 4 and 3 to the Aurignacian, while layers 2 and 1, although poorly documented, were referred to an archaic Upper Paleolithic (Felgenhauer, 1956-1959; Otte, 1981; Hahn, 1977; Kozłowski, 1986).



FIG. 1— Location of sites mentioned in the text.
1. Willendorf and Schwallenbach; 2. Stratzing;
3. Alberndorf; 4. Dolni Vestonice, Pavlov and
Milovice; 5. Bohunice and Stranska Skala.

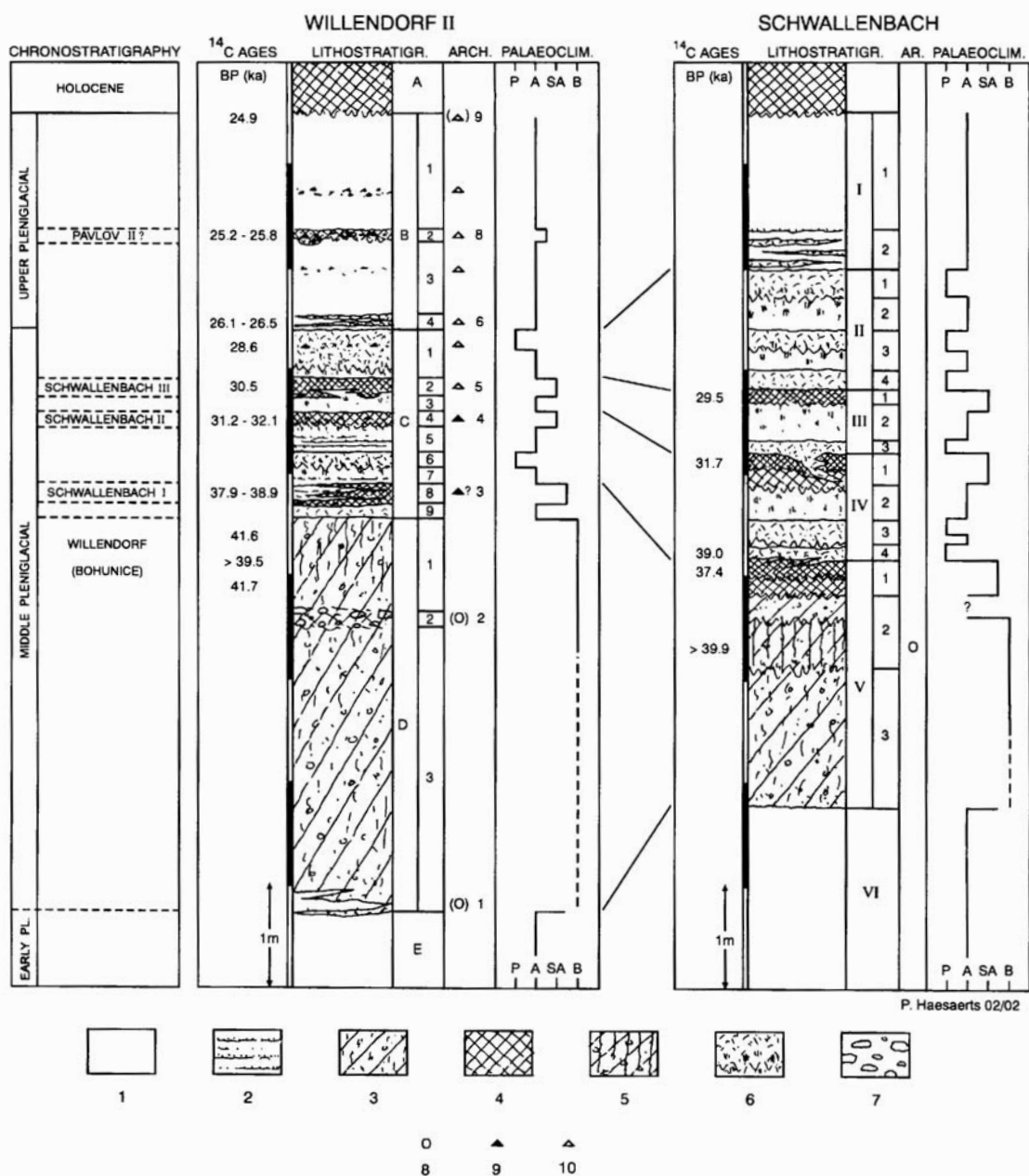


FIG. 2 – Willendorf II and Schwallenbach: comparative sequences. Graphic symbols: 1. loess; 2. sandy loess; 3. loam; 4. humiferous horizon; 5. B horizon; 6. bleached horizon (tundra gley); 7. stones; 8. early Upper Paleolithic; 9. Aurignacian; 10. Gravettian. Abbreviations for paleoenvironments: P. arctic, with deep frost or active permafrost; A. arctic; SA. subarctic; B. boreal.

Until quite recently, only sparse stratigraphic and chronological information was available for this remarkable geoarcheological succession. Some complementary data were first obtained in 1981 when a small profile was cut through units B, C and D in the western wall of the old excavation field and sampled for ^{14}C dating by one of us (Haesaerts, 1990a). Dated between 41 700 and 25 800 BP, the geoarcheological succession recorded in units D, C and B was thus assigned to the middle pleniglacial and the beginning of the late pleniglacial. Yet, the available dates provided only little information about the chronology of the main cultural layers.

The stratigraphic studies at Willendorf II were reactivated once again in 1993 by a joint team of the Royal Belgian Institute of Natural Sciences and of the University of Vienna, through the cleaning of a 5.5 m high and 3 m wide section at the same place as the 1981 profile, precisely at the limit between the 1908-1911 excavation and the northern area worked-out by F. Felgenhauer in 1955. Besides the stratigraphic reading, exhaustive samples were collected for various complementary analyses: paleopedology, malacology, paleobotany, ^{14}C and TL dating (Damblon et al., 1996; Frank and Rabeder, 1994; Haesaerts et al., 1996; Zöller, 2000).

Following the 1981 and 1993 campaigns, most of the data previously gained at Willendorf II could be integrated into a well documented geoarcheological and paleoclimatic sequence encompassing at least four interstadial episodes. The chronology of the system could be fixed by a set of thirty-six ^{14}C dates ranging from 41 700 to 22 180 BP, among which twenty-six were produced in Groningen on high quality material from the 1993 profile (Damblon et al., 1996; Haesaerts et al., 1996). Special attention was also paid to the positioning of cultural layers 1 to 9 within the 1993 stratigraphic succession, using 1908-1927 and 1955 field records (Haesaerts et al., 1996, p. 30). Further, complementary data were gained in 1995 at Schwallenbach, located about 1 km to the north, where a 40 m long section did show a loess-paleosol succession similar to Willendorf II (Fig. 2), hence demonstrating the regional significance of this record for the middle pleniglacial in Central Europe.

The geoarcheological succession

The stratigraphic system established for Willendorf II by F. Brandtner (1956-1959) encompasses six loessic and loamy bodies lying on top of a low terrace of the Danube. The lower half of this succession consists of two generations of pale yellowish loess (units G and E) separated by a reddish brown partly reworked paleosol (unit F). At the excavation field, only the upper half of the sequence corresponding to units D, C and B could be recognized, following up the loess of unit E which represents the early pleniglacial (Haesaerts, 1990a).

Unit D

This unit consists of a 3.5 m thick stony heterogeneous brown loam, characterized in its upper part (subunit D1) by a distinct polyhedral pedality, abundant biogalleries filled with carbonates and rather numerous scattered fragments of conifer charcoal. The latter was dated between 41 700 and 39 500 BP, the oldest age being the most probable as present day rootlets were observed. The abundant molluscs preserved in subunit D1 are indicative of a rather mild climatic environment with some wooded parcels near the site (Frank and Rabeder, 1994), while pedosedimentary characteristics evoke a rather humid climate with drier conditions at the end. This well expressed climatic episode probably centered around 41 500 BP, also recorded in a similar position at Schwallenbach, was named the Willendorf Interstadial (Haesaerts et al., 1996).

According to Bayer's field notes, cultural layer 2, which was not encountered in the 1981-1993 profile, could be situated just below the subunit D1 loamy deposits corresponding to the Willendorf Interstadial, while cultural layer 1, located at the base of subunit D3 (Felgenhauer, 1956-1959), should fit somewhere at the early to middle pleniglacial transition.

Unit C

This unit is about 2 m thick and comprises a complex set of stratified yellowish grey sandy loess (subunits C1 *pro parte*, C3, C5, C7 and C9), of bleached horizons (subunits C3, C5 and C7) and of three humiferous horizons (subunits C1 *pro parte* and C6) containing scattered artifacts and charcoal concentrations in variable proportions. The upper humiferous horizon (subunit C2) is best expressed and occurs as a decimetric dark brown layer slightly stretched by solifluction. The second horizon (subunit C4) is less developed but almost *in situ*, in contrast with the third horizon (subunit C8), which occurs as brownish grey lenses entirely stretched by solifluction and contains ash stripes with high concentration of charcoal in the left corner of the 1981-1993 profile.

One of the major issues consists of positioning within the 1993 stratigraphic succession the different cultural layers recovered during previous excavations (based on 1908-1927 and 1955 field records — Bayer, 1930; Felgenhauer, 1956-1959). The good concordance between these three sets of data was discussed with F. Felgenhauer in November 1996 and is illustrated by the distribution of the cultural layers with regard to the 1993 profile (Fig. 3) as restored using the planimetric records drawn by J. Bayer (Felgenhauer, 1956-1959, Figs. 73-81). Cultural layers 3, 4 and 5 ascribed by J. Bayer to distinct dark colored horizons (*dunkel-gelbbraunlichem Lösslehm*, cf. Felgenhauer, 1956-1959, p. 90), thus fit with the three humiferous horizons of the 1993 profile (subunits C8, C4 and C2). This correlation is also supported by two pictures taken in 1955 at the southern edge of the excavation (Felgenhauer, 1956-1959, Figs. 83-84), showing the position of cultural layers 3, 4 and 5 in a stratigraphic succession almost identical to that in the 1993 profile.

Concerning the chronology of the system, three dates were produced in Groningen on charcoal from the ashy stripes of subunit C8, which are in lateral continuity with remnants of a fireplace within cultural layer 3 encountered by J. Bayer in the NW corner of the 1908-1911 area (Fig. 3), only partly excavated at that time (Felgenhauer, 1956-1959, fig. 75). Two high quality samples collected in 1993 were respectively dated to 38 880±1500/-1200 BP (GrN-17805 on 3.53 g of charcoal) and 37 930±750 BP (GrA-896, on 0.32 g of charcoal). These dates are definitely older than the date 34 100±1200/-1000 (GrN-11192) on charcoal collected in 1981 from the same ashy stripes, which can be due to the fact that this sample was at the minimal weight and was not submitted to the kind of optimal treatment applied to the 1993 samples (Damblon et al., 1996). The time span 39 000-38 000 BP is thus the most reliable for subunit C8 as well as for cultural layer 3.

On the other hand, the dates previously obtained on charcoal from the humiferous horizons making up subunits C4 (cultural layer 4) and C2 (cultural layer 5) remain valid (Haesaerts, 1990a; Haesaerts et al., 1996). The age of these horizons is estimated at, respectively, ca. 32 000 BP and ca. 30 500 BP (Fig. 2). The chronological succession of unit C is completed by the 28 560±520 BP (GrN-17804) result on charcoal preserved, with a few artifacts, in the sandy loess on top of which developed the thick tundra gley of subunit C1.

Altogether, unit C encompasses the upper part of the middle pleniglacial (between ca. 39 000 and ca. 26 000 BP) and records a complex succession of climatic episodes. Sandy loess layers (subunits C9, C7, C5, C3 and C1 *pro parte*) represent cold episodes, while bleached horizons (subunits C6 and C1 *pro parte*) show characteristics of tundra gley indicating deep frost or permafrost conditions (Van Vliet-Lanoë, 1976; Haesaerts and Van Vliet-Lanoë, 1981). The second tundra gley (subunit C1 *pro parte*) is most developed and occurs as a marker at the boundary between the middle and the late pleniglacial (Haesaerts, 1990b).

Moreover, the three humiferous horizons (subunits C8, C4 and C2) as well as cultural layers 3, 4 and 5 are related to interstadial episodes, such an interpretation being in good agreement with the pedological characteristics and the malacological content (Frank and Rabeder, 1994). Taking into consideration the neighbouring section of Schwallenbach, where three well developed humiferous soils are preserved *in situ* in a similar stratigraphic and chronological background (Fig. 2), these three interstadial episodes were named Schwallenbach I (between 39 000 and 37 400 BP), Schwallenbach II (around 32 000 BP) and Schwallenbach III (around 30 500 BP).

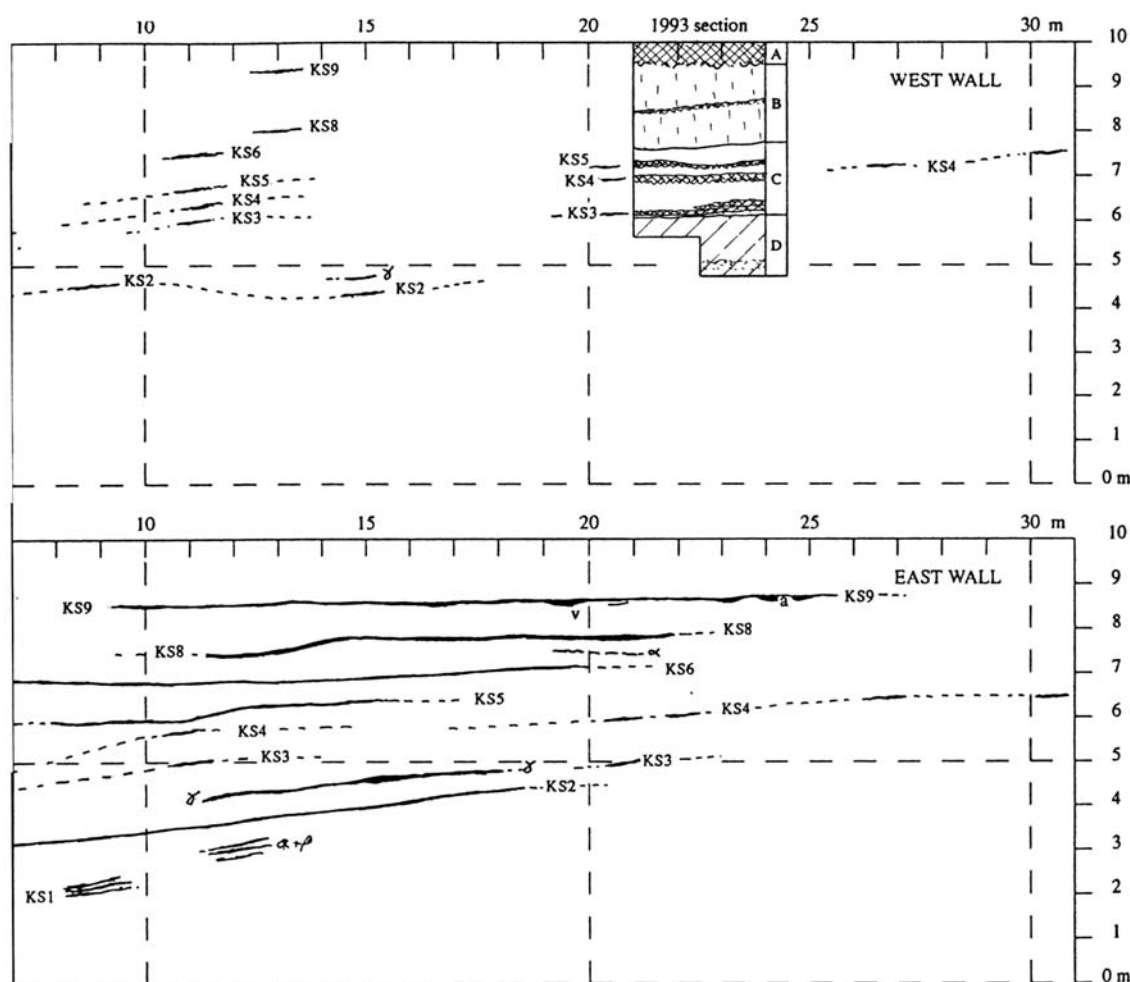


FIG. 3 – Willendorf II. Distribution of the cultural layers as recorded by Bayer on the wall of the railway trench (east wall) and on the west wall of the excavation field, with regard to the 1993 profile.

Unit B

The upper part of the geoarcheological succession at Willendorf II (cultural layers 6 to 9) belongs to the late pleniglacial loess cover (unit B), which shows evidence of a progressive trend towards a cold and dry climate (Frank and Rabeder, 1994). This loess caps the thick tundra gley C1 posterior to 28 560 BP, overlain by Gravettian layer 6, reworked by solifluction and dated to 26 500 and 26 100 BP. On the other hand, Gravettian layer 8,

which occurs in the middle part of unit B in association with an incipient humiferous horizon (subunit B2), provided consistent ages between 25 800 and 25 230 BP. Gravettian layer 9, which could no longer be observed *in situ*, was dated to 24 900 BP on high quality bone material from the 1927 excavation preserved in the Museum of Natural Sciences in Vienna (Haesaerts et al., 1996).

Regional background

The specificity of the geoarcheological record of Willendorf II rests on the conjunction of the following aspects: 1) a long loess-paleosol record covering almost 20 000 years (between ca. 45 000 and ca. 25 000 BP) and with rather high paleoclimatic resolution; 2) a remarkable succession of nine cultural layers encompassing early Upper Paleolithic, Auri-gnacian and several stages of Gravettian; 3) a strong chronological framework resting on a set of thirty-six ¹⁴C dates, most of them on high quality charcoal; 4) the opportunity it offers to control the reproducibility of the record thanks to the nearby section of Schwallenbach. These four aspects securely support the validity of the Willendorf II succession as a reference for the middle pleniglacial in Central European regions west of the Carpathians, allowing the integration of some other sequences from Lower Austria and Moravia (Fig. 4).

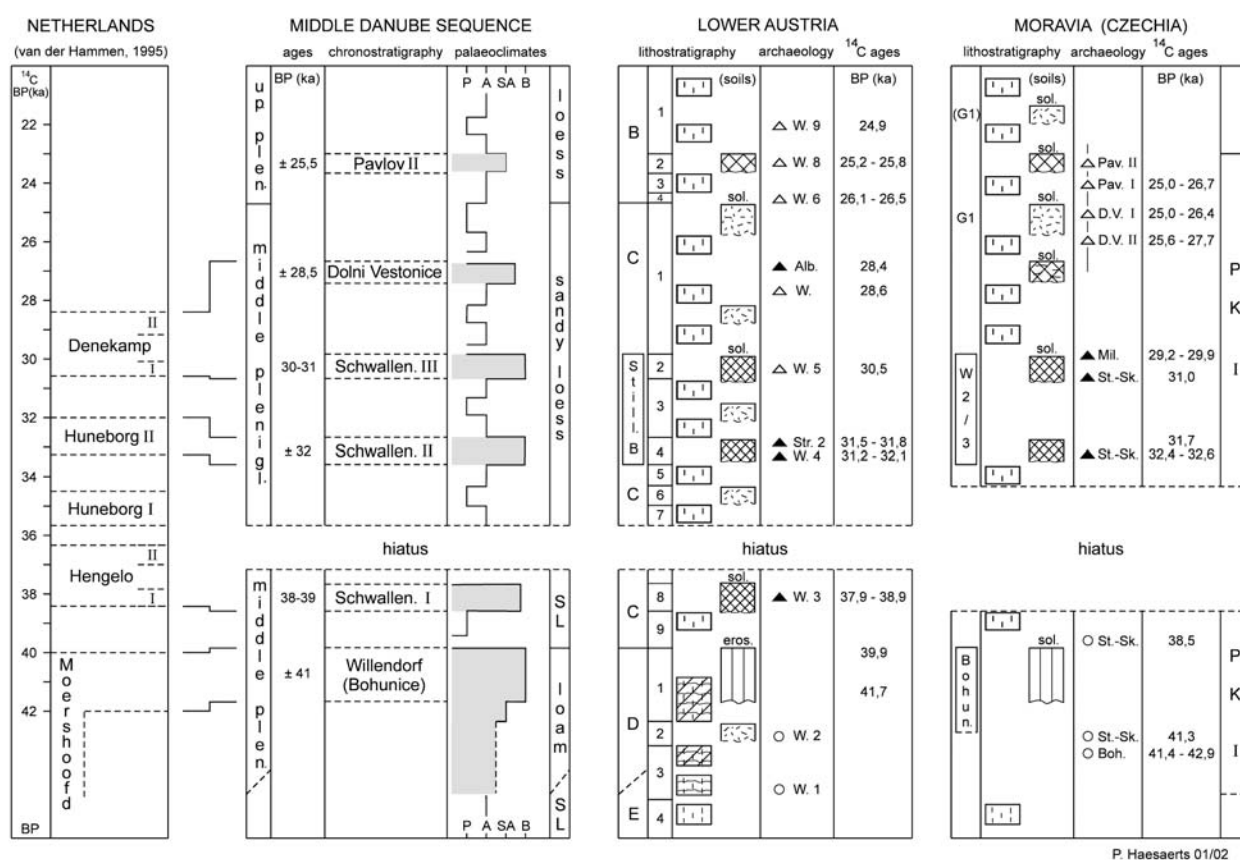


FIG. 4 – Paleolithic assemblages and sites of Lower Austria and Moravia with regard to the regional chronostratigraphy (middle pleniglacial and lower part of late pleniglacial) (graphic symbols as in Fig. 2). Abbreviations for paleoclimates: P. arctic, with deep frost or active permafrost; A. arctic; SA. subarctic; B. boreal. Abbreviations for lithology and soils: SL. sandy loess; Still. B. Stillfried B soil; Bohunice soil; sol. solifluction; eros. erosion. Abbreviations for Paleolithic sites: W. Willendorf II; Alb. Alberndorf (Bachner et al., 1996); Str. Stratzing (Neugebauer-Maresch, 1996); Pav. Pavlov (Klima, 1976; Svoboda et al., 1994); D.V. Dolni Vestonice (Klima, 1963, 1995; Oliva, 2000); Mil. Milovice (Oliva, 1988); St.-Sk. Stranska Skala (Svoboda et al., 1994); Boh. Bohunice (Valoch, 1976).

The brown soil developed on top of unit D during the Willendorf Interstadial shows close similarities with the Bohunice soil, also dated to between 43 000 and 38 500 BP in the Brno area (Valoch, 1976; Haesaerts, 1990b; Svoboda et al., 1994). On the other hand, the interstadial soil W2/3 at Dolni Vestonice as well as the so-called Stillfried B soil at Stranska Skala, which range from ca. 32 600 to ca. 30 000 BP (Klima, 1995; Svoboda et al., 1994; Damblon et al., 1996), fit well with the two interstadials of Schwallenbach II and Schwallenbach III. Concerning the end of the middle pleniglacial and its transition to late pleniglacial, this period is best recorded at Dolni Vestonice and at Pavlov, where loamy and loessic slope deposits disturbed by solifluction are preserved between the W2/3 soil and the thick tundra gley G1 (Klima, 1995), which is probably an equivalent of the tundra gley C1 at Willendorf. At Dolni Vestonice and at Pavlov, the main phase of Gravettian settlement occurred between ca. 27 000 and 25 500 BP (Damblon et al., 1996; Oliva, 2000), after the development of a humiferous horizon corresponding to the Dolni Vestonice interstadial dated around 28 600 BP (Svobodova and Svoboda, 1988; Klima, 1995). In this system, the Gravettian occupation of Pavlov II, preserved in a weak humiferous soil between G1 and the upper loess cover (Klima, 1976), could correspond to Willendorf's cultural layer 8, also related to a short episode of surface stabilization around 25 500 BP.

As a conclusion, the Willendorf II and Schwallenbach successions form the core of the reference sequence for the middle pleniglacial in Central Europe to the west of the Carpathians, enabling the positioning of the main early Upper Paleolithic assemblages and sites of this area within a well documented paleoclimatic record with strong chronological basis for the 45 000 to 25 000 BP timespan (Fig. 4). However, the distribution of such assemblages within this long period of time is somewhat skewed due to the limited number of sites, as only those with a stratigraphic background were taken into account. Furthermore, considering the signature of the paleoclimatic sequence, the comparison of this record with the high-resolution middle pleniglacial climatic data, well dated by ¹⁴C on peat in the Netherlands (van der Hammen, 1995), is interesting. Indeed, both records show close similarities regarding the succession through time of the main interstadial episodes (Fig. 4). Moreover, such a comparative approach points to the presence of a hiatus of several millennia in the Central European sequence between the Schwallenbach I and Schwallenbach II interstadials, hiatus which should correspond to the Hengelo II and Huneborg I climatic episodes dated between 37 000 and 34 000 BP in the Dutch sequence.

Lithic production in cultural layers 1 to 4: a typo-technological study

The lowest cultural layers 1 to 4 of the Willendorf II sequence are of critical importance in the debate concerning the appearance of Upper Paleolithic industries in Central Europe. They have already been studied from a typological viewpoint, first by F. Felgenhauer in the 50's (Felgenhauer, 1956-1959), then by A. Broglio and G. Laplace in the 60's (Broglio and Laplace, 1966), and last by J. Hahn in the 70's (Hahn, 1977). New stratigraphic and chronological results obtained within the framework of an international cooperation have helped to define a more precise chronostratigraphic sequence (Haesaerts, 1990a; Damblon et al., 1996; Haesaerts et al., 1996). For the first time, it is possible to correlate archeological data with chronostratigraphic aspects. It is now necessary to supplement the past studies with a new methodological perspective for documenting typological and technological patterns in cultural layers 1 to 4.

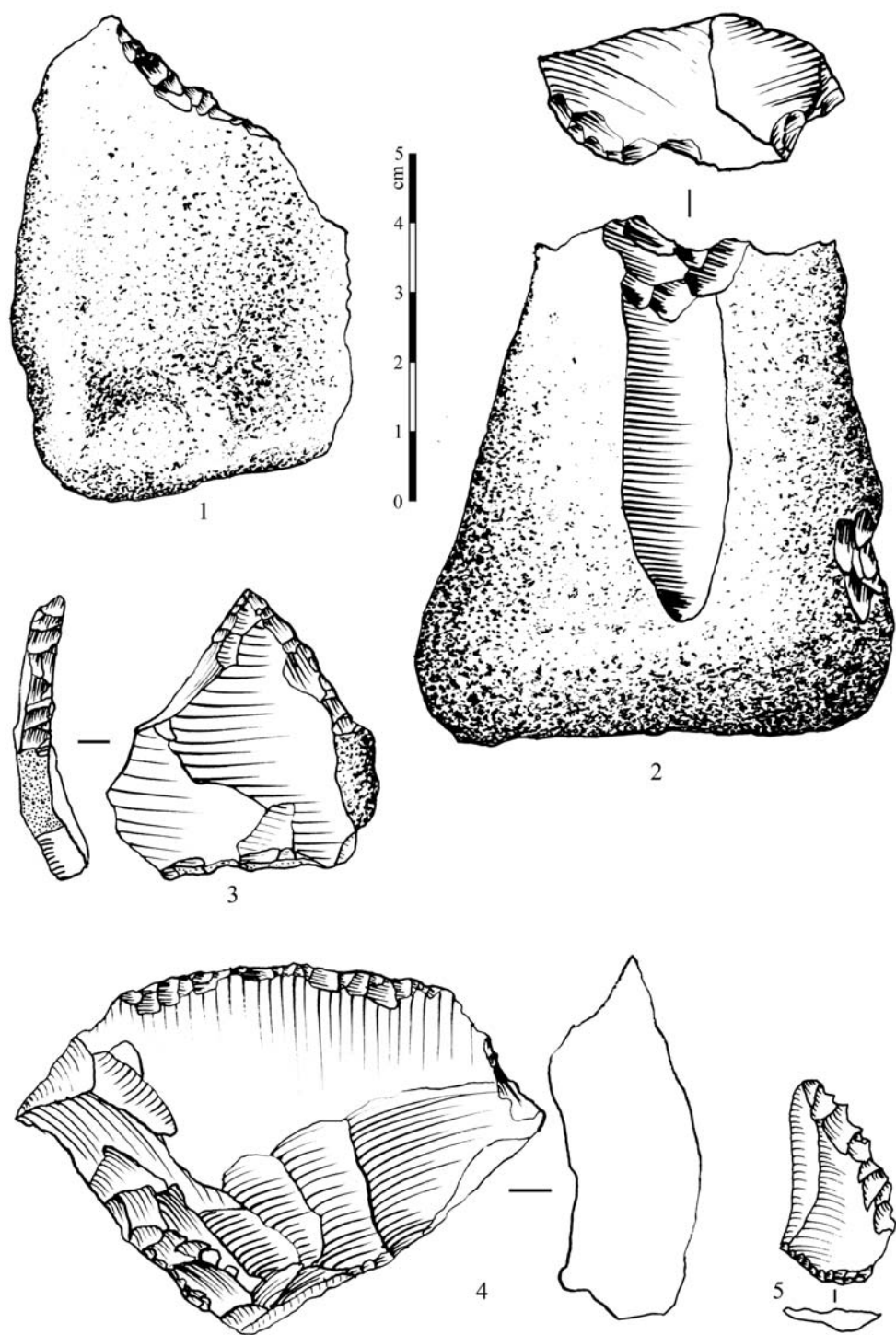


FIG. 5 – Willendorf II, layers 1 (1-2) and 2 (3-5). 1. retouched flake; 2. core; 3. bec; 4. sidescraper; 5. denticulate (drawings by N. Teyssandier).

It should first be noted that these four cultural layers represent disparate assemblages of unequal value. Layers 1 to 3 are very poor and only contain about forty artifacts. Their interpretation is all the more difficult because the quantitative and qualitative value of the assemblages changes from one layer to another. In fact, layer 4 is the only one to offer a rich and diversified assemblage containing more than 100 tools in association with numerous debitage products.

Cultural layer 1

Layer 1 contains only three artifacts (Fig. 5, no. 1-2), all undiagnostic. Their characters did not allow us to specify a chrono-cultural attribution, as already mentioned by J. Hahn (1977, 1993) for instance.

Cultural layer 2

This layer yielded a slightly more important assemblage, which, nevertheless, is insufficient for a real typo-technological characterization (Table 1). The Vienna collections contain 41 pieces corresponding to 32 tools, 7 unretouched blades and 2 cores. Blade debitage seems to be exclusive and there is no clear evidence of a specific flake production. However, the small size of this assemblage should be kept in mind as it could bias some of the results.

TABLE 1
Willendorf II, layer 2: typological list in relation to the type of blanks.

Tool-type	Blank				Total
	Blade	Blade-like flake	Flake	Debris	
Single end-scraper	4	1			5
Retouched blade – one edge	3				3
Retouched blade – two edges	1				1
Denticulate			2		2
Notch			3	1	4
Bec			1		1
Truncated piece			1		1
Sidescraper			2		2
Retouched flake		3	10		13
Total	8	4	19	1	32

Flakes are preferentially used for the manufacture of a diversified tool-kit dominated by retouched flakes, which are generally heterogeneous and only partially retouched. The assemblage also includes a small proportion of notches, denticulates (Fig 5, no. 5) and scrapers (Fig. 5, no. 4), as well as one bec (Fig. 5, no. 3) and one truncated piece, both on flakes. Blade tools are not so numerous; they are represented by five endscrapers (Fig. 6, no. 1-4) — more often than not on cortical blades — and four retouched blades (Fig. 6, no. 5-6). Among the retouched blades, a more elongated and regular specimen (Fig. 6, no. 5) indicates that it has been detached with a soft organic hammer. This is testified to by the carefully abraded unfaceted butt and the particularly well developed lip.

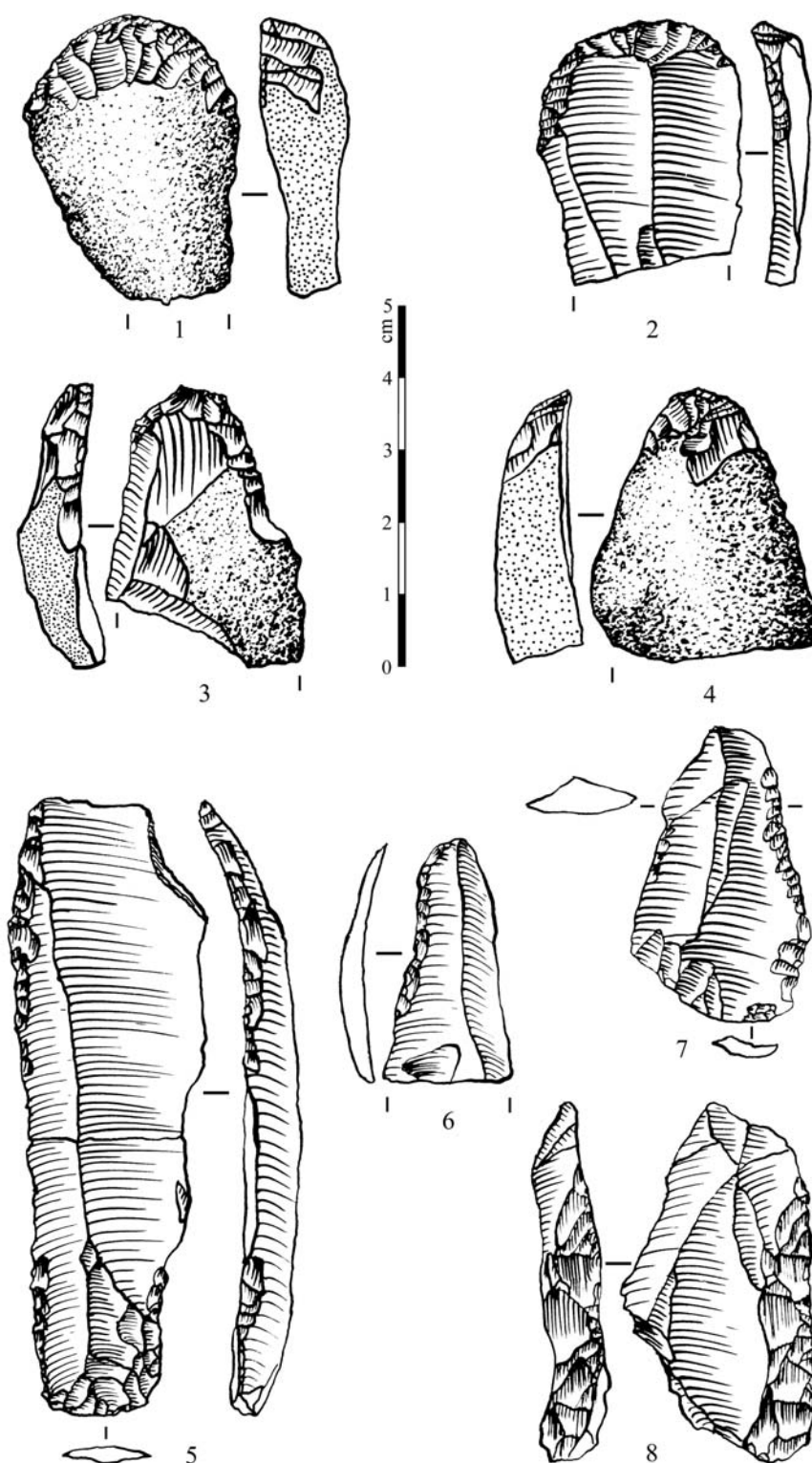


FIG. 6 – Willendorf II, layer 2. 1-4. single endscrapers; 5-6. retouched blades; 7-8. retouched flakes (drawings by N. Teyssandier).

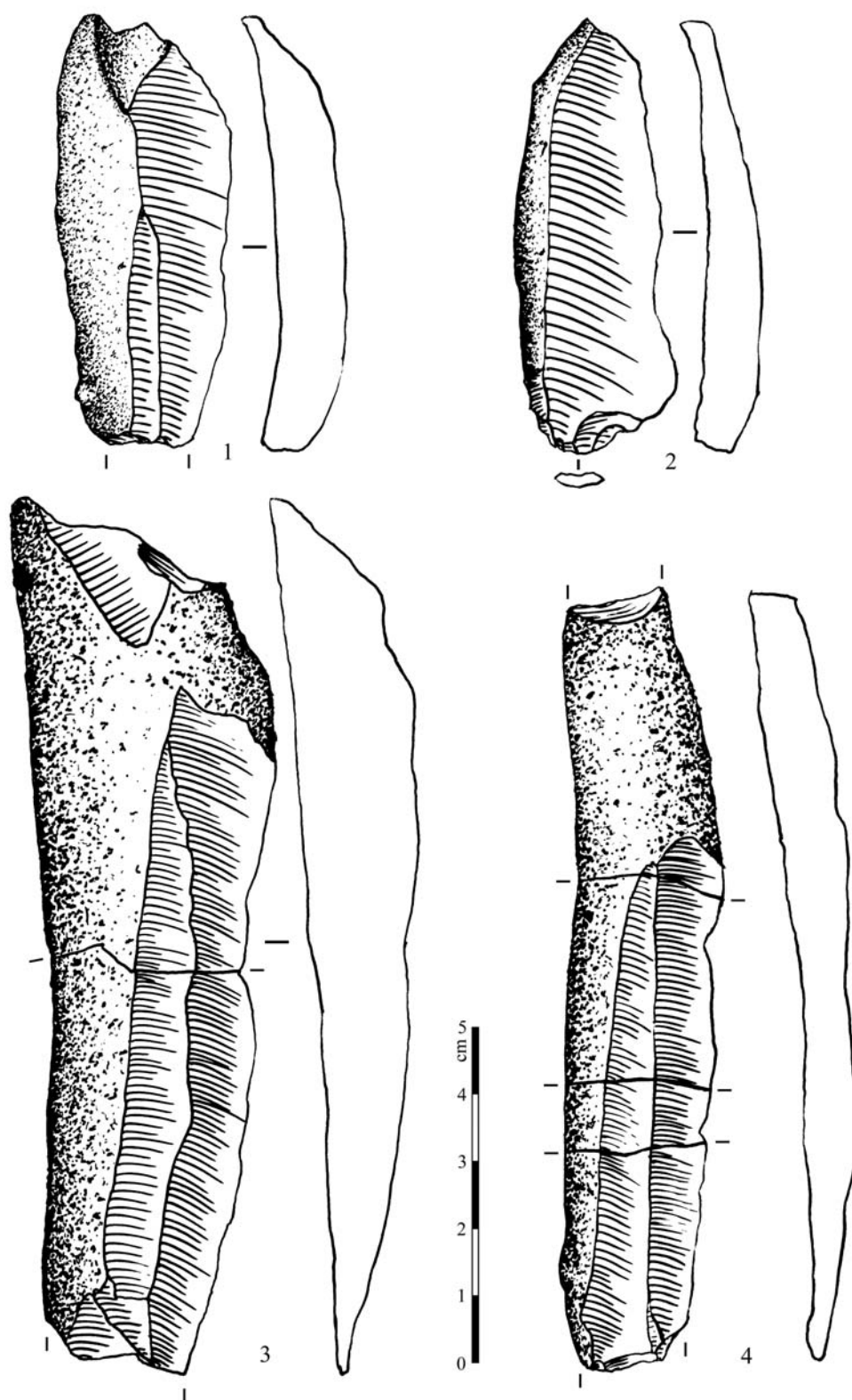


FIG. 7— Willendorf II, layers 2 (1-2) and 3 (3-4). Cortical blades (blades 1-2 and 3-4 are conjoining) (drawings by N. Teyssandier).

Debitage products corroborate the use of a soft organic hammer for detachment. A refitting of two blades, one cortical and the other semi-cortical with an abrupt cortical versant, illustrates the initial sequence of blade production (Fig. 7, no. 1-2).

Finally, it is difficult to propose a clear chrono-cultural attribution for layer 2 of Willendorf II. Only non-diagnostic tools are found in this assemblage; typical Aurignacian or transitional forms, for example, are lacking. It is thus very difficult to confirm the attribution to the Aurignacian proposed by A. Broglio and G. Laplace (1966), or the attribution to the Bachokirian proposed by J.K. Kozłowski and M. Otte (2000). We prefer to use the term early Upper Paleolithic to qualify this assemblage.

Cultural layer 3

The lithic assemblage of layer 3 is numerically equivalent to that of layer 2. It consists of 38 pieces represented by 22 tools, 10 unretouched flakes, 5 unretouched blades and one core (Table 2). The representation of the different tool-types, however, changes. More tools are made on blades, endscrapers are more numerous, and their forms are more diversified; thick endscrapers, in particular, appear for the first time (Fig. 8, no. 1-5). These consist mainly of carinated and nosed forms, which differ from classic endscrapers by the use of thicker blanks and by technically more complex processes of preparation and maintenance. They also show clear bladelet scars, another distinctive feature that sets them apart from single endscrapers.

TABLE 2

Willendorf II, layer 3: typological list in relation to the type of blanks.

Tool-type	Blank			Total
	Blade	Blade-like flake	Flake	
Single end scraper	2	2	1	5
Carinated end scraper		2		2
Atypical carinated endscraper			1	1
Thick nosed endscraper	2		3	5
Retouched blade - two edges	3			3
Blade with some retouches	2			2
Burin on retouched truncation	1			1
Bec	1			1
Truncated piece			1	1
Sidescraper			1	1
Total	11	4	7	22

While layer 2 was characterized by a clear imbalance in favor of flake tools, the tendency is different here, with a far greater use of blade blanks. New tendencies appear in Willendorf layer 3: the increase in the use of blade blanks for tool manufacture, and the appearance of thick, carinated and nosed endscrapers. Moreover, retouched blades are more diversified, and the presence of two regular blades with continuous lateral retouch on both edges (Fig. 8, no. 6, 9) is of special interest. These specimens are very close to those usually assigned to the Aurignacian elsewhere.

It is nevertheless difficult to interpret these data unambiguously in a more general perspective. What importance should be attached to the appearance of carinated forms in Wil-

lendorf II? As previously mentioned, layer 3 is well dated between 38 880 and 37 930 BP (e.g. Haesaerts et al., 1996). These dates are uncontroversial, since they were obtained on the same charcoal concentration well identified both in the old excavations (Bayer and Obermaier's) and in the 1993 profile cleaning (Fig. 3). Therefore, the chrono-cultural attribution of Willendorf layer 3 depends on the significance attached to the carinated pieces: do they clearly represent Aurignacian diagnostics (*"fossile directeur"*), or should they be considered as unspecific items that can also occur in transitional industries, as some authors have suggested (Zilhão and d'Errico, 1999)?

Until now, layer 3 has always been interpreted as Aurignacian (eg. F. Felgenhauer, 1956-1959; A. Broglio and G. Laplace, 1966; and J. Hahn, 1977, 1993). More recently,

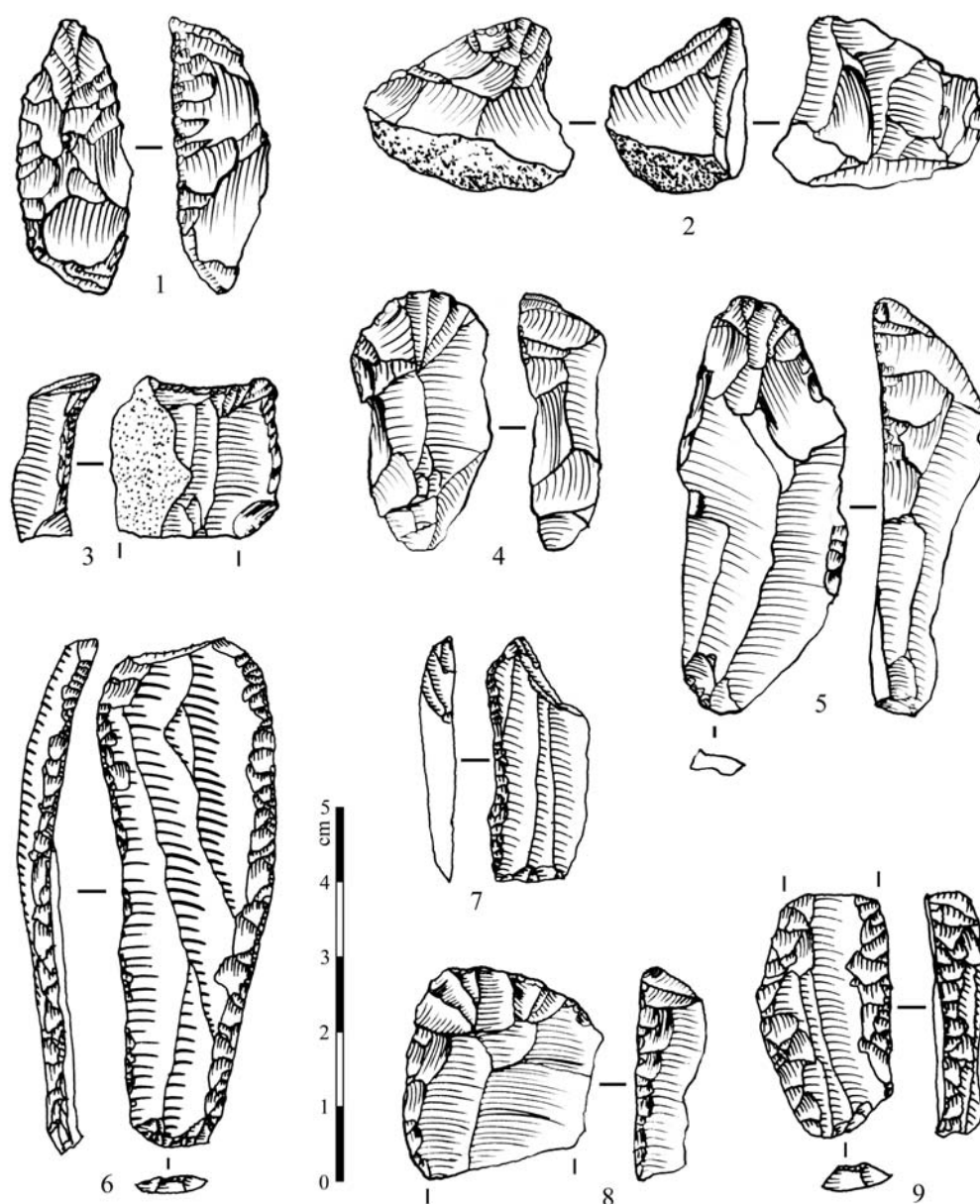


FIG. 8 – Willendorf II, layer 3. 1-3: nosed endscrapers; 4-5: carinated endscrapers; 6, 9: retouched blades; 7: burin on retouched truncation; 8: single endscrapper (drawings by N. Teyssandier).

J. Zilhão and F. d’Errico (1999) have forcefully rejected the attribution of the lithic assemblage from this layer to the Aurignacian, given that “the only thing ‘aurignacoid’ about its lithic assemblage are the thick scrapers” (Zilhão and d’Errico, 1999, p. 39). The “aurignacoid” character of the carinated pieces discovered in layer 3 is evident to us. They present some technical particularities that are very close to what is seen in the Aurignacian technocomplex (e.g. Bon, 2000); additionally, some specimens are very similar to certain pieces from layer 4, the chrono-cultural attribution of which to the Aurignacian is unquestionable. By comparison, layer 3 can also arguably be attributed to the Aurignacian. It is nevertheless important to keep in mind the small size of this assemblage, which weakens meaningful comparison.

Cultural layer 4

Quantitatively, layer 4 is suggestive of a clear break in the Willendorf sequence. It has yielded a large lithic assemblage with >2000 artifacts and 126 tools. Importantly, bone points with massive bases are also present (Albrecht et al., 1972; Hahn, 1977). The most striking feature of this assemblage is the importance of debitage products associated with bladelet production. More than half of the assemblage can be ascribed to the production of small bladelets by the reduction of specific carinated pieces.

TABLE 3
Willendorf II, layer 4: typological list in relation to the type of blanks.

Tool-type	Blank						Total
	Blade	Blade-like	Flake	Cobble fragment	Split fragment	Indeterminate fragment	
Single endscraper	4	1	2				7
Carinated endscraper	4		18			2	24
Thick nosed endscraper	4		52	2	4	2	64
Flat nosed endscraper	1		6				7
Burin on retouched truncation	3		3				6
Dihedral burin	2						2
Angle burin on break	2						2
Multiple burin			1				1
Core-burin			1				1
Mixed burin	1						1
Endscraper-burin		1					1
Blade with abrupt retouch – one edge	1						1
Retouched blade – two edges	1						1
Retouched bladelet	1						1
Bec			1				1
Notch				1			1
Splintered piece	1						1
Sidescraper			3				3
Retouched flake		1					1
Total	25	3	87	2	4	5	126

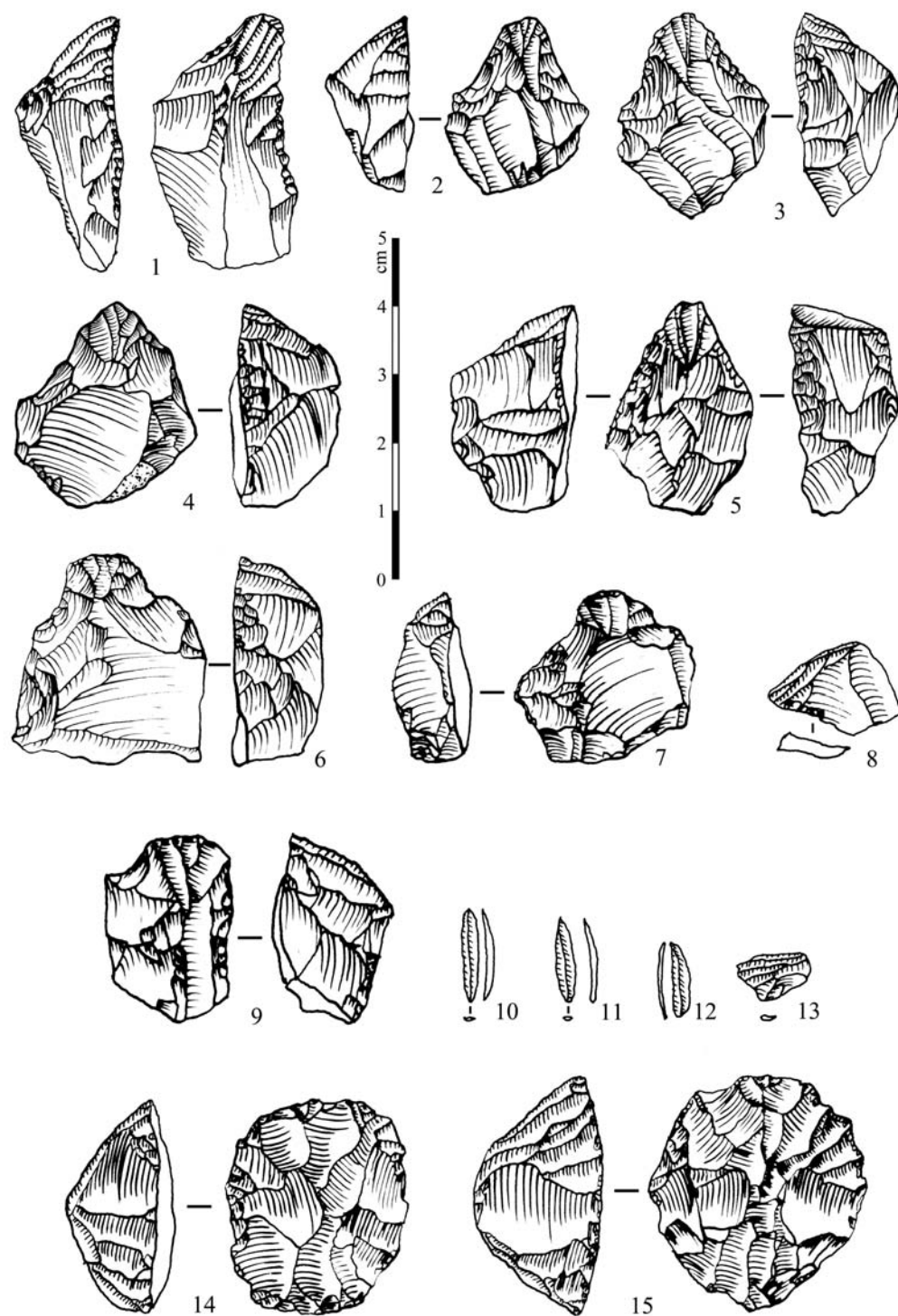


FIG. 9 – Willendorf II, layer 4. 1-7, 9. nosed endscrapers; 8, 13. rejuvenating flakes from nosed endscrapers; 10-12. bladelets from nosed endscrapers; 14-15. carinated endscrapers (drawings N. Teyssandier).

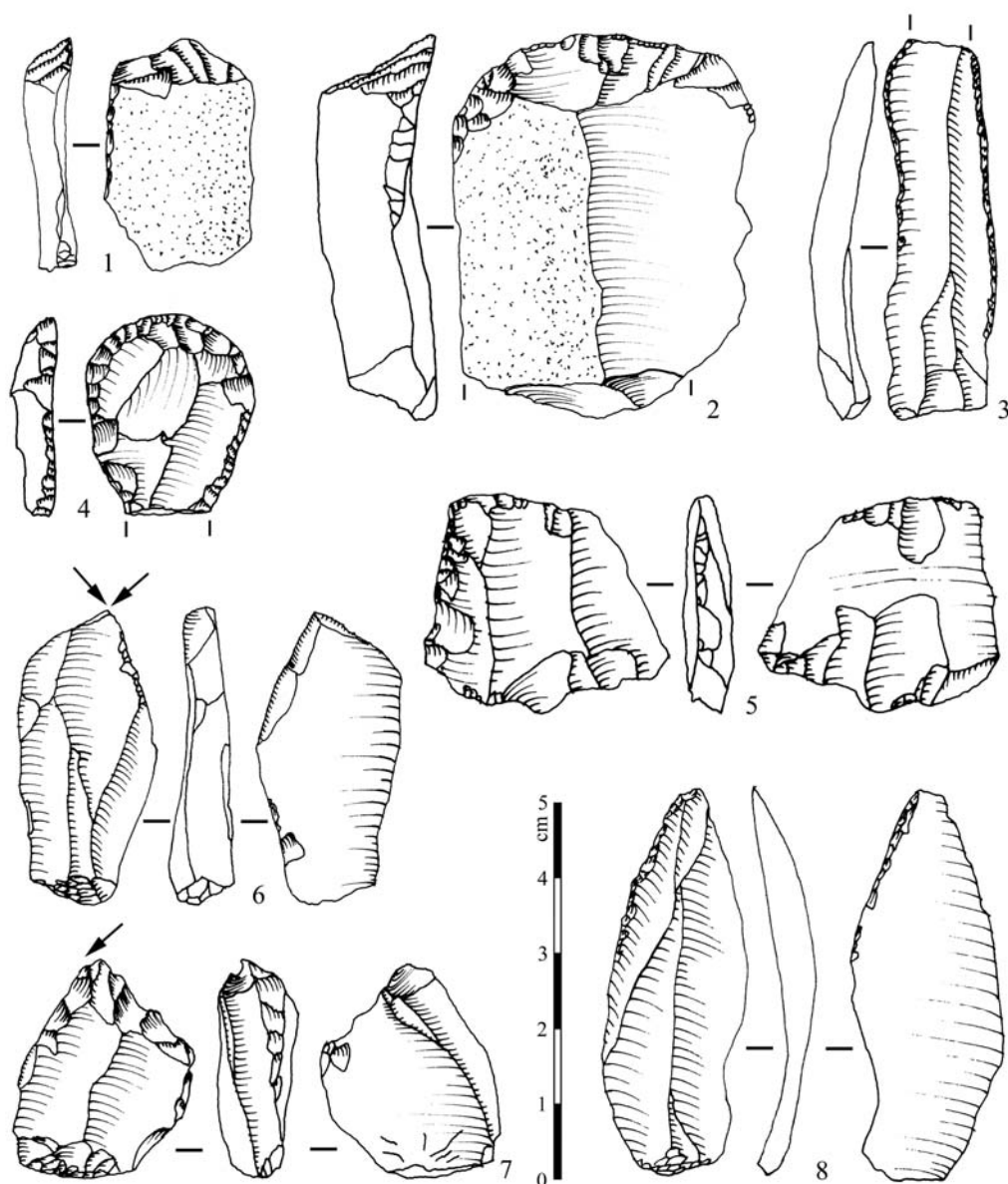


FIG. 10 – Willendorf II, layer 4. 1-2, 4: single endscrapers; 3, 8: retouched blades; 5: splintered piece; 6: dihedral burin; 7: burin on retouched truncation (drawings N. Teyssandier).

The tool-kit is largely dominated (> 70%) by thick endscrapers (nosed and carinated). The particularity of the layer 4 tool-kit lies in the paucity of other tool-types, which are each poorly represented. Burins on retouched truncation outnumber dihedral ones, and some tool-types (e.g., blade retouched on two edges, splintered piece, *bec*, notch, retouched flake) are represented by a single piece.

Nosed endscrapers are extremely numerous and represent the most typical artifact of this assemblage (Fig. 9, no. 1-13). They are generally made on small flakes of a high quality flint. More often than not, knappers selected specific blanks for their manufacture (22 to 32 mm long, 15 to 20 mm wide, and 9 to 17 mm thick, and always detached with a hard hammer) possibly obtained in the framework of a designated *chaîne opératoire*. Their morpho-technical characters and the relatively high level of standardization are, for instance, not in

keeping with a production in the framework of ordinary blade reduction sequences. They also show clear evidence of lateralization, testified to by the almost systematic position of the notching on the left side of the piece. Lastly, bladelet removals suggest that small bladelets (8 to 14 mm long and 2 to 4 mm wide) were sought; however, retouched bladelets are totally lacking in the assemblage, even if several unretouched bladelets were recovered. The technical and morphometrical evidence leads us to interpret these nosed endscrapers as bladelet cores rather than as classical tools.

Carinated endscrapers (Fig. 9, no. 14-15) are more diversified both in terms of the raw materials used and in terms of the implemented technical processes. Most of these carinated pieces seem to be related to the production of bladelets. The rest of the toolkit is not very rich and is dominated by single endscrapers (Fig. 10, no. 1-2, 4) and burins (Fig. 10, no. 6 and 7) more generally on blades. Concerning the blade debitage, it is difficult to give precise information due to the paucity of the assemblage; we can only underline that it is principally unipolar and that the use of a soft organic hammer is clearly demonstrated.

Conclusion

With a new chronostratigraphic background, the Willendorf sequence is one of the best documented for the Upper Pleistocene of Central Europe. New ^{14}C datings have now been correctly associated with the loessic sequence, and it has also been possible to correlate human occupations with major interstadial events. While Willendorf can unquestionably be used as a benchmark in a chronostratigraphic perspective, where the archeological interpretations are concerned the situation is far more complicated. The paucity of artifacts in cultural layers 1 to 3 and the specificity of layer 4, with its dominant nosed endscraper component, make comparisons extremely difficult. Given the nature of the Willendorf material, one must also proceed with great caution when interpreting some of the “trends” apparent in the lowest layers of the sequence. What importance should be attached to the high proportion of retouched flakes in layer 2? Is it really an archeological fact or is it a bias due to old excavations or functional factors? For all these reasons, we feel it would be rash to conclude that there is an evolutionary filiation between what is mainly a tool-kit dominated by flake tools in layer 2 and by blade tools in layer 3.

Finally, layer 4 is the only cultural component that can be unambiguously assigned to the Aurignacian. ^{14}C datings around 32 000 BP and typo-technical characters allow us to make a precise attribution to an evolved Aurignacian. A clear chronocultural attribution of layers 1 to 3 is far more complicated and layers 1 and 2 are too undiagnostic to be interpreted. Nothing can be said about layer 1 and its three atypical pieces, and the absence of typical tools does not allow a definite chronocultural attribution for layer 2. The carinated pieces in layer 3 may be interpreted as an Aurignacian component on the basis of the typological and technical affinities between these carinated forms and those usually related to the Aurignacian in Western Europe.

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