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The Chronology of the Aurignacian and of the Transitional Technocomplexes

Dating, Stratigraphies, Cultural Implications

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Defining the earliest Aurignacian in the Swabian Alp: the relevance of the technological study of the Geissenklösterle (Baden-Württemberg, Germany) lithic and organic productions

NICOLAS TEYSSANDIER DESPINA LIOLIOS

ABSTRACT The Geissenklösterle cave site (Baden-Württemberg, Germany) has achieved celebrity for having yielded several rich Aurignacian occupation levels, among the earliest in central Europe. Recently, the coherence of J. Hahn's archeostratigraphic subdivisions has been called into question, and doubts raised about the validity of the earliest Aurignacian assemblage (reconstructed level III). The paper presents the first results of a fresh technological approach to the lithic and organic productions of the seven Aurignacian levels. These results add support to J. Hahn's interpretations and speak in favor of the existence of a genuine Aurignacian predating the split-based points facies.

Introduction

Conceptions of the earliest Aurignacian occupations in Europe currently remain a topic of intense debate, for they are closely related to the more general issue of the first forms of social organization developed by anatomically modern humans in this part of the world. At present, the timing of the arrival of Aurignacian groups in Europe is still an unresolved issue, and conflicting models have been propounded: do the earliest occurrences of the Aurignacian date back to ca. 40 000 BP in the Balkans, in the middle Danube valley and in Spain (Kozłowski and Otte, 2000), or do they strictly postdate the so-called transitional industries and therefore only appear ca. 36 500 BP (Zilhão and d'Errico, 1999)?

Because of their early age estimates or of their stratigraphic sequences, a certain number of sites are central to the discussion. A case in point is the Achtal Geissenklösterle cave site, situated in the heart of the Swabian Alp: it is one of the major reference sequences that are considered of special significance to the understanding of the earliest Aurignacian. Ranging from the Middle Paleolithic to the Mesolithic, the stratigraphy is notable for the wealth of its Aurignacian and Gravettian occupation levels (Hahn, 1988; Scheer, 1993). During excavation by J. Hahn between 1974 and 1991, seven archeological levels were defined as Aurignacian (Fig. 1). Building from an in depth taphonomic study based on extensive refitting and the spatial distribution of conjoining pieces, J. Hahn suggested that the Aurignacian sequence consisted of two major assemblages ("reconstructed" levels II and III), and that sorting of the material by complex post-depositional processes

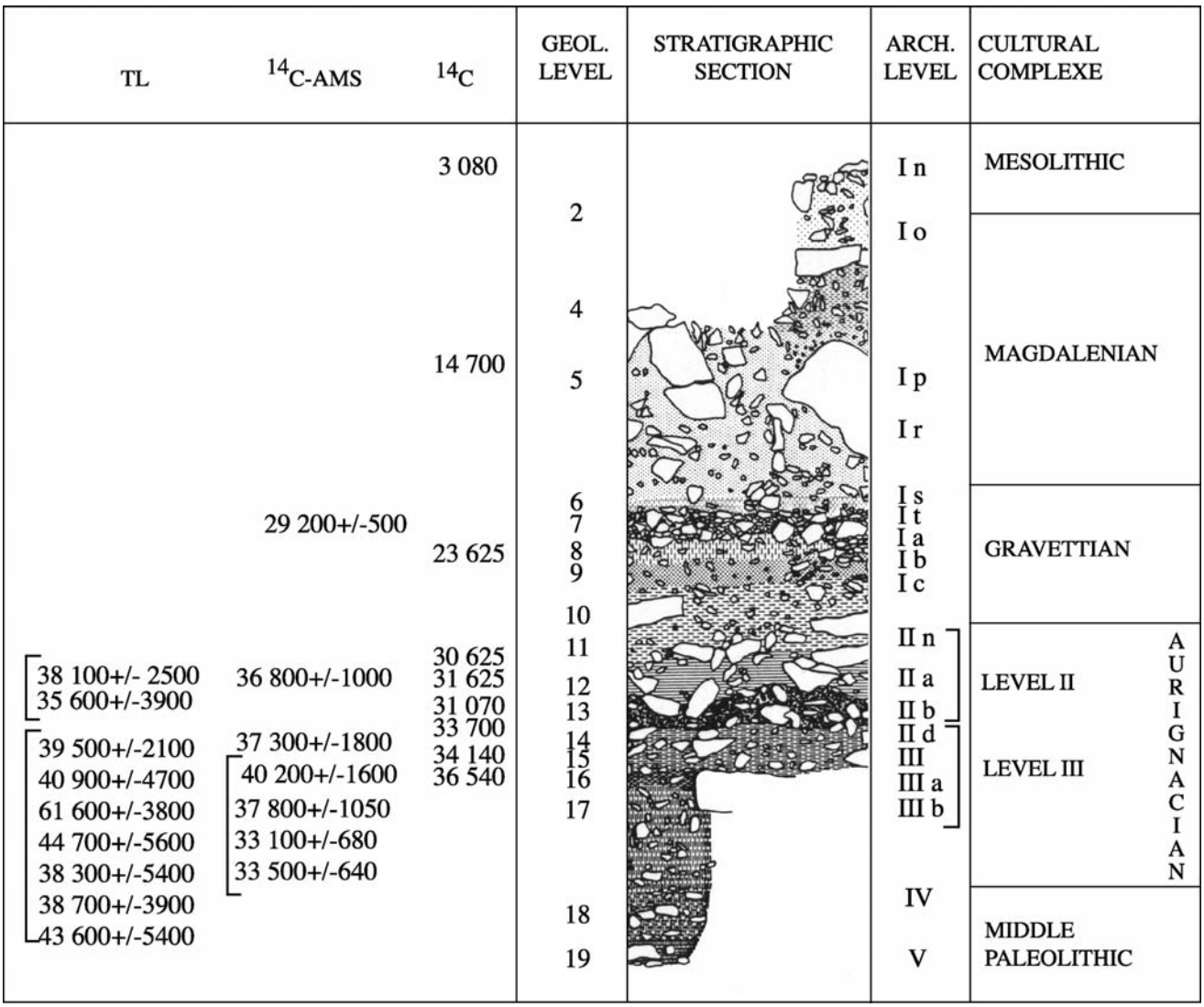

FIG. 1 – Stratigraphic profile of the Geissenklösterle cave (after Hahn, 1988, modified). AH refers to the archeological levels and GH to the geological horizons.

was responsible for the formation of the seven archeological levels identified (Hahn, 1988). According to the author, the major assemblages are organized around one main occupation level each, IIb and IIIa, respectively structured around an ash lens and a hearth. Initially, J. Hahn did not construe the differences between the two assemblages as being only chronocultural, but considered they might also be induced by economic and functional variability (Hahn, 1988). A few years later, after new AMS dating results gave an earlier age estimate for reconstructed level III, the assemblages were reinterpreted and respectively defined as a typical early Aurignacian (reconstructed level II) overlying a Proto-Aurignacian (reconstructed level III) (Hahn, 1995).

The general opinion is that the chronocultural attribution of reconstructed level II is uncontroversial. Complete with split-based points, personal ornaments and some remarkable mobiliary art, its composition is representative of the early Aurignacian (Aurignacian I) defined in southwest France. On the other hand, with its associated early age estimates, reconstructed level III has dramatically reopened the debate about the timing and nature

of the earliest Aurignacian occurrences in the middle Danube valley (Bolus and Conard, 2001; Kozłowski and Otte, 2000; Richter et al., 2000; Zilhão and d'Errico, 1999). Devoid of art objects and containing but a few personal ornaments and a scanty organic industry lacking any type fossils, its chronocultural attribution has recently been discussed by J. Zilhão and F. d'Errico: it is assessed either as a "transitional" assemblage, or as resulting from a disturbance of the overlying typical Aurignacian (Zilhão and d'Errico, 1999). The archeological definition and chronocultural attribution of reconstructed level III are therefore extremely problematic. In this context, the following technological study of the lithic and organic productions of the seven Geissenklösterle Aurignacian levels aims to cast new light on the debate.

The results obtained testify to the existence of at least two distinct Aurignacian assemblages and give currency to J. Hahn's earliest contentions. While indicating that these assemblages can indeed be identified with the Aurignacian, they also highlight important differences between their technoeconomic patterns, which cannot be imputed to post-depositional disturbance. Additional studies, such as further lithic refittings, are however required to confirm these preliminary results.

The lithic productions

Two distinct lithic assemblages

The question of a possible chronocultural difference between reconstructed levels II and III was not clearly spelled out in J. Hahn's monograph (1988). Technological data were lumped together for all levels, and while typological profiles were presented for reconstructed levels II and III respectively, the archeological levels identified during excavation were not distinguished in the process and all the lithics grouped into two assemblages. Such a presentation does not allow the exact stratigraphic position of each object to be known, and this is particularly troublesome where the more diagnostic tools, carinated and nosed endscrapers for instance, are concerned. There is therefore good cause to call into doubt the integrity of reconstructed level III and to question the origin of the supposedly related carinated/nosed pieces (Zilhão and d'Errico, 1999): do they really belong to this level or were they moved down by turbation from reconstructed level II? The point we want to make in this section of the paper is that, in spite of explicitly acknowledged disturbance, two specifically patterned assemblages can be distinguished.

There are indeed grounds for thinking that these carinated/nosed pieces belong to reconstructed level III. First and foremost, it should be clear that the tool count presented here includes absolutely all the artifacts recovered up to 1991 (Table 1), whereas in his monograph J. Hahn had taken into account only the results of excavation until 1984 (Hahn, 1988). While he counted only 16 carinated and nosed endscrapers, these now add up to 46. They are massively concentrated within reconstructed level III, and mainly so in the allegedly original occupation level IIIa (Table 1; Fig. 2). Reconstructed level II has yielded only six carinated/nosed pieces, whereas 40 were recovered from reconstructed level III, 27 of which are situated in IIIa. Insofar as they are best represented in reconstructed level III, and notably in level IIIa, which does not lie directly below reconstructed level II, it is unlikely that these items originated in the latter level: if this were the case, a higher proportion of carinated/nosed pieces might be expected in reconstructed level II as a whole, and in the upper levels of reconstructed level III (IId and III).

TABLE 1

Typological composition of the Aurignacian levels of Geissenklösterle cave.

	IIa	IIb	reconstructed II	IId	III	IIIa	IIIb	reconstructed III
single endscraper	11	2	13 (8,23%)	3	8	9	—	20 (12,82%)
atypical single endscraper	—	—	—	—	—	1	—	1 (0,65)
double endscraper	—	—	—	—	1	—	—	1 (0,65)
end scraper on retouched blade	6	4	10 (6,33%)	—	—	3	—	3 (1,92%)
end scraper on Aurignacian blade	—	1	1 (0,63%)	—	—	—	—	—
carinated endscraper	—	1	1 (0,63%)	1	3	9	1	14 (8,97%)
thick nosed endscraper	1	3	4 (2,54%)	1	7	15	—	23 (14,74%)
double thick endscraper	1	—	1 (0,63%)	—	—	3	—	3 (1,92%)
endscraper-burin	1	1	2 (1,27%)	—	1	1	—	2 (1,28%)
borer-burin	—	1	1 (0,63%)	—	—	—	—	—
burin on break	4	4	8 (5,06%)	—	2	3	—	5 (3,20%)
double burin on break	1	1	2 (1,27%)	1	—	1	—	2 (1,28%)
burin on retouched truncation	3	5	8 (5,06%)	1	5	11	—	17 (10,9%)
dihedral burin	—	—	—	1	—	—	—	1 (0,65%)
core burin	—	—	—	2	—	1	—	3 (1,92%)
retouched blade – one edge	6	10	16 (10,12%)	5	3	2	—	10 (6,41%)
retouched blade – two edges	4	7	11 (697%)	2	—	—	—	2 (1,28%)
blade with use-traces	—	—	—	—	2	6	2	10 (6,41%)
truncated blade	—	2	2 (1,27%)	—	1	2	1	4 (2,56%)
pointed blade	3	9	12 (7,6%)	—	—	1	—	1 (0,65%)
Aurignacian blade	1	1	2 (1,26%)	—	—	—	—	—
splintered piece	18	40	58 (36,7%)	6	11	2	—	19 (12,17%)
notch	—	—	—	1	5	4	—	10 (6,41%)
retouched flake	—	—	—	1	1	2	—	4 (2,56%)
flake with use-traces	—	—	—	—	—	1	—	1 (0,65%)
Kostenki piece	2	2	4 (2,54%)	—	—	—	—	—
pointed bladelet	—	1	1 (0,63%)	—	—	—	—	—
Dufour bladelet	—	1	1 (0,63%)	—	—	—	—	—
Total	62	96	158	25	50	77	4	156

Other data as well speak in favor of the existence of two separate assemblages. First, the laminary character of the tools is more pronounced in II than it is in III, with 90% of blade tools in the upper level as against only 60% in the lower level. This can be accounted for by the greater proportion of carinated/nosed pieces in reconstructed level III. Conversely, retouched blades, pointed blades and splintered pieces (Fig. 2), numerous in II, are rare in III. The fact that reconstructed levels II and III are each typologically balanced also supports the case for their distinction: in both instances, the two main archeological levels, respectively IIa-IIb and III-IIIa, exhibit relatively similar typological profiles, except for single endscrapers, the proportions of which vary greatly between IIa and IIb.

Finally, differences pertaining to the way the lithic productions are patterned can also be perceived. Reconstructed level III is characterized by complete blade reduction sequences, right from the first phases of exploitation to the final phases of core discard and tool manufacture. On the other hand, there is scantier evidence of on-site blade production in

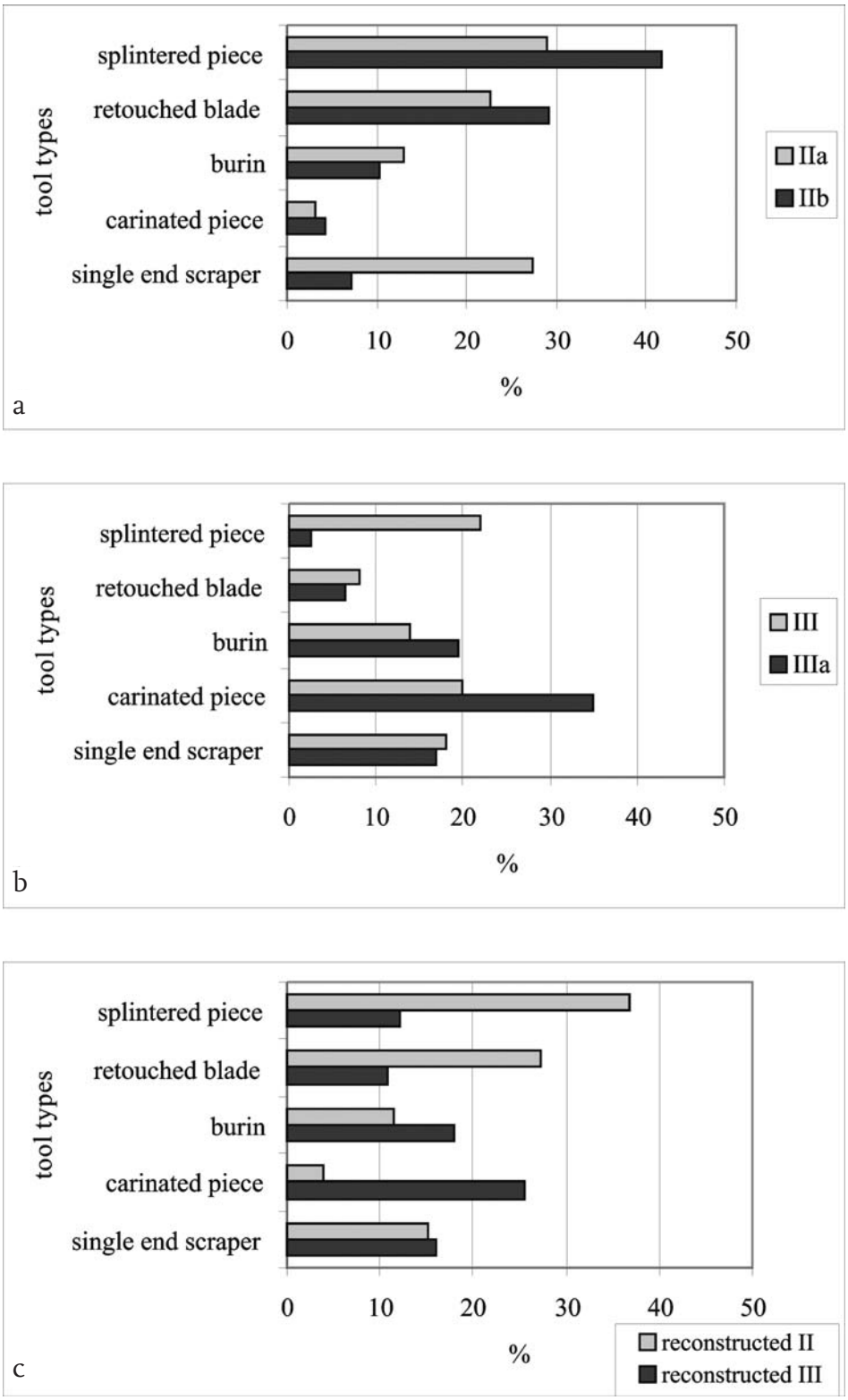

FIG. 2 – Frequency of the main tool-types of reconstructed levels II and III of the Geissenklösterle cave (a: comparison between the main levels of reconstructed level II; b: comparison between the main levels of reconstructed level III; c: comparison between reconstructed levels II and III).

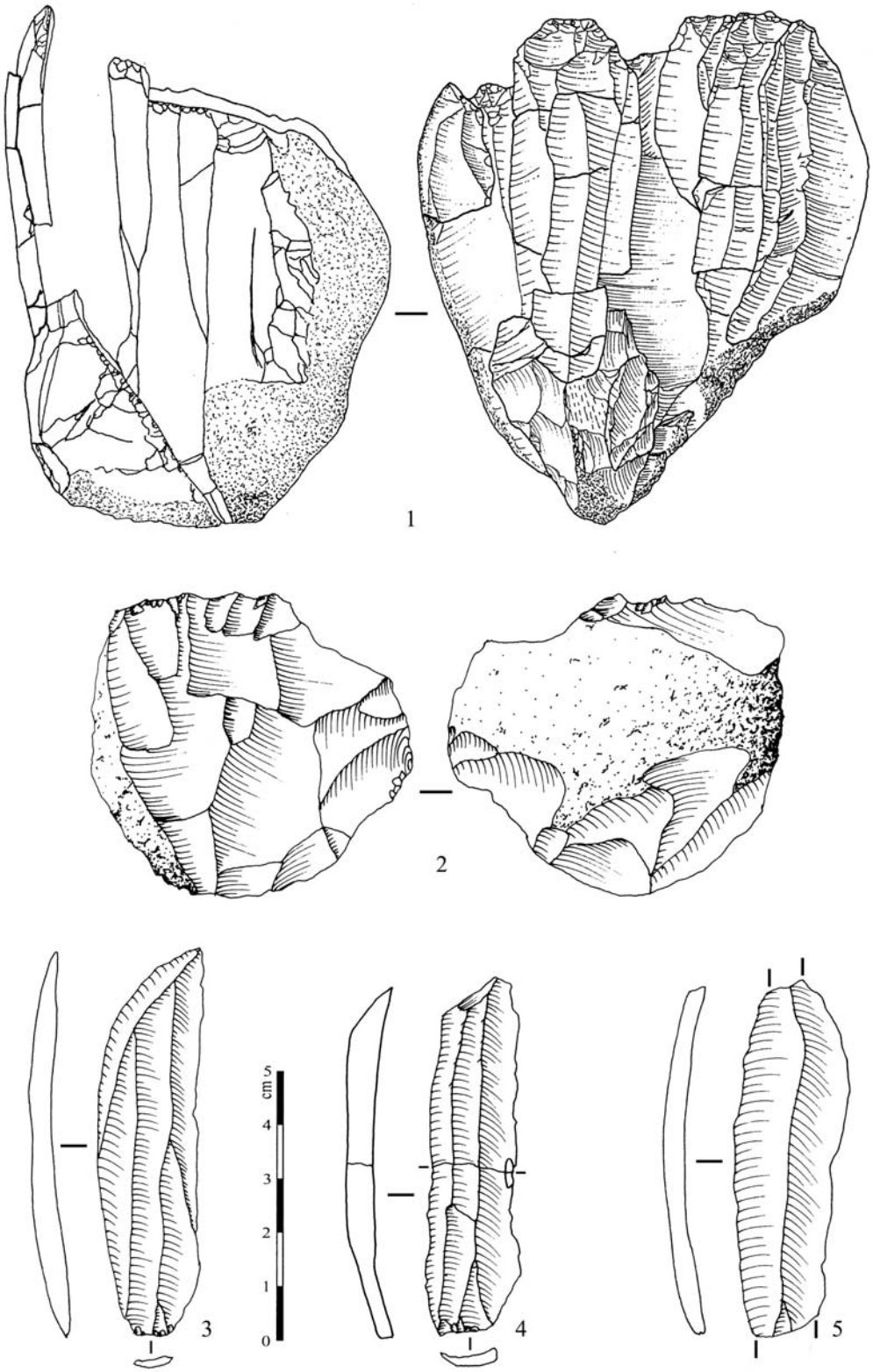

FIG. 3 – Geissenklösterle cave. Blade production of reconstructed level III. 1. refitting of a blade production sequence (after Hahn, 1988, modified); 2. blade core; 3-5. blades (drawings by N. Teyssandier).

reconstructed level II, since the related reduction sequences are more fragmentary, and cores as well as the initial debitage phases are but poorly represented. Additionally, this assemblage features a wider range of raw materials than the lower levels, a greater use of exogenous materials, and the introduction of blade blanks and tools produced off-site (Burkert, 1999; Burkert and Floss, in press).

The above data substantiate the claim that reconstructed levels II and III are indeed distinct from one another. While there is no denying that the sequence has suffered some disturbance, as meticulously demonstrated by J. Hahn in his pioneering study, we believe it has proved possible to show that reconstructed level III cannot be construed as resulting only from a disturbance of reconstructed level II. The more discriminating lithic elements — the carinated/nosed pieces in particular — undoubtedly originate in the former level and not in the latter. Further quantification of these preliminary observations and their comparison with the ongoing study of the spatial distribution of refitted items is the task that now lies ahead of us.

A single operative concept for the production of blades

While reconstructed levels II and III should be distinguished from one another as argued above, they nevertheless share specific features that warrant their joint attribution to the same technocomplex: the Aurignacian.

From a technological standpoint, no major conceptual differences could be perceived between reconstructed levels II and III, both predominantly characterized by a production of blades from mostly local and relatively high quality raw materials. The debitage, conducted on medium-sized clasts (≤15 cm maximum dimension), is mainly unipolar (Fig. 3). It is worth noting that this type of debitage produces a set of blades that are *de facto* diversified via the progressive reduction in length of the core. There is no evidence here of a cleavage between a production of long blades and a production of smaller blades. Initializing blade debitage by means of a crest does occur, but more often than not this process seems to have been eschewed in favor of more local and perfunctory shaping out removals, debitage starting off directly with the detachment of cortical blades or blade-like flakes. Throughout reduction, two technical processes are frequently used to control the morphology of the core and allow further debitage: a few slightly plunging removals ensure that adequate longitudinal convexities are maintained, while keeping the debitage surface sufficiently convex is achieved by detaching neo-crests where this surface meets one of the sides of the core. In terms of intentions, such exploitation systems are not highly constrained insofar as it is possible to obtain a set of sometimes much diversified blanks from the same block: blades varying in width and exhibiting a more or less curved profile. The removal of the primarily sought blade blanks is exclusively carried out by direct percussion with a soft organic hammer.

The methods and techniques used are the same as those described for the production of blades in the early Aurignacian of Western Europe (Aurignacian I), with which they can be compared (see Bon, 2000).

Diversified bladelet productions

The bladelet productions (Fig. 4) of the two assemblages are conceptually related in spite of major differences pertaining to the frequency of the implemented exploitation systems. Bladelets are mainly extracted from carinated/nosed pieces (Fig. 4, no. 1) or from

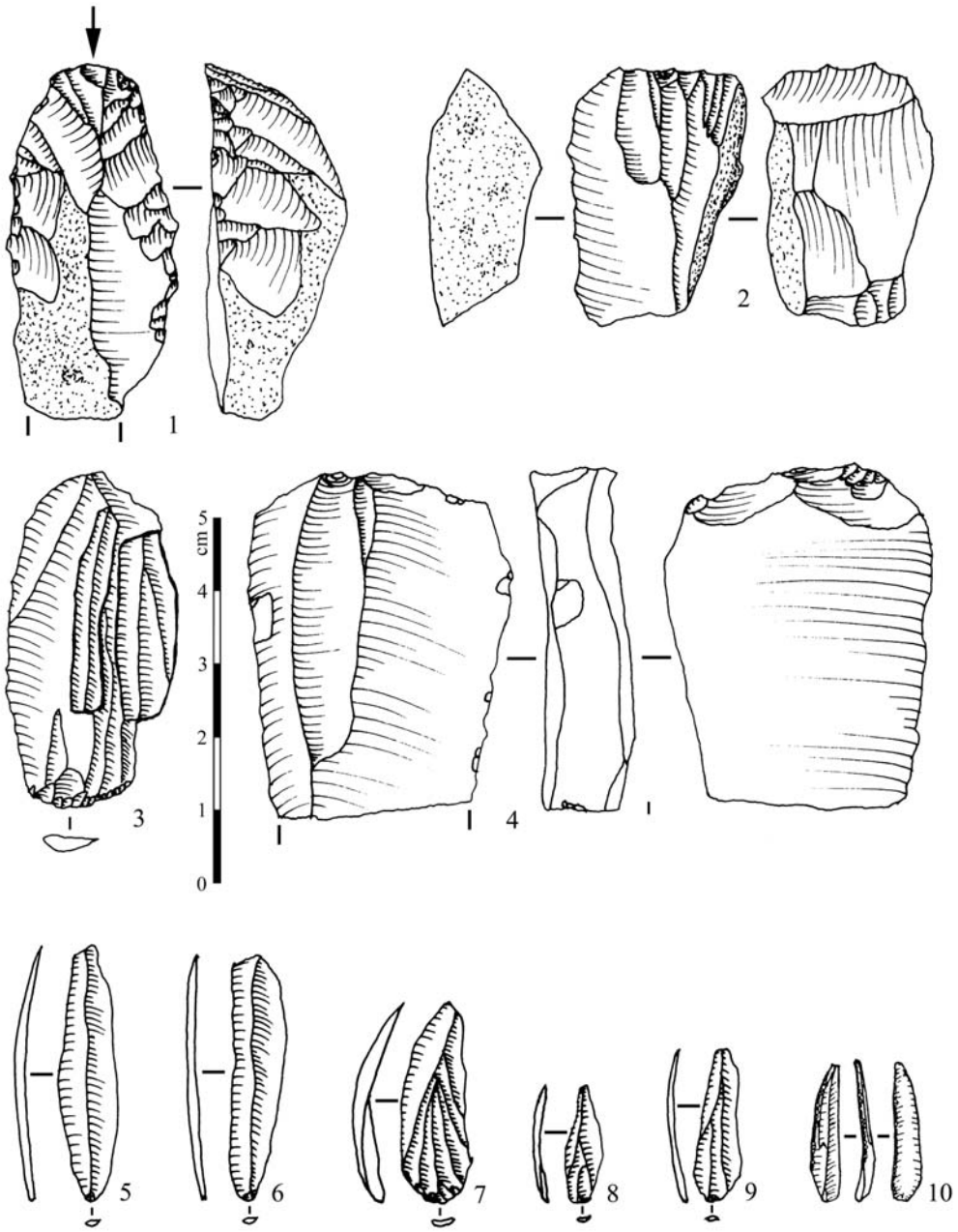

FIG. 4 – Geissenklösterle cave. Examples of Aurignacian bladelet productions. 1. carinated endscraper; 2. prismatic bladelet core; 3. bladelet fitting into a blade production; 4. Kostienki core (only in reconstructed level II); 5-6. bladelets from prismatic cores; 7-9. bladelets from carinated pieces; 10. Dufour bladelet (drawings by N. Teyssandier, except no. 10, which is after Hahn, 1988).

prismatic cores on which blade debitage was previously conducted (Fig. 4, no. 2). It seems, however, that, in reconstructed level III, blade and bladelet debitage were more independent processes. This is directly related to the prevailing exploitation of carinated/nosed pieces for the production of bladelets in this assemblage. The technical and typological attributes of these carinated/nosed pieces (Fig. 5) are very homogeneous, and can be compared with those defined in several early Aurignacian assemblages of Western Europe (Bon, 2000; Chiotti, 1999; Lucas, 2000). On the other hand, no retouched bladelets were retrieved from reconstructed level III. Whether much importance should be attached to this in the

present context is debatable, since only one such item — a Dufour bladelet of the Roc-de-Combe subtype (Fig. 4, no. 10) — was identified in the unquestionably Aurignacian reconstructed level II.

The concepts implemented in the blade and bladelet productions of the two assemblages are evidence of a shared cultural identity. Nevertheless, in view of their appreciably different typological profiles and technoeconomic patterns, these assemblages cannot be considered as belonging to the same stratigraphic unit.

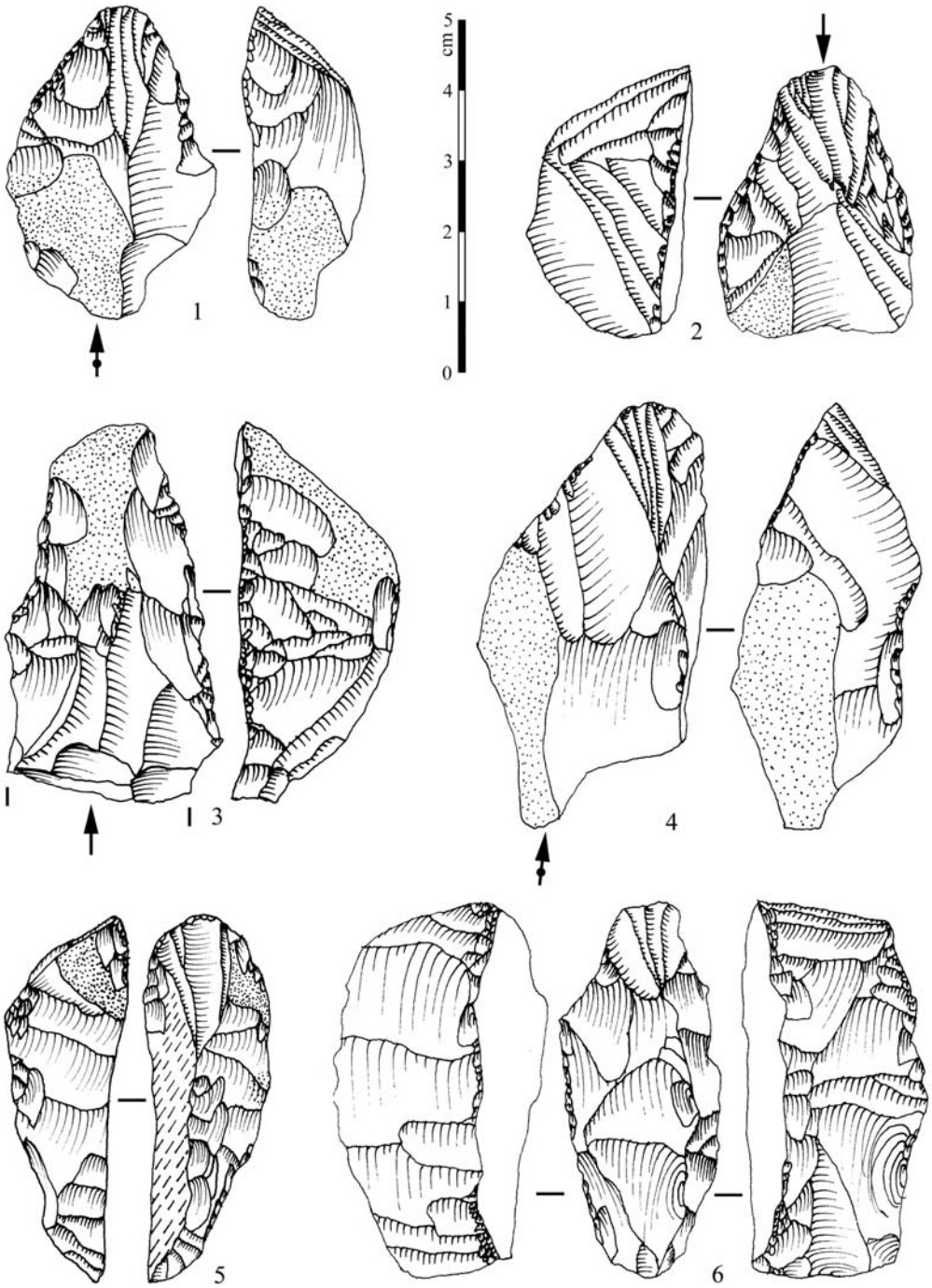

FIG. 5 – Geissenklösterle cave. Examples of carinated pieces from level IIIa (no. 3 is a preform) (drawings by N. Teyssandier).

The organic productions

Although fewer organic than lithic artifacts were recovered from the Geissenklösterle Aurignacian levels, they are qualitatively significant and equally support the case for the existence of Aurignacian occupations predating those classically defined as early Aurignacian. J. Hahn (1988) had indeed drawn heavily on the organic material culture to distinguish between two different assemblages, one of which displayed a type fossil (the split-based point) specific to the early Aurignacian. As demonstrated below by the comparative analysis of the organic productions, the two assemblages can furthermore be told apart on the basis of their respective technoeconomic patterns.

The production of reconstructed level II: a typical early Aurignacian assemblage

In order to serve as a basis for comparison, the content and patterning of the organic assemblage from reconstructed level II will be described first. The production is rich and made up of 89 worked artifacts, concentrated within occupation level IIb (Fig. 6). It is characterized by the presence of split-based points, but also displays some other noteworthy features.

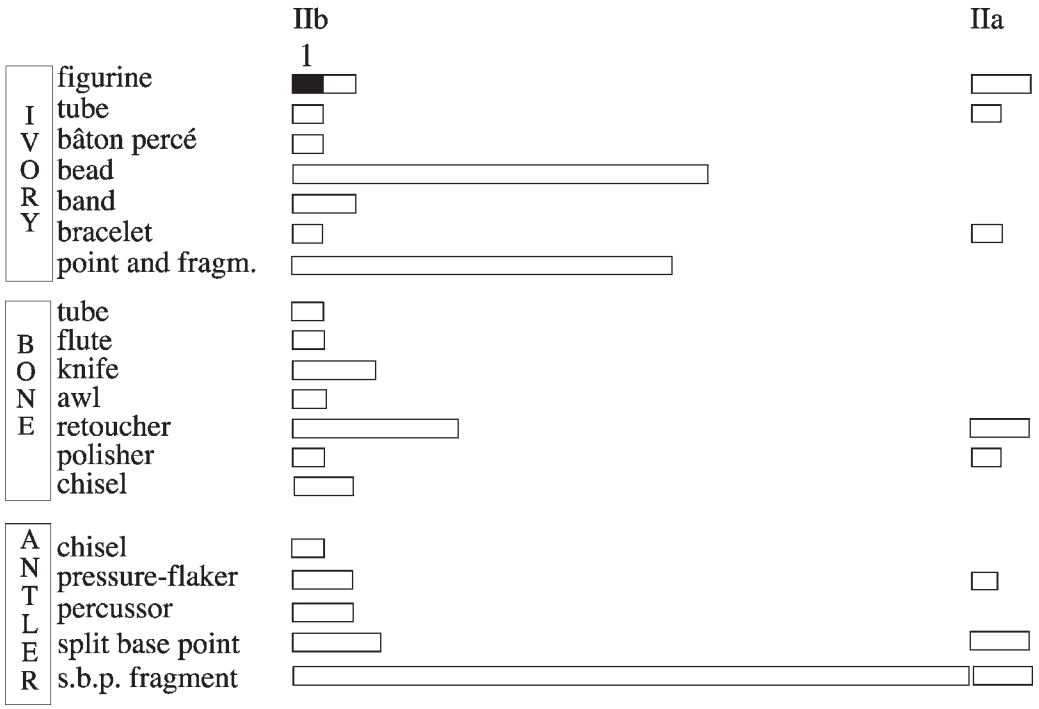

FIG. 6 – Geissenklösterle cave. Typological composition of reconstructed level II (n= 88).

First, raw material management is highly differentiated, i.e. distinct raw materials are each independently used for specific purposes. A whole range of organic materials, bone, ivory and antler, was worked to produce a diversified set of tools, as well as personal ornaments and art objects. Antler was chiefly selected for the production of split-based points and percussion implements, bone was used for making awls, polishers and retouchers, while ivory was preferred for mobiliary art, ornaments and projectile points with a massive

base of cylindrical cross-section. This particular allocation of raw materials testifies to a thorough appreciation of the properties of organic substances, be they material or economic, the latter in terms of resource availability.

Second, the production sequences are varied and differ in their degree of complexity. Neither the techniques involved nor the way production is organized are identical in bone, antler and ivory-working.

Bone (Fig. 7) is transformed by means of relatively simple debitage techniques, primarily breakage. Long bones are fractured for consumption purposes (Münzel et al., 1994; Münzel, 1995), and certain fragments are then selected for technical purposes. Ribs too are fractured before being split, while bird bones are sawn before being broken by flexing. Shaping techniques involve scraping and retouching in the case of medium and large-sized mammal bones, incising and boring in the case of bird bones. Shaping does not occur systematically and is generally restricted to the active parts of the tool. However, when moving from bone to antler, and then to ivory, the production sequences become more complex.

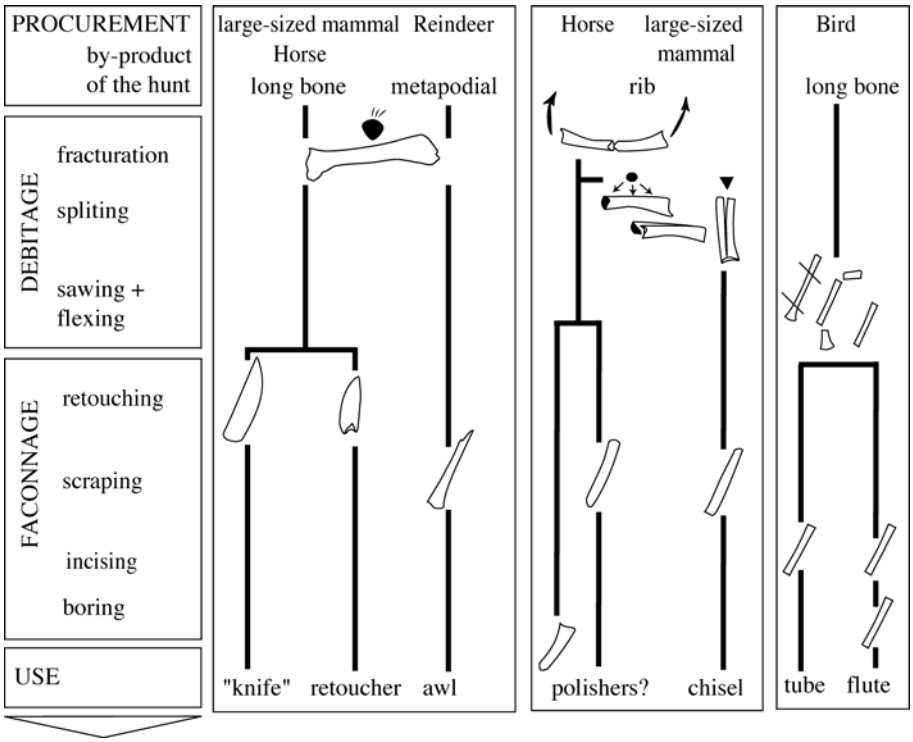

FIG. 7 – Geissenklösterle cave. Bone-working production sequence (Geissenklösterle, reconstructed level II).

Antler blanks are produced via cleaving (Fig. 8). This technique is peculiar to the Aurignacian, as the groove and splinter technique only emerges in the Gravettian and cleaving is unknown in other cultural contexts. The first step consists of dividing the antler into several sections by deep gashing or transverse breakage; the sections are then cleaved along the grain, in order to obtain longitudinal segments (Knecht, 1991; Liolios, 1999, in press). The groove and splinter technique will subsequently replace cleaving for technical and economic reasons pertaining to the control of the attributes of the longitudinal segments obtained via cleaving and to the length of time required for bringing these segments to shape. Points are made from fragments of antler beam, while antler burr is used for the

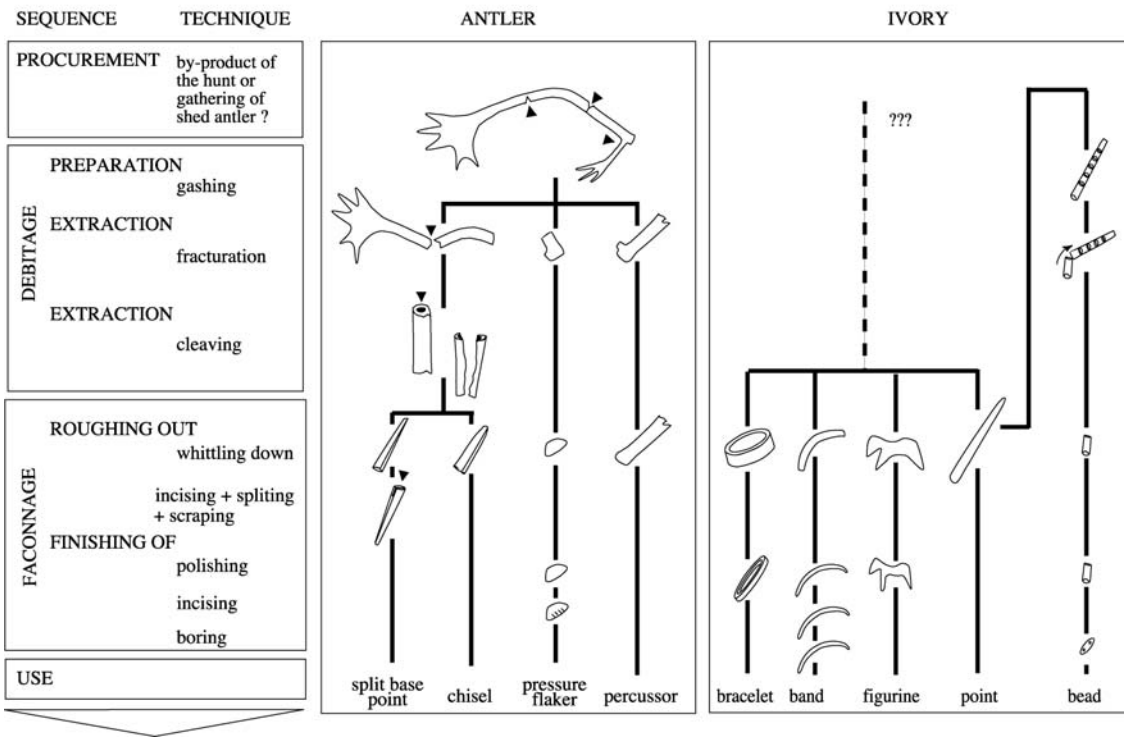

FIG. 8 – Geissenklösterle cave. Antler and ivory-working production sequences (Geissenklösterle, reconstructed level II).

manufacture of hammers and pressure-flakers. Shaping plays an all-important part in the manufacturing process, although points and hammers are only partly brought to shape. The main shaping technique is scraping, which is recorded on all of the artifacts; for pressure-flakers, the final shaping stages include incising and polishing.

The processes involved in ivory-working are by far the most complex (Fig. 8). The products are extremely diversified: bracelets, bands (?), art objects (Hahn, 1986), points with a massive cylindrical base. There is also evidence of a secondary production sequence specifically aimed at manufacturing beads from segments previously brought to shape, as described by R. White (1995) in other Aurignacian contexts. A large number of shaping techniques are recorded (scraping, polishing, incising, boring), and they have been intensively used. On the other hand, the initial phases of the production sequence are not represented: there are no by-products suggesting that debitage was at least partly conducted on-site, whereas shaping chips are abundant (Hahn, 1988; Christensen, 1999; Liolios, 1999).

The production of reconstructed level III: an early Aurignacian lacking split-based points?

The organic assemblage recovered from the combined archeological levels of reconstructed level III is much poorer than that of the upper levels, thus precluding any straightforward step by step comparison. This discussion will therefore focus on discriminating peculiarities, rather than on differences derived from more rigid or mechanical comparisons (lack of split-based points, of mobiliary art, etc.). The assemblage is made up of 20 worked artifacts, most of which are concentrated within occupation levels III and IIIa (Fig. 9). It is devoid of both split-based points and art objects.

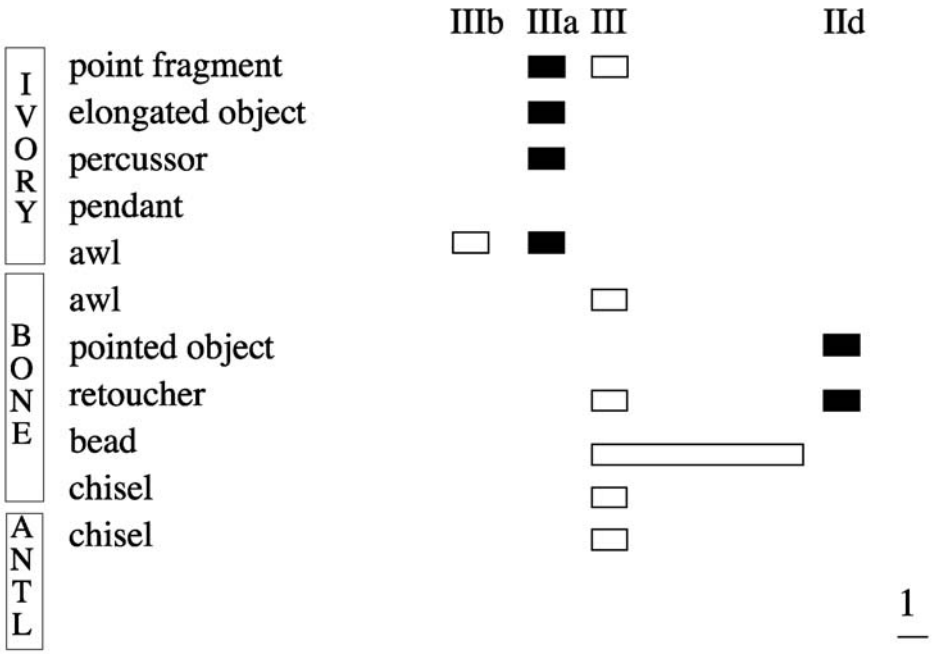

FIG. 9 – Geissenklösterle cave. Reconstructed level III typological composition (n= 20).

To begin with, the available raw materials are not each independently used for specific purposes. The range of technical goals is relatively wide, as shown by the presence of awls, points, hammers, chisels and retouchers. However, this diversity is not the outcome of an intentional and differentiated management of raw materials: awls are made from bone as well as ivory, chisels from both antler and bone. This was not the case in reconstructed level II. Should these artifacts be derived from the upper archeological levels, is it conceivable that ivory awls and bone chisels alone, which are lacking in reconstructed level II, were affected by post-depositional disturbance?

Additionally, the assemblage includes several objects of personal ornamentation, which, however, cannot be compared with those yielded by reconstructed level II. Some of these consist of sections of small mammal bone shafts (Fig. 10). Hahn (1988, personal communication) speculated they might be beads, but it must be admitted that the function of these small bone tubes less than 1 cm long and produced via sawing and flexing, is rather enigmatic. There are also two ivory pendants, which can be distinguished from the items in reconstructed level II by their elongated shape and single perforation. Once again, on the assumption that sorting occurred, only those elements that differ from the finds in reconstructed level II would have been moved down by turbation.

The technical processes involved in bone-working (Fig. 11) are unsophisticated: blanks are all selected from among the remains of processed bones, and then either directly used or scraped along their active parts. Shared by both assemblages, such techniques are too simple to be discriminating. It is nevertheless worth noting that unlike what obtains in the upper levels, bone-working applies only to long bones while ribs are overlooked.

Although antler is exceedingly common in reconstructed level III, antler-working is very poorly represented, by a single artifact, a chisel. Brought to form by minor scraping along its distal end, it was manufactured from a longitudinal segment produced via cleaving. The debitage method is identical to that observed in reconstructed level II. Even though there is but one such artifact, its occurrence is significant insofar as it documents the use of a technique that is peculiar to the Aurignacian.

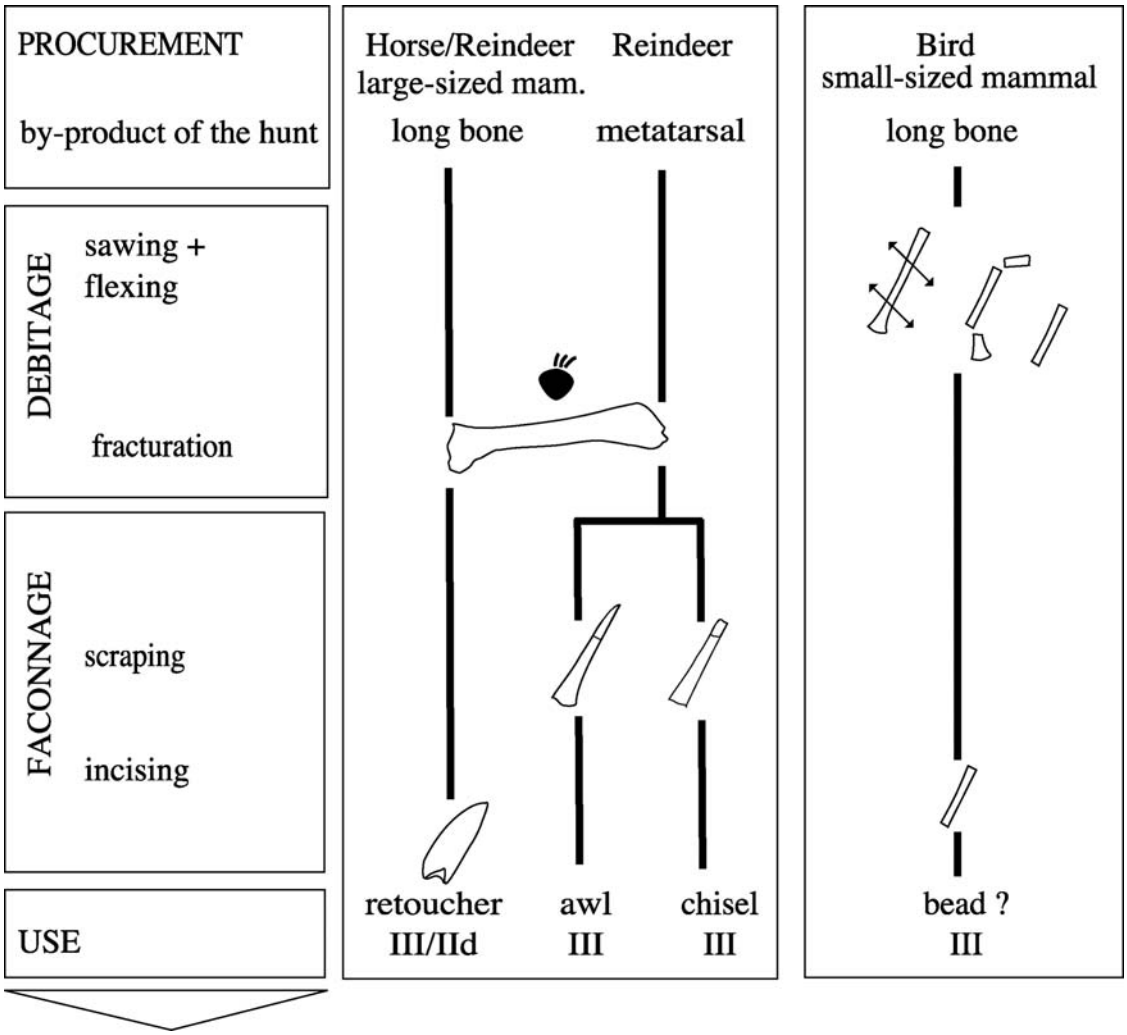

FIG. 10 – Geissenklösterle cave. Bone-working production sequence (Geissenklösterle, reconstructed level III).

Ivory is the most extensively worked material, even though the implemented processes are not as complex as in reconstructed level II. Debitage by-products show that blanks were extracted via cleaving. The tools manufactured from such blanks include massive-based points, typical of the central European Aurignacian, one awl, one specimen bearing impact scars and therefore termed "hammer", and two pendants. Artifacts made from ivory are the only ones entirely brought to shape, but by means of a single shaping technique, scraping. When the distribution of ivory-working remains throughout the site is considered, it seems that debitage by-products sufficiently large to be identified as such are exclusive of reconstructed level III (Fig. 12). Tiny fragments, bearing traces of scraping, are much more evenly distributed between the different archeological levels. It is conceivable that some ivory-working by-products were moved down from reconstructed level II, but the presence of large-sized items in III and IIIa cannot be accounted for by post-depositional sorting. This is indeed all the more debatable since large-sized ivory-working by-products are lacking in reconstructed level II, thus suggesting — pending further verification — that in this particular level the initial debitage phases of ivory-working were not conducted on-site.

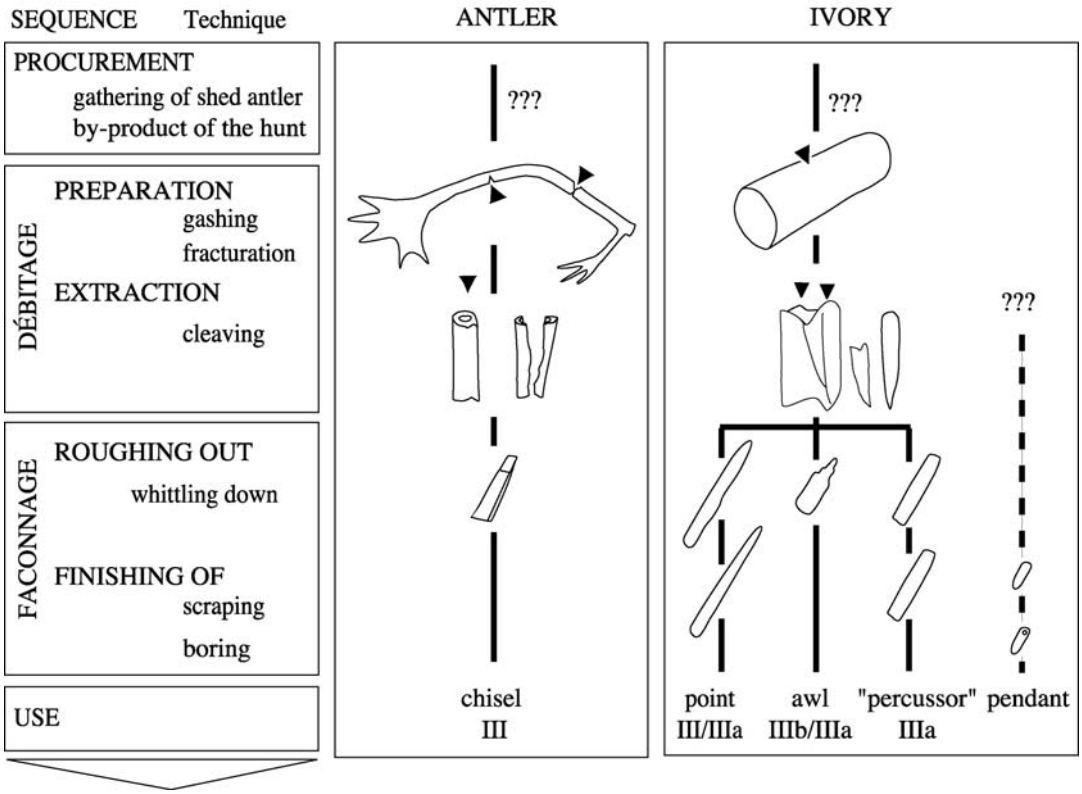

FIG. 11 – Geissenklösterle cave. Antler and ivory-working production sequences (Geissenklösterle, reconstructed level III).

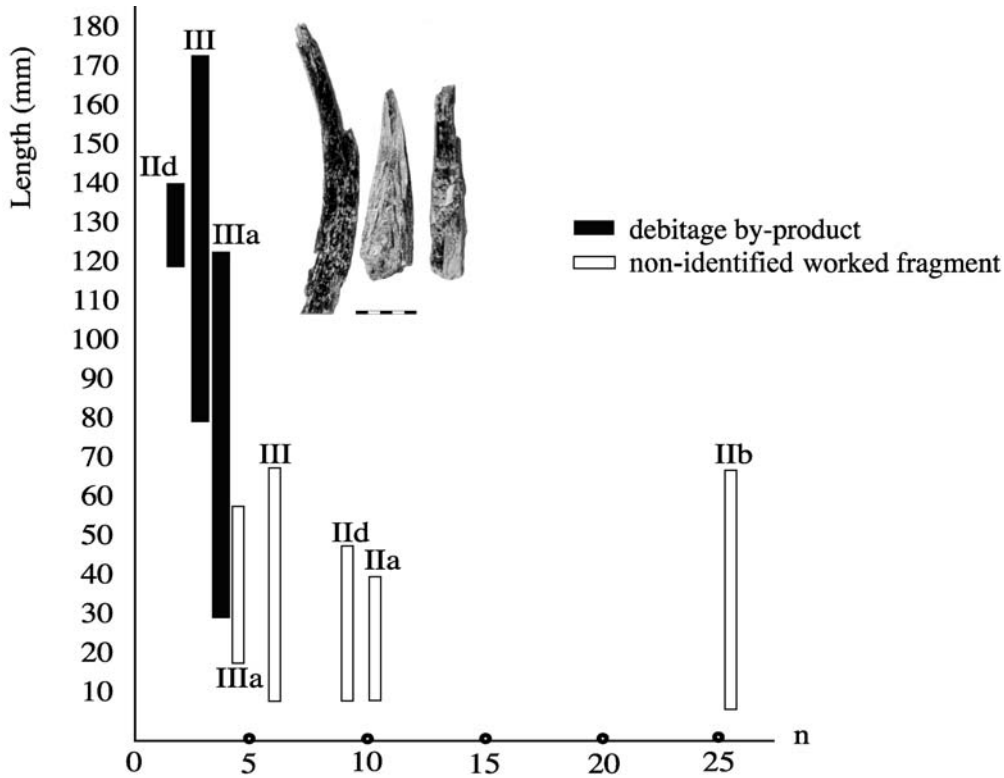

FIG. 12 – Geissenklösterle cave. Distribution and size of worked fragments and debitage by-products.

Two distinct Aurignacian organic productions

Reconstructed level III lacks type fossils and is devoid of art objects. It is mainly characterized by its lack of a differentiated raw material management, by technically and economically simple production sequences, and by the prevailing use of scraping as a shaping technique. Other peculiarities include the scantiness of antler-working, the presence of original personal ornaments, and the on-site debitage of ivory.

These specificities substantiate the claim for distinct occupations predating those of reconstructed level II. That the productions of reconstructed level III should also be identified with the Aurignacian is warranted by the use in both assemblages of a similar technique for obtaining antler blanks via cleaving, which is peculiar to the Aurignacian, and by the shared occurrence of such characteristic tools as the massive-based ivory points. The significance of these results is best appreciated in comparison with the specificities of the reconstructed level II organic productions and of the reconstructed level III lithic productions.

Conclusion

The results of our joint technological study argue for the existence of Aurignacian levels predating the split-based points facies. Reconstructed level III is characterized by the predominance of carinated/nosed pieces associated with an Aurignacian blade debitage, by the absence of split-based points, and by its meager organic component. The unarguably Aurignacian operative concepts implemented in the lithic and organic productions rule out any attribution of the archeological content to a transitional facies. However, in the absence of regional points of comparison, it is no easy matter to assess this content more precisely. On a wider scale, comparisons are fraught with even greater difficulties insofar as the stratigraphic sequences featuring an Aurignacian phase predating the split-based points facies are much debated (e.g. Kozłowski and Otte, 2000; Zilhão and d'Errico, 1999).

On the other hand, giving full support to the hypothesis of a Proto-Aurignacian, as suggested by J. Hahn, is equally problematic if the classical definition of that facies is anything to go by: an industry with a high retouched bladelet component. In fact, this assumption gained currency largely as a result of the recently obtained AMS dating results, some of which place the alleged age of reconstructed level III at a considerably earlier date than previously thought (Richter et al., 2000). However, when the entire series of available dates is considered (Hahn, 1988, 1995; Richter et al., 2000; Zilhão and d'Errico, 1999; Conard, oral communication during the "Geissenklösterle Workshop", 2001, Tübingen), these can be seen to have a very wide chronological range (between 33 100 BP and 40 200 BP); reconstructed level III could therefore arguably be relatively close in time to classical early Aurignacian assemblages. Should this be the case, how is one to account for the fact that the two major assemblages display appreciably different typological profiles? This may well be due to functional and economic factors, hinging on distinct subsistence-related on-site activities. Such a possibility would account for the similarity between the operative concepts identified for the lithic and organic productions in each assemblage, as well as for the differences in the frequency of tool-types and in the completeness of reduction sequences.

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