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# SPY CAVE

125 years of multidisciplinary research
at the Betche aux Rotches
(Jemeppe-sur-Sambre, Province of Namur, Belgium)

Edited by Hélène ROUGIER & Patrick SEMAL

**Volume 1**

**2013**

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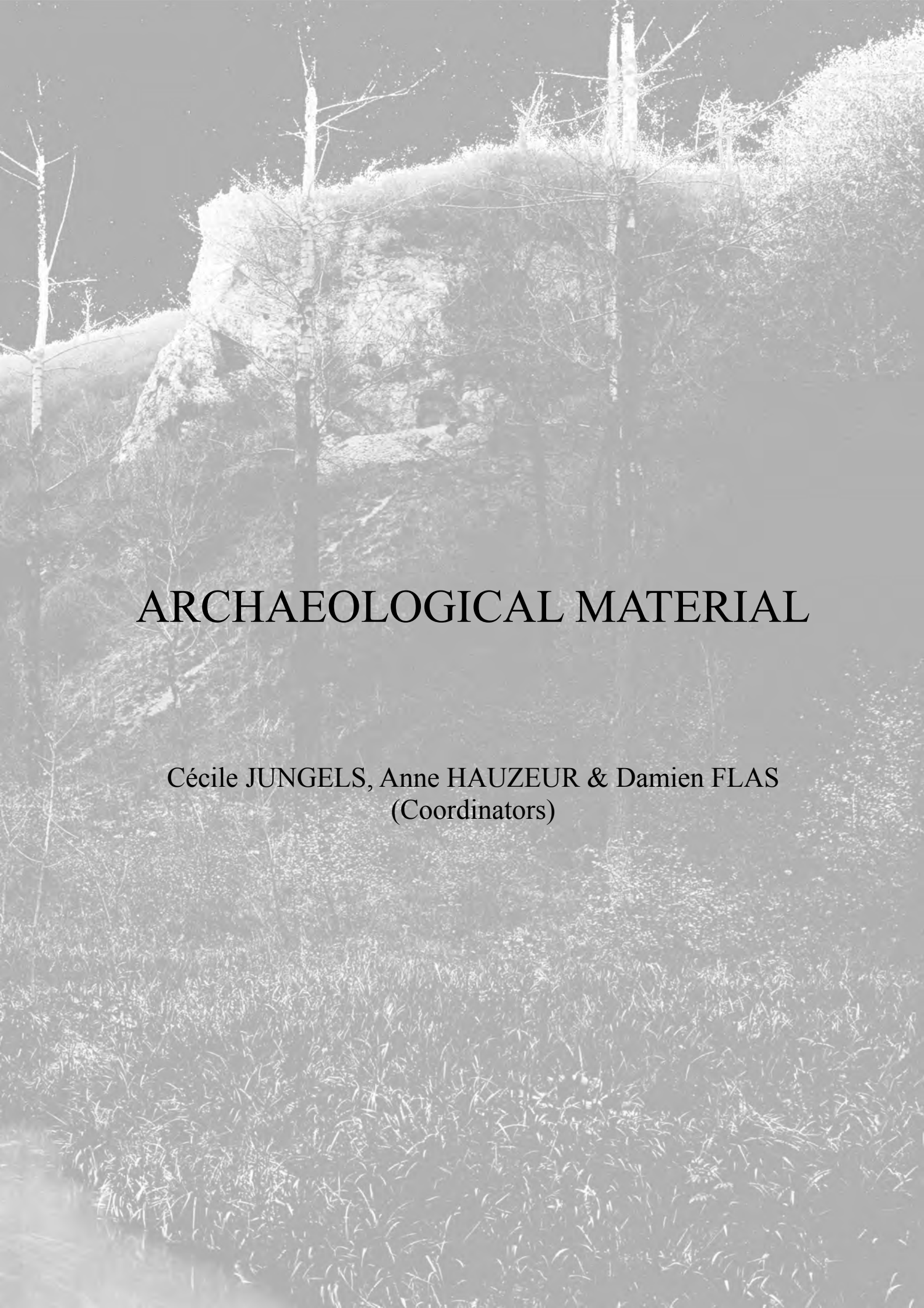

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Cécile JUNGELS, Anne HAUZEUR & Damien FLAS
(Coordinators)

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CHAPTER XII

# NEW PERSPECTIVES ON THE AURIGNACIAN FROM SPY: LITHIC ASSEMBLAGE, OSSEOUS ARTEFACTS AND CHRONO-CULTURAL SEQUENCE

**Damien FLAS, Élise TARTAR, Jean-Guillaume BORDES, Foni LE BRUN-RICALENS & Nicolas ZWYNS**

***Abstract***

*The Aurignacian assemblage from the* deuxième niveau ossifère *("second fauna-bearing level") at Spy is one of the richest in Northern Europe, not only in terms of pendants/osseous artefacts but also the abundant lithic artefacts. However, several factors limit the information that can be derived from this collection: excavation inaccuracy; evident mixing of different technocomplexes; the assemblage having been partly reworked; and an almost complete absence of sieving at excavation. If a quantitative approach and precise description of the technical behaviour represented in the collection is thus not possible, the Aurignacian lithic assemblage is nonetheless wide enough to permit a new study, particularly of those artefacts related to bladelet production. Bladelet production constitutes the most culturally meaningful aspect of the Aurignacian, in contrast to blade production which is more ubiquitous and thus more difficult to recognise in a mixed assemblage. The recent recognition of the significance of bladelet production for understanding the chrono-cultural structure of the Aurignacian warrants reappraisal of this assemblage: an assemblage that has not been studied since the important work of Marcel Otte published in 1979. Although it is certainly not possible to build a regional chrono-cultural sequence based upon the Spy assemblage, it is possible to shed light on it via comparison with the more firmly established Aurignacian sequence from South-West France.*

*Moreover, the presence of split-based osseous points – generally considered as a marker of the Early Aurignacian (or Aurignacian I) – in a region where hitherto only the Late Aurignacian has been well recognised raises the possibility of an early stage of the Aurignacian in Northern Europe and/or incongruity between the chrono-cultural positions generally ascribed to Aurignacian lithic and osseous artefacts.*

## INTRODUCTION

If the assemblage from Spy classified as belonging to the Aurignacian complex is rich and varied (lithic and osseous artefacts, personal ornaments), its characterisation and further classification within the Aurignacian is problematic, mainly because of the absence of a reliable stratigraphic context.

It is for this reason that D. de Sonneville-Bordes (1961) gave only a short description of the Spy collection, merely underscoring the presence of typical features such as split-based osseous points and *burins busqués*, but without proposing any attribution to a precise phase of the Aurignacian. D. de Sonneville-Bordes (1961: 431-432) wrote simply of an "*Aurignacien typique*" (typical Aurignacian), while emphasising "… [*qu'*] *il existait certainement dans les gisements des subdivisions secondaires, passées inaperçues*" ("[that] secondary subdivisions that have not been recognised likely existed in the assemblages").

Studying the Belgian Early Upper Palaeolithic, M. Otte (1979) divided the Belgian Aurignacian into different groups, notably the "Spy-Goyet" group including the Aurignacian assemblages from those two eponymous sites and also from Trou du Sureau and Trou Al'Wesse; a group particularly characterised by the presence of split-based osseous points. This group is, according to Otte, the oldest phase of the Belgian Aurignacian. In this framework, the Aurignacian assemblage from Spy was considered as homogeneous. This earliest Belgian Aurignacian group was described as bearing not only similarities

with the French ("Atlantic") Aurignacian, but also importantly showing an eastern influence (the presence of blade leaf-points and of massive-based osseous points), and could be placed together with the Aurignacian of the Rhine Basin and of the British Isles (Otte, 1979: 611).

If the Aurignacian assemblage from Spy was already the subject of a precise typological study (Otte, 1979: 193-312), it can now be tackled in light of new ideas regarding this technocomplex, and especially those concerning osseous industry and bladelet *débitage* (Le Brun-Ricalens *et al.*, 2005).

In addition, there exists a particularly interesting issue already underscored by Marcel Otte (1979: 312, 607): the noticeable inconsistency between those elements of the assemblage generally considered as features of the Early Aurignacian (most notably split-based points) and those elements ordinarily attributed to later phases of the Aurignacian (notably *burins busqués*).

Based upon the characterisation of Aurignacian bladelet production and on a reappraisal of osseous points, we present a discussion concerning this apparent paradox, and reflect upon the Northern Aurignacian chrono-cultural sequence.

## ANALYSIS OF LITHIC ASSEMBLAGE

### Methodology and preliminary comment

From the outset it is important to stress that the Aurignacian collection from Spy, even if it comes from the *deuxième niveau ossifère* (De Puydt & Lohest, 1887; de Loë & Rahir, 1911), cannot *a priori* be considered as a homogeneous assemblage, nor strictly separated from those other complexes that also come from the same layer (mainly Mousterian [Jungels *et al.*, this volume: chapter X], but also Lincombian-Ranisian-Jerzmanowician [Flas, this volume: chapter XI] and even Gravettian [Pesesse & Flas, this volume: chapter XIII]). In addition to the inaccuracy of the early excavations, a part of the assemblage comes from secondary deposits (excavations of the slope by F. Twiesselmann and excavations of backdirt and deposits disturbed by the first excavations; see Pirson *et al.*, this volume: chapter VI). The lack of a reliable and precise stratigraphic context, and the absence of sieving during most of these excavations, prevents us from undertaking a quantitative study of the different components of the Aurignacian lithic assemblage. Our approach is therefore mainly qualitative and based upon comparison. Indeed, if it is not possible to define a regional sequence based upon the assemblage from Spy, it is nonetheless possible to shed new light on this collection with reference to stratigraphic sequences observed elsewhere.

As for those who have formerly studied this assemblage, retouched tools and cores are still considered in this study as the most informative typological categories. Most of these artefacts have previously been isolated by M. Otte. Those lithic artefacts which can reasonably be identified as Aurignacian were selected[1]. To understand the processes of bladelet *débitage* represented, we focused most particularly on the carinated artefacts. These were integrated into a database. Indeed, in a study such as this, carinated pieces have two advantages:

- in a mixed assemblage such as that from Spy, they can be more easily attributed to the Aurignacian complex than other types of artefact;

- they result from bladelet production, which appears to be particularly meaningful when seeking to understand the technocultural structure of the Aurignacian (Bon, 2002; Bordes, 2005, 2006; Tartar *et al.*, 2006: 115-116; Teyssandier, 2006; Le Brun-Ricalens *et al.*, 2009).

To complement these data, a significant sample of unwashed waste coming from the excavations of F. Twiesselmann (in 1952-1954) was sampled, deriving from different spatial zones of those excavations. This permitted the identification of more elements relating to the bladelet *débitage* process (microblades/bladelets, burin spalls, bladelet core tablets, *etc.*).

[1] Four collections have been studied: Royal Belgian Institute of Natural Sciences (several dozen thousand artefacts of all sizes, including those smaller than 1 cm, confirming the sieving of a part of the backdirt), *Grand Curtius* Museum (majority of tools and numerous carinated pieces), *Université de Liège* (majority of tools and cores), and Royal Museums of Art and History (tools, unretouched blanks, bladelet production, waste products; the part formerly selected by M. Otte has been studied as well as a sample of the waste products, yielding few significant artefacts previously not recognised).

## Tool-kit and blade production

Besides carinated pieces – then still viewed more as tools than as cores – M. Otte (1979: 193-312) classified several tool types in the Aurignacian assemblage. These included numerous dihedral burins, some piercers and splintered pieces, and also "blades with Aurignacian retouch" (Aurignacian blades) and endscrapers made on similar blanks. However, given the mixed nature of the collection, we were more cautious about the chrono-cultural attribution of these ubiquitous pieces. It is nonetheless clear that some artefacts show typological and technological features (morphology and blank size) consistent with the Aurignacian (for example: a double endscraper on a retouched blade, created on a curved unipolar blank; SF1: 1, see also 2 & 4).

Other tool types can be classified as Aurignacian due to their association with carinated pieces on the same blank: 10 dihedral burins, three burins on truncation, three burins on break, three endscrapers and one point associated with carinated endscrapers or burins have been observed in the collections.

Obviously multiple artefacts are rare and therefore the selected assemblage will significantly underestimate the total Aurignacian lithic assemblage. This inevitable underestimation of the original Aurignacian assemblage does not, however, preclude a qualitative characterisation of the industry, as the necessarily excluded assemblage appears less chrono-culturally significant than those selected carinated artefacts and the bladelets produced from them.

Overall, the noticeable low level of artefacts with lateral retouch should be underscored. In the studied collection unretouched blades are much more numerous than retouched ones, and those lithic artefacts selected as Aurignacian (carinated endscrapers and burins) show a similarly low level of lateral retouch (5 %: n = 17 of 340).

If it is difficult to identify Aurignacian tools, it is even more uncertain to recognise unretouched blanks, *débitage* waste and blade cores that could yield information about Aurignacian blade production technique at Spy. It is thus not possible to give a quantified description.

It is possible, however, to study those laminar blanks used as bladelet cores (mainly nosed endscrapers and narrow-fronted carinated endscrapers; *cf.* Table 1) to observe similarities of blade production with other Northern European and Belgian Aurignacian assemblages (Flas, 2004a, 2008: 63-75): blade production is almost exclusively carried out using a unipolar *débitage* process, platforms are mainly plain or faceted, organic soft hammer percussion has been used (according to platform thickness and the presence of ventral "lips"), and blanks are often curved. The size of blanks produced is of course difficult to estimate. However, if the presence of long and wide blades is clear, they are certainly less numerous than those of medium size (<10 cm in length).

It is therefore not possible to recognise a blade *débitage* using hard hammer percussion, a process that has previously been considered a meaningful feature peculiar to "*la culture technologique des Aurignaciens du Nord de l'Europe*" ("the technological culture of the Northern Europe Aurignacians"; Gouédo *et al.*, 1996: 40). The visible use of hard hammer percussion in the selected assemblage likely relates to a bias due to the selection of carinated pieces: these artefacts have often been made on cortical flakes and other waste products (crested blade, *lame de flanc*, tablet; *cf.* Table 1) detached using hard hammer, whereas blade *débitage* itself has been carried using soft hammer percussion. The use of blade *débitage* by-products as blanks for carinated pieces is a phenomenon recognised in many other Aurignacian assemblages (a.o. Tixier, 1991; Le Brun-Ricalens, 1993; Chadelle, 2005; Flas *et al.*, 2006).

## Bladelet production

### *Bladelet cores*

All lithic artefacts showing sufficiently organised bladelet removals to assume the deliberate nature of their production were considered bladelet cores, in agreement with different studies indicating the bladelet core function of carinated artefacts (a.o. Aubry *et al.*, 1995; Lucas, 1997; Soriano, 1998; Chiotti, 2000; Chazan, 2001; Bordes & Lenoble, 2002; Le Brun-Ricalens & Brou, 2003; Flas *et al.*, 2006; Le Brun-Ricalens *et al.,* 2006; Pesesse & Michel, 2006; Jardón Giner, 2007).

In addition to these pieces other types of bladelet core could potentially be attributed to the Aurignacian (e.g. bladelet cores on flake edges or prismatic bladelet cores on blocks) but these were not included in this study due to their ubiquity. Whatever their technocultural attribution, these cores are rare in comparison to cores of carinated "endscraper" and "burin" type.

Two main modes can be described for bladelet production from carinated artefacts:

1) Carinated endscraper, with bladelets struck from the ventral face of the blank through its thickness. This type forms a significant majority of carinated bladelet cores: of 340 carinated pieces, 276 are endscrapers (81.1 %). Three types have been distinguished:

- nosed endscrapers, defined by the presence of one or two notches delimiting the "front" (bladelet flaking surface) (Figure 1). There are 100 nosed endscrapers (29.4 % of carinated pieces),

| | *Blank* | | | | | | | | | *Total* | *%* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Indet.* | *Tablet* | *Flake* | *Cortical flake* | *Blade* | *Cortical blade* | *Crested blade* | *Neo-crested blade* | *Block* | | |
| Carinated pieces | 62 | 4 | 62 | 64 | 84 | 41 | 6 | 14 | 3 | 340 | 100 |
| *"endscrapers"* | *45* | *4* | *54* | *57* | *66* | *35* | *4* | *11* | *1* | *276* | *81.1* |
| nosed | 12 | 2 | 21 | 19 | 28 | 12 | 2 | 4 | 0 | 100 | 29.4 |
| narrow-fronted | 23 | 1 | 16 | 26 | 23 | 14 | 2 | 3 | 0 | 108 | 31.7 |
| carinated | 10 | 1 | 16 | 12 | 15 | 9 | 0 | 4 | 1 | 68 | 20.0 |
| *"burins"* | *17* | *0* | *9* | *7* | *18* | *6* | *2* | *3* | *2* | *64* | *18.8* |
| carinated | 4 | 0 | 4 | 3 | 4 | 2 | 1 | 2 | 1 | 21 | 6.2 |
| *busqués* | 3 | 0 | 1 | 1 | 4 | 1 | 0 | 1 | 0 | 11 | 3.2 |
| plane/flat carinated | 10 | 0 | 4 | 3 | 10 | 3 | 1 | 0 | 1 | 32 | 9.4 |

Table 1. Carinated artefacts studied. More than 600 carinated pieces were identified by M. Otte (1979: 193-312). Otte's totals and our own differ mainly due to fewer collections being viewed during this study. In addition, there were some differences of typological classification of a limited number of artefacts.

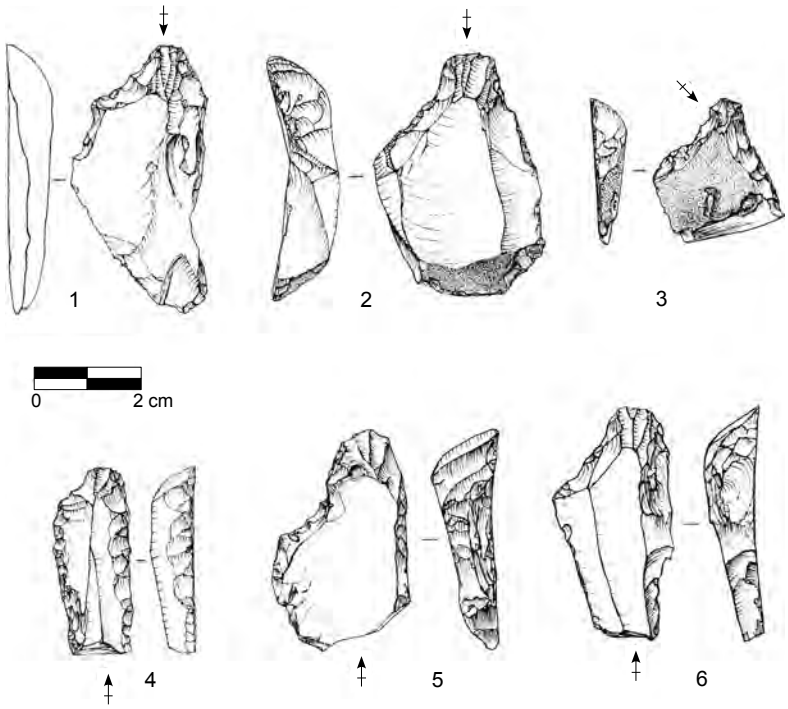


Figure 1. 1-6: nosed endscrapers (illustrations by A.-M. Wittek, ADIA).

including two doubles. Among the 88 identifiable blanks used for their production are 46 blades (including 12 cortical blades, two crested blades and two neo-crested blades), 40 flakes (of which 19 are cortical) and two tablets (Table 1);

- narrow-fronted carinated endscrapers, with a bladelet flaking surface deliberately restricted in width by convergent lateral retouch (Figure 2). 108 were recognised (31.7 % of carinated artefacts), including three doubles. These first two types of carinated endscraper can be tentatively corresponded to different stages of a single bladelet *débitage* process;

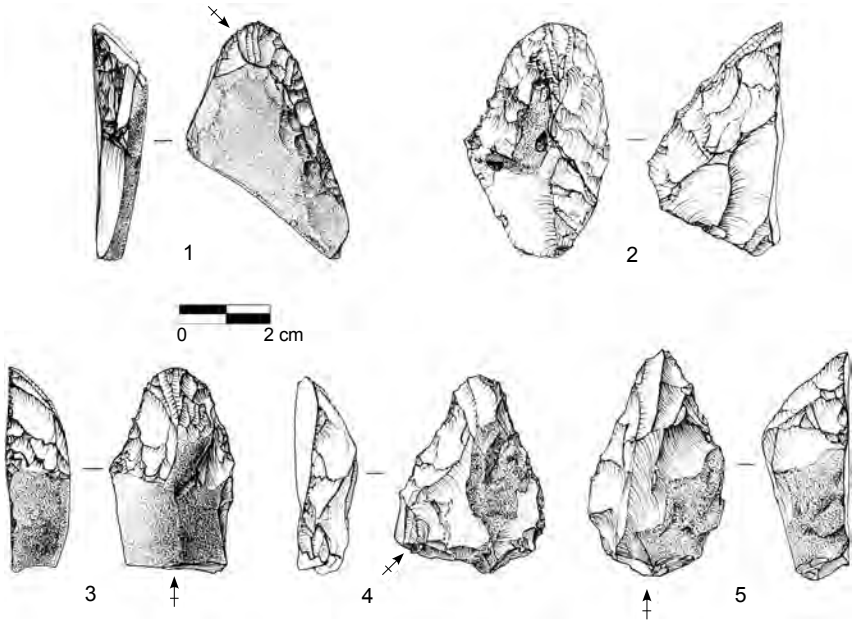


Figure 2. 1 to 5: narrow-fronted carinated endscrapers (illustrations by A.-M. Wittek, ADIA).

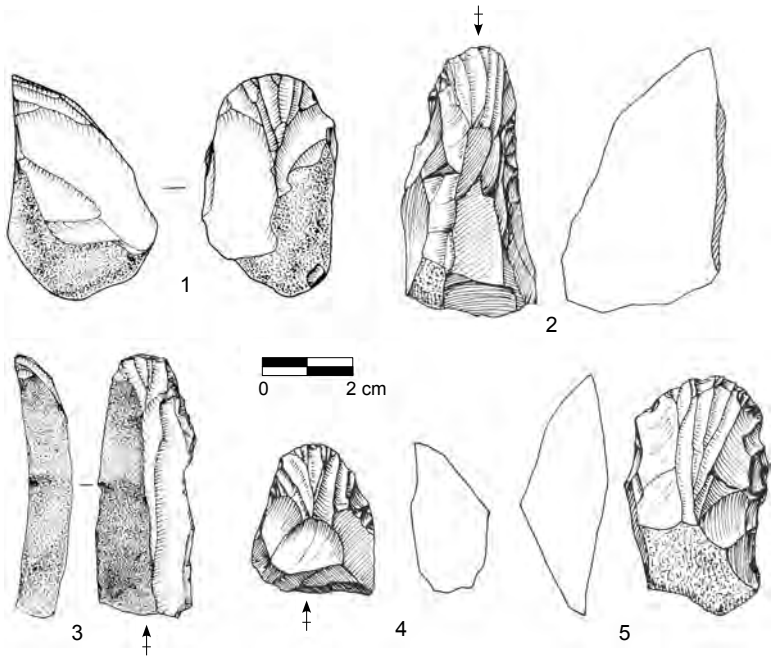


Figure 3. 1-5: carinated endscrapers (1 by D. Flas/A.-M. Wittek, ADIA; 2, 4-5 from Otte, 1979; 3 by A.-M. Wittek, ADIA).

- carinated endscrapers (*stricto sensu*), with a "scraper" edge not restricted by any clear, intentional shaping, and which is therefore often as large as the blank and shows a regular semi-circular shape (Figure 3). 68 pieces were classified in this category (20 % of carinated artefacts) including one double artefact and another associated with a plane (or flat) carinated burin (Vachons type). One artefact that can be considered as a rough-out of a carinated endscraper is also present (SF1: 7), to compare with similar pieces from Tuto de Camalhot (Bon, 2002: 45) and Geißenklösterle (Teyssandier & Liolios, 2003: 187).

2) Carinated burin, with bladelet removals struck from a platform on the edge or at one end of the blank. Three classic types can be distinguished:

- carinated burins (*stricto sensu*) (Figure 4: 1-2), of which there are 21 examples (6.2 % of carinated artefacts) including one double;

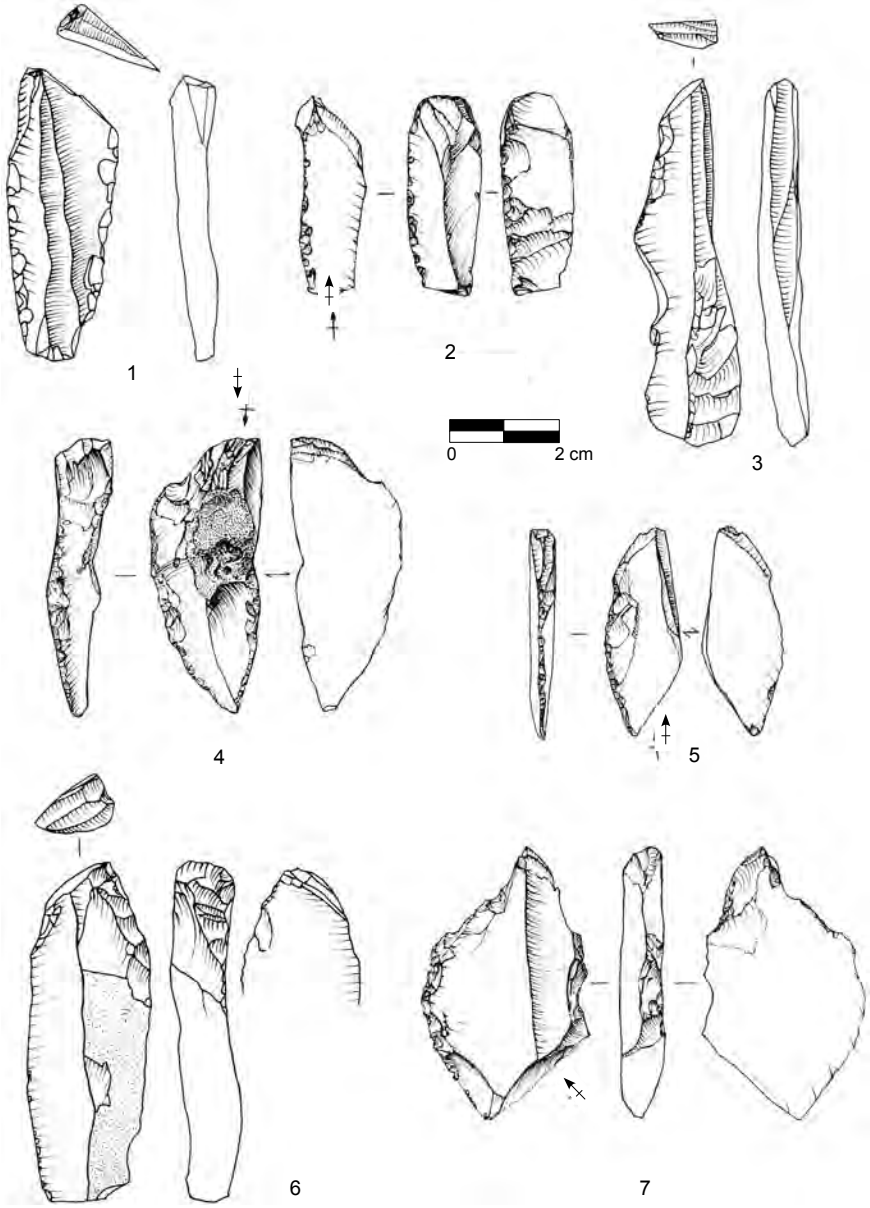


Figure 4. 1-2: carinated burins; 3-7: *burins busqués*
(1, 3 & 6 by F. Le Brun-Ricalens/A.-M. Wittek, ADIA; 2, 4-5 & 7 by A.-M. Wittek, ADIA).

- *burins busqués*; a sub-type of carinated burin characterised by the presence of a notch curtailing the bladelet removals (Figure 4: 3-7). Only 11 typical *burins busqués* were recognised (3.2 % of carinated artefacts). Among those carinated burins included in the above category, eight are close to a *burin busqué* type with similar morphology, but cannot be classified as such due to the absence of a notch;

- plane (or flat) carinated burins, with bladelet removals (and/or adjustment of the bladelet *débitage* surface) on the ventral face (Figure 5), of which there are 32 examples (9.4 % of carinated artefacts), including one double. Some, but not all, correspond to the typological definition of the Vachons burin (Demars & Laurent, 1989: 56-57) and/or to its technological definition (a core yielding straight, pointed bladelets; Pesesse & Michel, 2006; Figure 5: 4-7); others are more simple carinated burins yielding curved and/or twisted bladelets but with bladelet removals lying on the ventral face (Figure 5: 1-2). Four examples belong to a further particular type (Figure 5: 3), with small twisted bladelet removals on the ventral face, reminiscent of the "ogival-rostrate grattoirs" recognised by Breuil in the Aurignacian assemblage from Paviland in Wales (Sollas, 1913; Swainston, 2000: 110-111). This latter type has recently been defined as a "Paviland burin" and described as a particular technique for the production of small, twisted bladelets (Dinnis, 2008, 2013).

*Bladelets*

Any study of the bladelet *débitage* detached from carinated artefacts is hindered by the lack of fine-gauged sieving during most of the excavations. In comparison to the plentiful bladelet cores there are thus very few bladelets, and even fewer retouched examples.

However, by-products and unretouched bladelets corresponding to the different methods of bladelet production described above are

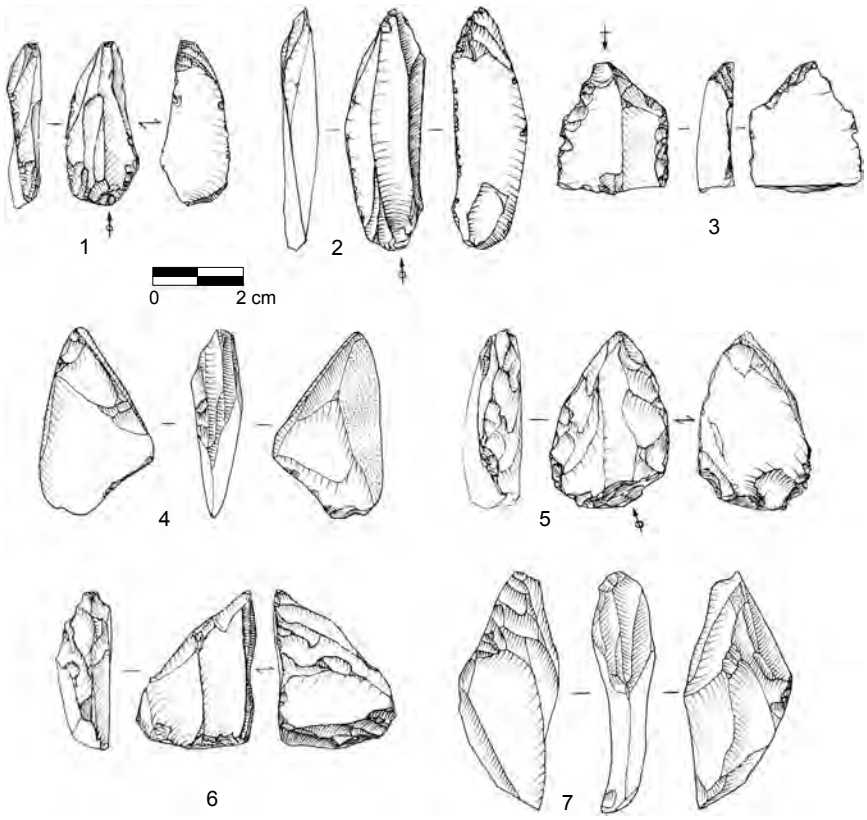


Figure 5. 1-2: plane (or flat) carinated burins; 3: Paviland burin;
4-7: Vachons burins (1-3, 5-6 by A.-M. Wittek, ADIA; 4 & 7 by D. Flas/A.-M. Wittek, ADIA).

present in the assemblage: regular, twisted bladelets; bladelet *débitage* rejuvenation flakes from nosed endscrapers; bladelets bearing a part of the notch deriving from *burin busqué* cores; and bladelets bearing remnants of the ventral face deriving from plane/flat carinated burins (Figure 6).

Even with the presence of these *débitage* pieces, unretouched bladelets are not numerous enough to describe more precisely the characteristics of bladelets produced. Therefore it is necessary to infer morphological and dimensional features of the bladelets themselves from the bladelet *débitage* surfaces of the carinated core artefacts (Figures 7-10; Table 2).

In this way, five different bladelet blank categories can be recognised (Table 2):

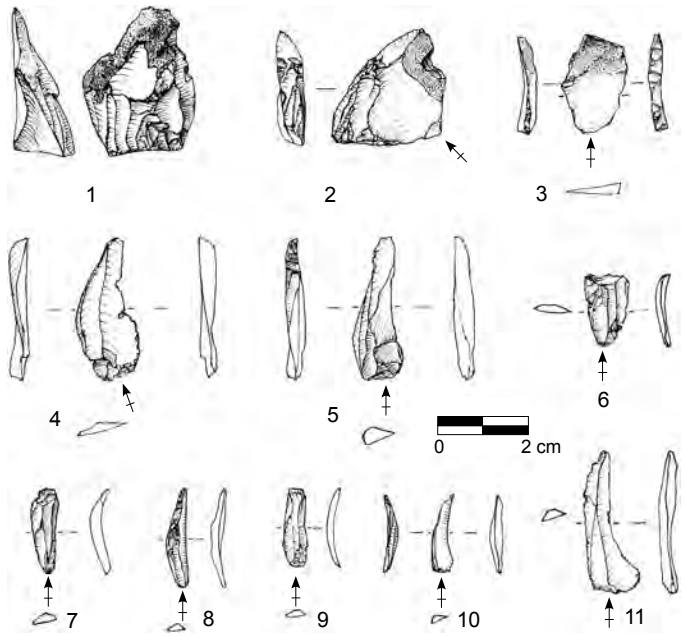


Figure 6. 1-2: bladelet *débitage* rejuvenation flakes from nosed endscrapers; 3: tablet from carinated piece; 4, 10 & 11: bladelets bearing remnants of the ventral face deriving from plane/flat carinated (or Vachons) burins; 5 to 9: bladelets bearing a part of the notch deriving from *burin busqué* cores (illustrations by A.-M. Wittek, ADIA).

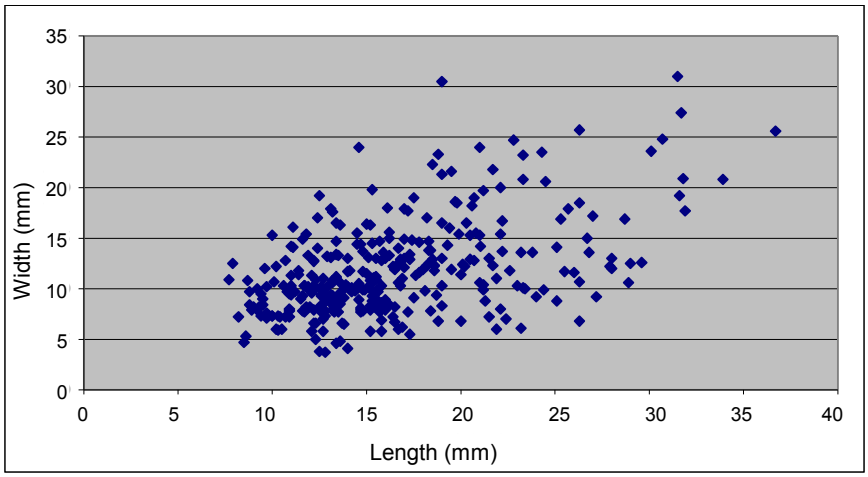


Figure 7. Size of bladelet *débitage* surfaces of carinated pieces (n = 328).

| *Bladelet types* | *Dufour bladelet* | *Nosed scraper* | *Narrow-fronted carinated scraper* | *Carinated scraper* s.s. | *Carinated burin* s.s. | *Plane/flat carinated burin* | Burin busqué | *Total* |
|---|---|---|---|---|---|---|---|---|
| Small curved (7-23 mm) | 0 | 68 | 71 | 52 | 6 | 11 | 0 | 208 |
| Small twisted (9-28 mm) | 0 | 19 | 15 | 5 | 9 | 17 | 5 | 70 |
| Mid-sized rectilinear (20-31 mm) | 0 | 1 | 0 | 0 | 1 | 7 | 0 | 9 |
| Mid-sized curved (25-37 mm) | 3 | 1 | 1 | 10 | 0 | 0 | 0 | 15 |
| Large rectilinear | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

Table 2. The different bladelet production objectives, based on (rare) retouched bladelets and the bladelet removal scars seen on different carinated bladelet core types (299 carinated pieces with legible bladelet removals).

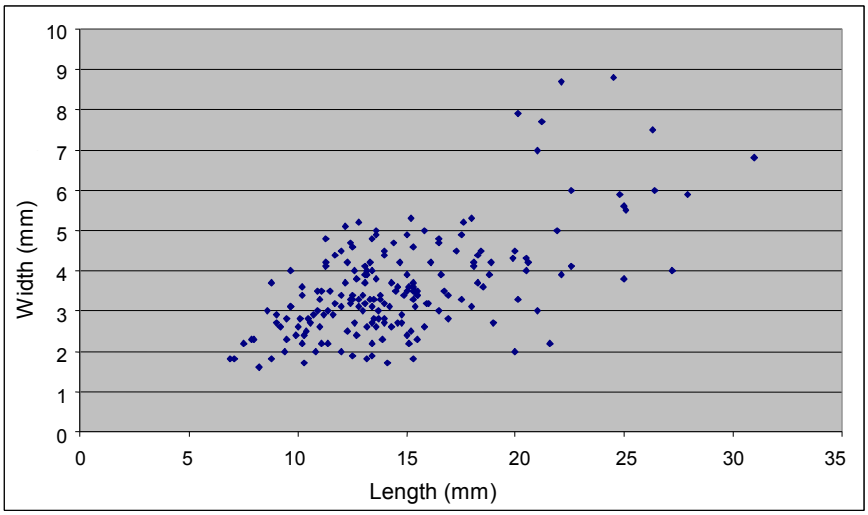


Figure 8. Size of last bladelet removal (n = 189).

- small, curved, non-twisted bladelets, of a length between 7 and 23 mm (Figure 9), ordinarily struck in the middle and along the longitudinal axis of the bladelet *débitage* surface (for example see Figure 1: 1-2). With reference to the final bladelet removal scar on *débitage* surfaces (legible on 299 carinated pieces), this is the most prevalent bladelet type, with 208 carinated artefacts yielding such blanks. This bladelet type has been produced mainly from nosed endscrapers (68 artefacts), narrow-fronted carinated endscrapers (71), and carinated endscrapers (52), and more rarely from carinated burins (6) and plane/flat carinated burins (11);

- small, twisted bladelets. These are less numerous, with the removal scars of this bladelet type recognised on 70 pieces. They derive from all types of carinated artefact, but more commonly from burins rather than endscrapers, and particularly *burins busqués* (Table 2). Of the 43 carinated pieces showing a legible and complete twisted bladelet removal, the majority (84 %; n = 36 of 43) are between 9 and 20 mm in length, with the seven longest being between 20 and 28 mm (Figure 10).

Additionally, carinated burins and *burins busqués* have also yielded small, curved bladelets, sometimes twisted, showing an unretouched back (potential blanks for "Caminade bladelets" [Bordes & Lenoble, 2002; Flas *et al.*, 2006]; "*lamelle de type C*" [Chiotti, 2003]);

- medium-sized, straight bladelets, longer than 20 mm, but never longer than 31 mm. Removal scars of this bladelet type can be observed on one nosed endscraper, one carinated burin, and 7 plane/flat carinated burins (more or less similar to the Vachons burins; *cf.* Pesesse & Michel,

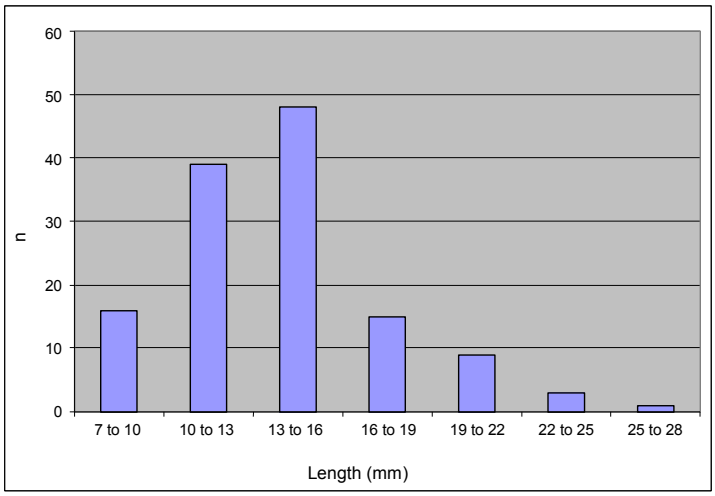


Figure 9. Length of curved bladelet removals.

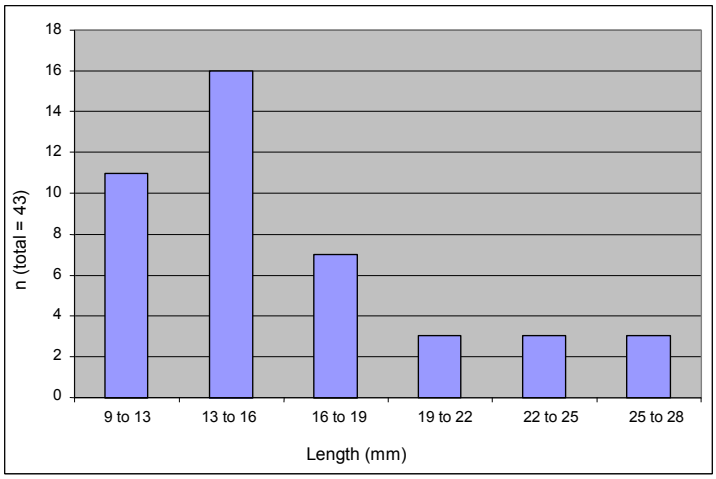


Figure 10. Length of twisted bladelet removals.

2006 for a description of this bladelet production technique);

- medium-sized, curved and non-twisted bladelets, represented by three Dufour bladelets (Figure 11: 1-3) of which only one is complete and has a length of 26.3 mm and a width of 7.7 mm. The two others are proximal fragments with widths of 5.8 mm and 7.1 mm.

This bladelet type derives from those rare carinated endscrapers that have bladelet *débitage* surfaces greater than 25 mm in length (12 artefacts comprising 10 carinated endscrapers, one nosed endscraper and one narrow-fronted carinated endscraper; Figure 3: 1-2, 4-5; Figure 7;

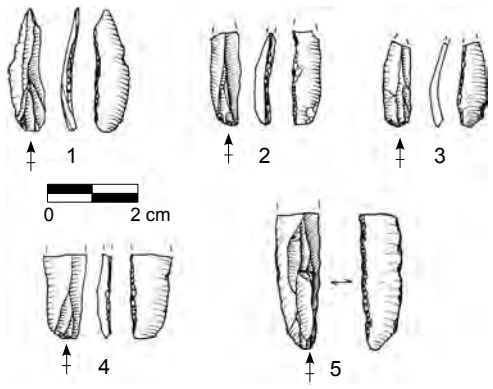


Figure 11. 1-5: Dufour bladelets (Dufour sub-type); 1-3: middle size, curved, non twisted; 4-5: long and straight (1-4 by F. Le Brun-Ricalens/A.-M. Wittek, ADIA; 5 by D. Pesesse/A.-M. Wittek, ADIA).

Figure 9). Although some of these endscrapers have bladelet *débitage* surfaces up to 37 mm in length, none shows complete bladelet removals longer than 28 mm (Figure 9).

- the presence of a long and straight bladelet type is attested to only by two proximal fragments of long Dufour bladelet (Figure 11: 4-5). The first of these is only 17 mm in length, but its width (10 mm) and morphology indicate that its blank was large and straight, and that it would not have been detached from a carinated core but rather from a prismatic bladelet core. The second example is broken in the mesial part and is also 10 mm in width (for 30 mm in preserved length).

There exists two further distal fragments of large retouched bladelets (SF1: 3, 5) but their irregularity and the location of their retouch (inverse on the left edge and direct on the right edge) make them atypical; their Aurignacian attribution is thus uncertain. Similarly, other large retouched bladelets (SF1: 6) are not typologically significant and could belong to other Upper Palaeolithic industries.

In addition, four retouched bladelets compared to "Krems points" by M. Dewez (1969) have been recovered from Spy. These were not taken into account by M. Otte (1979, pers. com.) who doubts their authenticity, and it was not possible to observe them during this study. Even if they are authentic their stratigraphic provenance is unknown (they were collected by an amateur investigator), and their wide, rounded bases certainly make them atypical in comparison with those "Krems" or "Font-Yves" points found in the Proto-Aurignacian (Demars & Laurent, 1989: 107-108). These uncertainties mean that these four artefacts cannot be integrated into the Aurignacian assemblage from Spy.

## Chrono-cultural characterisation of the Spy Aurignacian lithic assemblage

### *Different bladelet production techniques in the Aurignacian chrono-cultural sequence*

Regarding blade production, beyond a general similarity to other Aurignacian assemblages, further attribution to early or late phases of the Aurignacian is not possible. Overall it can be noted, however, that it shares similarities with other Northern European Aurignacian assemblages that seem to correspond chronologically and techno-culturally to a Late Aurignacian (Djindjian, 1993b; Flas, 2004b, 2005, 2006: 206-222).

A similar restriction of interpretation also affects those common (but less chrono-culturally significant) tool types which cannot easily be recognised as Aurignacian. It is possible, however, to underscore the paucity of lateral retouch on blades and on other artefacts. Such lateral retouch is, of course, a feature common to the Early Aurignacian (de Sonneville-Bordes, 1960; Djindjian, 1993a; Bordes, 2006).

Of carinated bladelet-core artefacts, endscrapers considerably outnumber burins, with nosed endscrapers and narrow-fronted carinated endscrapers particularly numerous. Among the carinated burin types, *burins busqués* and plane/flat carinated burins (including pieces similar to Vachons burins and Paviland burins) can be found. Overall, with the exception of some larger carinated endscrapers at Spy, the composition of the carinated lithic assemblage is similar to other Aurignacian assemblages from the Meuse Basin such as Trou du Diable, Grotte de la Princesse Pauline and Goyet (Otte, 1979).

As described above, bladelet production methods have yielded two main blank forms: the majority producing small, curved bladelets (<23 mm in length) and a significant number producing small, twisted bladelets (mostly between 9 mm and 20 mm in length). The first bladelet form derives mostly from endscrapers, and particularly from nosed and narrow-fronted carinated endscrapers. Carinated burins and plane/flat carinated burins have sometimes also yielded such bladelets, but these core types (including the Paviland burins) have mostly been used to produce small, twisted bladelets, similar to those created using the *burin busqué*.

Beyond these two bladelet forms, the production of medium-sized, straight bladelets (between 20 mm and 31 mm in length), similar to those bladelet removals observed on Vachons burins from different French assemblages (Pesesse & Michel, 2006), is witnessed by the morphology of

some carinated artefacts, and particularly that of plane/flat carinated burins.

All of these bladelet forms accord perfectly with late phases of the Aurignacian. Indeed, if we compare with South-Western French Aurignacian sequences, the production of small curved and/or twisted bladelets, particularly from nosed endscrapers and *burins busqués*, characterises the late phases of the Aurignacian[2] (Bordes, 2005, 2006; Michel, 2010)[3]. Moreover, the production of larger, straight bladelets from plane/flat carinated burins (sometimes of the Vachons type) seems to develop during the latest phase of these Aurignacian sequences (Pesesse & Michel, 2006; Aurignacien III according to F. Djindjian [1993a]). In the same way, the presence of four Paviland burins in the Spy collection indicates similarities with the British Late Aurignacian (Dinnis, 2008, 2013).

If the main part of the Spy Aurignacian lithic assemblage accords well with the Late Aurignacian of Western Europe, a minority production of larger bladelets is also attested to: 12 carinated endscrapers yielding bladelets of more than 25 mm in length, and three curved but non-twisted Dufour (sub-type Dufour) bladelets that can be corresponded to this *débitage* technique. These pieces are ordinarily associated with the Early Aurignacian (= Aurignacian I) as it is now recognised in South-Western France (for example: Abri Pataud layers 13 to 11 [Chiotti, 2003], Caminade layers FG, Le Piage layers GI, Corbiac-Vignoble 2, Roc-de-Combe layer 7 [Bordes, 2005, 2006], Brassempouy layer A2, Tuto de Camalhot [Bon, 2002]).

With reference to their size and straightness, two further Dufour bladelet fragments (Figure 11: 4-5) correspond to the retouched bladelets found in the "Proto-Aurignacian"[4]. However, the development of larger retouched bladelets in the latest phase of the Aurignacian should here be noted, for example at Abri Pataud layer 6 (Chiotti, 2003: 144-152) and more generally other assemblages connected to the final phase of the Aurignacian (Pesesse & Michel, 2006; Pesesse, 2008). In an unstratified assemblage such as that from Spy, convergence of artefact form is therefore a key issue.

Due to the issues described above, it is impossible to reconstruct with certainty the original sequence from Spy. Confronted with the Aurignacian lithic assemblage as described here, two main hypotheses can be envisaged, already implicit in Marcel Otte's work (Otte, 1979: 312, 607).

*Diachronic hypothesis*

Based on the chrono-cultural sequence established mainly from sequences of the Aquitaine Region, and on comparisons with smaller and homogeneous Aurignacian assemblages from Northern Europe, the Aurignacian collection from Spy can be viewed as a mixture of different phases of Aurignacian occupation (Table 3).

*Synchronic hypothesis*

If we consider that sequences from different regions are not *a priori* strictly similar but can show clear peculiarities and evolutive rhythms, then the Aurignacian from Spy could be viewed as chrono-culturally homogeneous. It could date somewhere between 33 and 30,000 BP, in agreement with the reliable chronological data available for the Mosan Basin and more generally for the Northwest European Aurignacian (Flas, 2008: 59-69; Dinnis, 2010; Table 3).

This hypothesis would therefore assume a homogeneous origin for the Spy Aurignacian assemblage, despite the absence of precise stratigraphic data and the variety of bladelet production methods and bladelets produced, a feature never observed before in any reliable homogeneous Aurignacian assemblage.

A medium hypothesis would be to consider that there are no clear Early Aurignacian and Proto-Aurignacian elements, but rather two differ-

[2] Similar to Aurignacian II and III *sensu* Demars or Aurignacian IIa and IIb *sensu* Djindjian (1993a).

[3] For example: Pataud layers 8 and 7 lower (Brooks, 1995; Chiotti, 2000, 2003, 2005), Le Flageolet layer 9 (Lucas, 1997), Roc-de-Combe layer 6 and Caminade layer D2 (Bordes & Lenoble, 2002; Bordes, 2005, 2006), Le Facteur layer 19 (Delporte, 1968), La Ferrassie layer K4 and K3 (Djindjian, 1986).

[4] As in Le Piage layer K (Bordes, 2006), Isturitz layer C4d and C4b (Normand & Turq, 2005), the Mediterrannean "Archaic Aurignacian" assemblages (Bon, 2002; Bazile, 2005; Broglio *et al.*, 2005; Ortega Cobos *et al.*, 2005), and, among others, in Grotte du Renne layer VII (Arcy-sur-Cure; Perpère & Schmider, 2002) and at Krems (Teyssandier, 2006).

ent phases of Late Aurignacian in the lithic assemblage from Spy (one with numerous nosed endscrapers, and the second with carinated burins and particularly plane/flat carinated burins of the Vachons type).

potential for reconstituting *a posteriori* the complete corpus of Aurignacian osseous artefacts. One artefact class is, however, an exception: spear points, often considered as *fossiles directeurs* of different Upper Palaeolithic complexes,

| *Phase* | *Abundance* | *Characteristics* | *Comparisons* |
|---|---|---|---|
| Late Aurignacian 2 | minority | Plane/flat carinated burins (including Vachons type), possibly *burins busqués* and Paviland burins | Abri Pataud layer 7 upper and 6, Facteur layer 17 |
| Late Aurignacian 1 | majority | Nosed and narrow-fronted carinated endscrapers yielding small curved and/or twisted bladelets, possibly *burins busqués* and Paviland burins | Abri Pataud 8 and 7 lower, Le Flageolet layer 9, Roc-de-Combe layer 6, Caminade layer D2, Le Facteur layer 19, La Ferrassie layers K4 and K3 |
| Early Aurignacian | rare | Carinated endscrapers yielding curved bladelets longer than 25 mm, three Dufour bladelets, split-based osseous points (*cf. infra*) | Abri Pataud 13-11, Caminade FG, Le Piage GI, Corbiac-Vignoble 2, Roc-de-Combe 7, Brassempouy A2, Tuto de Camalhot |
| Proto-Aurignacian (?) | very rare | two large and straight Dufour bladelets | Le Piage K, base of Isturitz, l'Arbreda H, La Laouza, Esquicho-Grapaou, Arcy layer VII, Fumane |

Table 3. Aurignacian assemblage from Spy cave: hypothetical comparisons (*cf. supra* for the bibliographical references[3, 4]).

To discuss in more detail these two hypotheses, a study of the osseous points is necessary, as well as consideration of recently obtained radiometric data.

## ANALYSIS OF OSSEOUS POINTS

### Methodology and process of analysis

The Aurignacian osseous industry from the *deuxième niveau ossifère* of Spy is one of the richest assemblages in Northern Europe. Unfortunately the absence of precise stratigraphic documentation (see above) severely limits the information that can be gleaned from it; a greater problem than for the lithic assemblage given the comparatively smaller number of osseous artefacts and their less certain chrono-cultural significance. If all osseous artefacts from the *deuxième niveau ossifère* are considered, some pieces (*cf. supra*) demonstrate mixing with later complexes (Gravettian, or even Magdalenian). Recognising these intrusive pieces is particularly difficult as the majority of osseous artefacts types do not have chrono-culturally significant typological and/or technological features. This therefore limits the and used widely for the elaboration of the Upper Palaeolithic chrono-cultural framework. As part of composite hunting weapons (the point being the active part hafted on a wooden handle), spear points relate to a necessary technical and morphological standardisation. Moreover, they show a rapid evolution through time, as dictated by changes in the system of hafting used and therefore transformation of the morphology of the point base. Spear points are thus one of those rare osseous artefact classes that can be positioned in a chrono-cultural sequence (Tartar *et al.*, 2006). A qualitative study of spear points should thus allow the precise chrono-cultural attribution (and homogeneity) of the osseous industry of the *deuxième niveau ossifère* to be determined.

### Inventory of osseous points

M. Otte published two inventories of osseous spear points from Spy (Table 4); the first in the proceedings of the second international symposium on prehistoric bone industry (1977) and the second in his dissertation (1979).

The majority of osseous artefacts from Spy are housed in three museums: Royal Belgian

| *Osseous points from Spy* | *After Otte, 1977* | *After Otte, 1979* |
|---|---|---|
| Aurignac points (= split-based) | 7 | 7 |
| Massive-based points | 7 | 7 |
| Biconical points | 2 | |
| Cut-based point | 1 | |
| Fork-based point | | 1 |
| Fragments | – | 21 |
| *Total* | *17* | *36* |

Table 4. Inventory of osseous points from Spy cave, after M. Otte (1977, 1979).

| *New inventory of osseous points* | *Antler* | *Ivory* |
|---|---|---|
| Double bevelled base points | 2 | |
| Fork-based "point" | 1 | |
| Split-based points | 6 | |
| Massive-based points | | 3 |
| Point rough-outs | 1 | 1 |
| Point fragments | 9 | 9 |
| *Total* | *19* | *13* |

Table 5. Osseous point types studied from Spy by raw material.

Institute of Natural Sciences (RBINS), Royal Museums of Art and History (RMAH) and *Université de Liège* (ULg). In addition, some artefacts are present in the collection of F. Beaufays[5]. These latter artefacts and those housed at the *Université de Liège* were not studied during this work. According to the illustrations of the Spy osseous industry of M. Otte, no osseous points are present in these two collections, with the exception of one artefact in the Beaufays collection for which photographic documentation was available.

The totality of osseous artefacts stored at the RBINS and RMAH were sorted to isolate the weapon tips; a process made easier thanks to M. Otte's documentation aiding identification of artefacts described in his inventories.

However, the artefact counts in our inventory, comprising 32 pieces, differ from those of Otte (Table 5) for several reasons. First, we differed in our typological interpretation of individual artefacts: some pieces selected by M. Otte were omitted during this study, and some included here were not selected by M. Otte. Moreover, our counts include two fragments that were likely not seen by M. Otte, and eight fragments of osseous point included in his inventory could not be located. With reference to Otte's illustrations, these fragments could indeed correspond to mesial and distal parts of points, but do not appear to have clear chrono-cultural characteristics.

[5] The Beaufays collection was still a private collection when we performed this study. It joined the RBINS collections in 2009 (Semal *et al.*, 2009).

## Description of osseous points

*Pieces without context*

- Points with double bevelled base (n = 2)

The first of these two artefacts (no. 28; see Table 6) is a mesio-proximal point fragment with a sub-circular section. It is completely shaped and has a slightly asymmetrical double bevelled base, covered with oblique incisions (or grooves) on both faces, likely applied to ease its hafting. The artefact also shows traces of a secondary use as an *outil intermédiaire* (wedge): deep incisions at the distal part correspond to a mesial fracture of the point; these scars are covered by crushing traces (compression, processing of fibers) that are also present on the proximal end.

The second point (no. 6) is a proximal fragment, with a double bevelled base and a plano-convex section, showing oblique incisions on the upper face and horizontal incisions on the lower face.

The double bevelled base is a hafting aid for points that did not appear before the Gravettian (and persisted until the Magdalenian): this suggests that these fragments derive from levels overlaying the *deuxième niveau ossifère*.

- Fork-based piece (n = 1)

Made from antler, this artefact is 151 mm in length (no. 24; SF1: 8). Its surface has been completely scraped in a somewhat superficial manner, except on the mesial part (close to the proximal end) where more rigorous scraping has created a flat area on both faces. The "fork" (at the proximal part) is similar to adjustments observed on Magdalenian fork-based spear points and *navettes*. Due to restoration, those scars re-

| *Museum collection* | *Number* | *Osseous points from Spy* |
|---|---|---|
| Royal Belgian Institute of Natural Sciences | 1 | Split-based point |
| | 2 | Split-based point |
| | 3 | Split-based point |
| | 4 | Massive-based point |
| | 5 | Ivory point fragment |
| | 6 | Point with double bevelled base |
| | 7 | Ivory pointed fragment |
| | 8 | Ivory pointed fragment |
| | 9 | Ivory point rough-out |
| | 10 | Massive-based point |
| | 11 | Antler point rough-out |
| | 12 | Antler point fragment |
| | 13 | Antler point fragment* |
| | 14 | Antler point fragment |
| | 15 | Ivory pointed fragment |
| | 16 | Antler point fragment |
| | 17 | Antler point fragment |
| | 18 | Ivory pointed fragment |
| | 19 | Massive-based point |
| | 20 | Split-based point |
| | 21 | Antler point fragment |
| Royal Museums of Art and History | 22 | Split-based point |
| | 23 | Antler point fragment |
| | 24 | Fork-based piece |
| | 25 | Antler point fragment |
| | 26 | Ivory pointed fragment |
| | 27 | Ivory pointed fragment |
| | 28 | Point with double bevelled base |
| | 29 | Ivory pointed fragment |
| | 30 | Antler point fragment |
| | 31 | Ivory pointed fragment |
| Beaufays collection (see note 5 page 244) | 32 | Split-based point |

Table 6. New inventory of points/point fragments from Spy cave. The point fragment subjected to radiocarbon sampling (see text) is marked with an asterisk.

lated to the adjustment of the fork cannot be observed, and it is thus not possible to ascertain the process used to create it. Despite its strong curvature M. Otte (1979: 290-291) considered this piece as a spear point, proposing that the point was artificially straightened and only later regained its natural curvature. We consider this explanation unlikely, due to the completely rounded shape of the distal tip and the blank used. Indeed, spear points made of antler are almost always made from baguettes and not from volumetric blanks. Instead, we would compare this piece to Magdalenian *navettes*, likely used as endscraper hafts (Allain *et al.*, 1985).

In fact, according to A. de Loë & E. Rahir (1911: pl. II, no. 8), this artefact comes from the upper level at Spy. As other artefacts from Spy have been classified as Magdalenian, it seems likely that a small Magdalenian occupation went unseen during the excavations (Otte, 1979: 310).

*Artefacts from the* deuxième niveau ossifère

*Antler artefacts*

The typological attribution of an osseous point is based mainly on the morphology of its proximal part. Among the 15 antler points and point fragments identified, six retain at least a por-

tion of their proximal part. All of these correspond to split-based points (or "Aurignac points").

- Split-based points (n = 6)

All six points share a similar thin cross-section (between 4 mm and 6 mm) and a sub-lozangic outline with the greatest width located at the limit of the mesial and proximal parts. Their sections are biconvex (Figure 12: 1-3).

The regularity of their sections and the convergence of their edges testify to a very careful shaping. More pronounced shaping traces (scraping facets) are nonetheless sometimes visible on the edges and/or at the distal tip. It is likely that these correspond to resharpening of broken points.

The longest point (no. 2) is 89 mm in length and 23 mm in width, although as it is broken distally it would obviously have been longer when complete (Figure 12: 1). As only a small modification is visible on one edge, its probable length when complete would have been up to 110 mm. The smallest point, only 40 mm long, is also the only complete artefact (no. 22; Figure 12: 2). Another

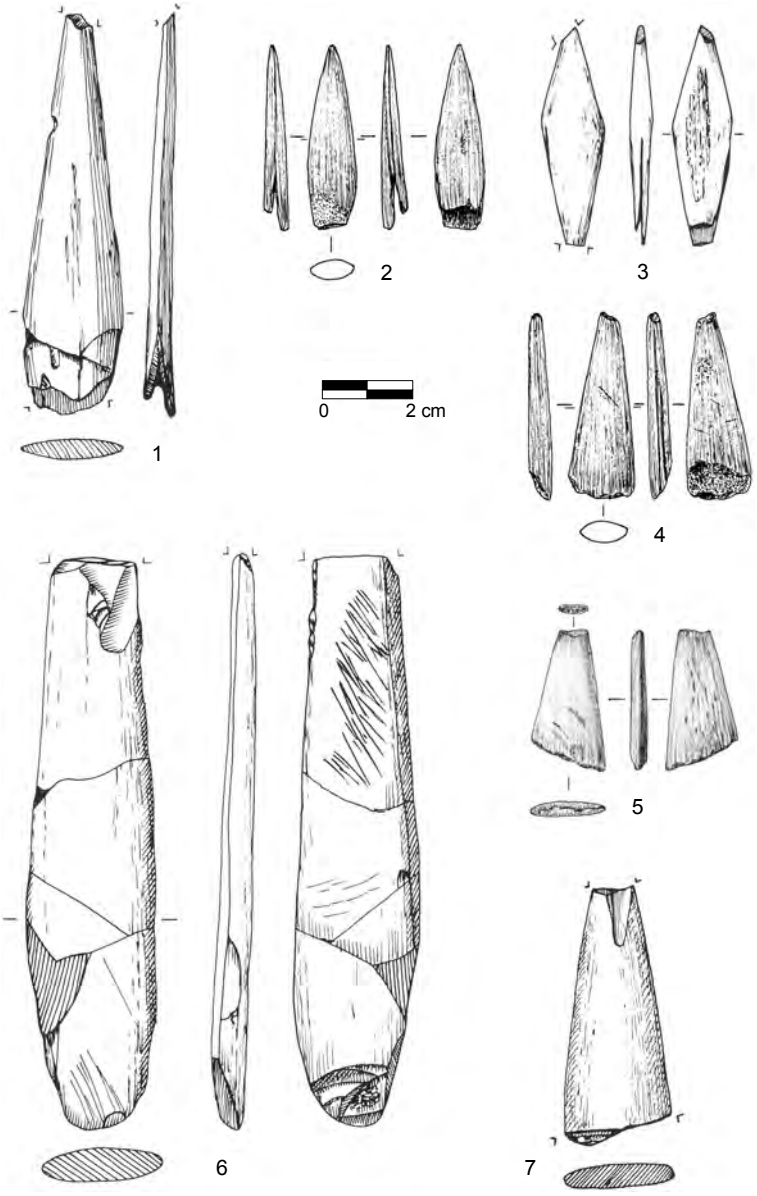


Figure 12. 1-3: split-based points (antler); 4-5: mesial fragments of likely split-based points (antler); 6-7: massive-based points (ivory) (1, 3, 6-7 from Otte, 1979; 2, 4-5 by A.-M. Wittek, ADIA).

artefact (no. 3), missing its distal part, is 49 mm in length, and when complete was likely no longer than 54 mm (Figure 12: 3). These last two pieces show scraping facets on their distal parts and on their edges, suggesting that their small size has resulted from repeated resharpenings.

The lips of the three other split-based points are broken a few millimetres before the base of the central incision. Only one of these (54 mm in length) retains its distal tip (no. 1): the distal tip is missing from the other two examples (nos. 20 & 32) (56 and 54 mm in length respectively).

- Point fragments (n = 9)

Nine point fragments lacking their proximal parts could not normally be classified typologically with precision. However, adjustments made to the proximal part of split-based points result in a characteristic thin cross-section that enables them to be distinguished from other types of point. As stated above, the specimens recognised in the Spy collection also show a very regular biconvex section. These same features can be observed on eight of the nine artefacts lacking their base, thus permitting their very likely allocation to the same split-based point class (Figure 12: 4).

One of these fragments (no. 13; Figure 12: 5) has been radiocarbon dated to 32,830 +200/−190 BP (GrA-32619; see Semal *et al.*, this volume: chapter XVI). This is the first dating of the Aurignacian occupations of Spy cave. It is in agreement with the chronological range of the Northern Europe Aurignacian, and is up to now one of the oldest radiometric dates for this complex in the region (Flas, 2004b, 2008; Dinnis, 2010, 2013)[6]. However, given the C/N ratio of the dated sample (3.6), it is likely a minimum age.

- Rough-out (n = 1)

An antler fragment with convergent edges of 50 mm in length (no. 11) is distinct from other point fragments due to its quadrangular section and its unworked upper face. This artefact is likely a point rough-out discarded during the shaping process.

[6] Isotopic analysis of this point fragment has been undertaken by H. Bocherens *et al.* (this volume: chapter XVII). According to this study the point would be most likely made of cave bear bone. If this is the case, it cannot be a split-based point (which are made of antler), as we propose here. However, due to a lack of isotopic analysis on antler, it is not possible to rule out that this artefact has been made from reindeer antler.

*Ivory artefacts*

- Ivory massive-based points (n = 3)

The first artefact is a mesio-proximal point fragment, 128 mm in length, 29 mm in width and with a thickness of 8 mm (no. 4; Figure 12: 6). Its section is elliptical and its base shows a convex outline. The convergent edges suggest that when complete the artefact would have been longer than 260 mm. On the mesial part of one of its faces a small area with impression traces testifies to its use as a retoucher. Also apparent are numerous oblique incisions of unknown origin.

The second piece is a mesio-proximal point fragment with quadrangular section, 130 mm in length, 20 mm in width and with a thickness of 9 mm (no. 10). The characteristics of its proximal part bear similarity to the artefact described above. Both faces are straight and converge gradually to form a slightly bevelled edge. This edge is covered with numerous transversal incisions, similar to those apparent on the antler bevelled base point described above.

The final point fragment shows somewhat similar characteristics. It is a mesio-proximal fragment, 60 mm in length, 16 mm in width and with a thickness of 7 mm (no. 19). As for the first example it has a quadrangular section and a straight base shaped by the convergence of the two faces. It is nonetheless distinct from the first example, as the incisions are located differently.

- Points and pointed artefacts of indeterminate type (n = 9)

Within this category the most remarkable artefact is a mesio-distal point fragment, 57 mm in length, 23 mm in width, with a thickness of 6 mm, and with a quadrangular section and convergent edges (no. 5; Figure 12: 7). The artefact has clearly been very carefully shaped. The distal tip is broken, and proximally remnants of the piece having been severed by sawing are observable. The artefact is likely resharpening waste; the broken point having been sawn off to salvage the intact part, which could then be reused or reshaped.

Other fragments in this category are very variable in shape and size (nos. 7, 8, 15, 18, 26, 27, 29 and 31). Indeed, it is difficult to ascertain whether they are actually point fragments.

- Rough-out (n = 1)
  An ivory fragment with convergent edges is likely a point rough-out (no. 9); numerous coarse scraping traces suggest that it was discarded during shaping.

**Chrono-cultural characterisation of osseous spear points from Spy cave *deuxième niveau ossifère***

This study of osseous points from Spy cave *deuxième niveau ossifère* confirms the presence of artefacts belonging to different industries. Three artefacts stand out as different from the rest of the assemblage: two points with double bevelled base, a type known from the Gravettian, and an uncommon fork-based piece, likely belonging to the Magdalenian.

The other spear points – six split-based points (14 if the antler point fragments with similar section and thickness are included) and three massive-based points – are consistent with an Aurignacian osseous industry. The split-based point is a strong cultural marker, and moreover the only osseous *fossile directeur* recognised in the assemblage. The presence of split-based points at Spy invites us to propose the presence of an Early Aurignacian phase (= Aurignacian I) as a chrono-cultural hypothesis.

Although the massive-based point type has often been compared to the flat lozange-shape point – a *fossile directeur* of the Aurignacian II according to D. Peyrony[7] – such comparison is inappropriate for the massive-based points from Spy cave. The lozangic points described by D. Peyrony are made from antler whereas the massive-based ones from Spy cave are made from ivory: two raw materials with very different capacities for shaping and bio-mechanical properties. Upper Palaeolithic osseous points are significant cultural markers only if they reflect a real evolution in weapon technology, without interference from the physical properties of different osseous raw materials. Thus, only the antler points can be considered as *fossiles directeurs*, and it should be reiterated here that split-based points are systematically made from antler (Liolios, 2006). Indeed, the creation of the split base is only possible on this material, being much more fissionable than ivory but less so than bone (Liolios, 1999: 90).

The presence of ivory massive-based points is thus not chrono-culturally incompatible with the presence of antler split-based points. Indeed, both are present in the Early Aurignacian from Geißenklösterle (Liolios, 1999).

The osseous point assemblage from Spy cave, with antler split-based points and ivory massive-based points in apparent association, evokes an early phase of the Aurignacian. Its association with a lithic assemblage more reminiscent of the Late Aurignacian would therefore lead us to a diachronic explanation, indicating the presence of several chrono-cultural components within the totality of the Aurignacian assemblage. However, the regional context of this conclusion, the variability of Late Aurignacian lithic industries, and our incomplete knowledge of Late Aurignacian osseous industries, inevitably leave this explanation tentative.

## DISCUSSION

With this reappraisal of the Aurignacian assemblage from Spy cave, it is possible to confirm that the lithic assemblage is in the majority consistent with an attribution to the Late Aurignacian (and more likely to several different phases of the Late Aurignacian). However, some lithic artefacts can also be classified as of an Early Aurignacian type (= Aurignacian I), and two pieces even reminiscent of the Proto-Aurignacian.

In contrast, the osseous assemblage includes antler split-based points, ordinarily considered a chrono-cultural marker of the Early Aurignacian, as well as ivory massive-based points that cannot be related precisely to any particular phase of the Aurignacian.

In the context of available data from Northern Europe, this raises an important issue: Aurignacian lithic assemblages from this region have been most of the time attributed to Late Aurignacian, techno-culturally (i.e. similar to

[7] A massive-based osseous point is merely a point without clear adjusting for hafting, like the "*pointe losangique aplatie*" (flat lozenge-shape point), also named "*simple*", "*pleine*" (solid) or even "*non fendue*" (unsplit) base point.

Aurignacian II and III [or IIa and IIb]; Djindjian, 1993b; Djindjian *et al.*, 1999, 2003; Brou *et al.*, 2013), as well as chronologically. Indeed, very few reliable dates are older than 31-32,000 uncal BP, and none is older than c. 33-34,000 BP (Sachse-Kozłowska, 1978; Hahn, 1989; Street & Terberger, 2000; Flas, 2004b, 2008; Jacobi, 2007; Dinnis, 2010, 2013).

Overall, the contents of the Spy cave Aurignacian lithic and osseous point assemblage necessitate that we return to the two explanatory hypotheses described above (i.e. diachronic or synchronic):

- that the "Early Aurignacian" complex can be found in the Meuse Basin, but has hitherto been underestimated/unrecognised. It can be noted here that in addition to Spy cave four further sites have yielded split-based points (Trou Magrite, Trou Al'Wesse, Trou du Sureau and Goyet; Otte, 1977); or,

- that in this region split-based points persisted in Late Aurignacian assemblages, weakening the chrono-cultural significance generally afforded to these "*fossiles directeurs*".

In favour of the presence of an Early Aurignacian, or even Proto-Aurignacian, in the far North of Europe, we can note the existence of assemblages related to these techno-cultural complexes in neighbouring regions. There is, of course, the Proto-Aurignacian assemblage from Grotte du Renne layer VII at Arcy-sur-Cure (Bon, 2002; Bon & Bodu, 2002), a level that has also yielded ornaments comparable to those from Spy cave *deuxième niveau ossifère* (Otte, 1979; White, 2002; Moreau, 2003). Otherwise, the Trou de la Mère Clochette (Brou, 1997, 2001; Brou *et al.*, 2009; Szmidt *et al.*, 2010), a cave of Rochefort-sur-Nenon (Jura), and the open-air site of Beg-ar-C'hastel (Giot *et al.*, 1975; Monnier, 1980: 419-423), on the North Coast of Brittany, have yielded assemblages with Dufour bladelets of large/medium size, comparable to those found in the Proto-Aurignacian and Early Aurignacian. In the Rhineland, the open-air site of Lommersum – stratigraphically situated in a cold phase below a humiferous horizon (that has been interpreted as corresponding to Denekamp interstadial) and with a spread of $^{14}C$ dates up to 33,500 BP (Hahn, 1989) – shows an industry reminiscent of the Early Aurignacian, including some large carinated endscrapers. An Early Aurignacian occupation in the Meuse Basin is thus not impossible.

Conversely we could consider the association between the split-based points and the Early Aurignacian not as secure as generally claimed (Liolios, 2006: 38-39). Indeed, this point type also exists in other contexts, such as in the Proto-Aurignacian of Arbreda cave layer H (Ortega Cobos *et al.*, 2005: 362) and Arcy-sur-Cure layer VII (Julien *et al.*, 2002). However, it should also be noted that split-based points have never been found in homogeneous Late Aurignacian assemblages.

At Spy, radiocarbon sampling of a spear point fragment, likely a split-based point (see above), gives a measurement of 32,830 +200/-190 uncal BP (GrA-32619). This date is clearly more recent than some of the available radiocarbon dates for the Early Aurignacian in Southern regions (Bon, 2002; Haesaerts & Teyssandier, 2003; Teyssandier *et al.*, 2006; Szmidt *et al.*, 2010) but it is likely a minimum age and is, however, one of the oldest dates for an Aurignacian occupation in Northern Europe (Flas, 2008; Dinnis, 2010, 2013).

We would therefore propose the presence of an Early Aurignacian (= Aurignacian I) phase, before 32,800 uncal BP, with split-based osseous points and a lithic assemblage including non-twisted, medium-sized Dufour bladelets knapped from carinated endscrapers. As these elements of the lithic assemblage are not numerous, it was tentatively a short occupation. The remainder of the Aurignacian assemblage corresponds to one, or more likely several, Late Aurignacian occupation phase(s) (represented by nosed and narrow-fronted carinated endscrapers used to create small bladelets, *burins busqués*, Paviland burins and Vachons burins).

This explanation therefore implies the existence of an Early Aurignacian in the Meuse Basin, but an Early Aurignacian phase that is likely chronologically later than the first phase of the Early Aurignacian in Southern European regions. It is certainly possible that this Northern

European Early Aurignacian phase has hitherto been underestimated as it resulted in the deposition of only few traces of short-term occupations (? hunting camps), traces that have now been mixed with larger Late Aurignacian assemblages during the course of imprecise excavation, as seems to be the case at Spy cave. This could explain the repeated occurrence of Aurignacian assemblages associating split-based osseous points with Late Aurignacian lithic elements, such as typical *burins busqués*, in the Meuse Basin (Otte, 1979).

Finally, the presence of two large and straight Dufour bladelet fragments in the Spy collection, even if too anecdotal to permit any sound conclusion, is a reminder of the issue of the Northern limits of the Proto-Aurignacian, an issue already raised by the assemblage from Beg-ar-C'hastel in Brittany.

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## BIBLIOGRAPHY

ALLAIN J., DESBROSSE R., KOZŁOWSKI J. K. & RIGAUD A., 1985. Le Magdalénien à navettes. *Gallia Préhistoire*, **28** (1): 37-124.

AUBRY T., DETRAIN L. & KERVAZO B., 1995. Les niveaux intermédiaires entre le Gravettien et le Solutréen de l'Abri Casserole (Les Eyzies de Tayac): Mise en évidence d'un mode de production original de microlithes et implications. *Bulletin de la Société préhistorique française*, **92** (3): 296-301.

BAZILE F., 2005. La composante lamellaire dans l'Aurignacien initial de la France méditerranéenne. *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIV$^{e}$ congrès UISPP (Liège, 2001). Luxembourg, ArchéoLogiques, **1**: 325-336.

BON F., 2002. *L'Aurignacien entre Mer et Océan. Réflexion sur l'unité des phases anciennes de l'Aurignacien dans le sud de la France*. Paris, Société préhistorique française, Mémoire **29**: 253 p.

BON F. & BODU P., 2002. Analyse technologique du débitage aurignacien. *In*: B. SCHMIDER (dir.), *L'Aurignacien de la Grotte du renne. Les fouilles d'André Leroi-Gourhan à Arcy-sur-Cure (Yonne)*. Paris, CNRS Éditions, **XXXIV$^{e}$** suppl. à *Gallia Préhistoire*: 115-133.

BORDES J.-G., 2005. La séquence aurignacienne du Nord de l'Aquitaine: variabilité des productions lamellaires à Caminade-Est, Roc-de-Combe, Le Piage et Corbiac-Vignoble II. *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIV$^{e}$ congrès UISPP (Liège, 2001). Luxembourg, ArchéoLogiques, **1**: 123-154.

BORDES J.-G., 2006. News from the West: a reevaluation of the classical Aurignacian sequence of the Périgord. *In*: O. BAR-YOSEF & J. ZILHÃO (ed.), *Towards a Definition of the Aurignacian*. Lisboa, American School of Prehistoric Research/ Instituto Português de Arqueologia, Trabalhos de Arqueologia, **45**: 145-169.

BORDES J.-G. & LENOBLE A., 2002. La "lamelle Caminade": un nouvel outil lithique aurignacien? *Bulletin de la Société préhistorique française*, **99** (4): 735-749.

BROGLIO A., BERTOLA S., DE STEFANI M., MARINI D., LEMORINI C. & ROSSETTI P., 2005. La production lamellaire et les armatures lamellaires de l'Aurignacien ancien de la grotte de Fumane (Monts Lessini, Vénétie). *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIV[e] congrès UISPP (Liège, 2001). Luxembourg, ArchéoLogiques, **1**: 415-436.

BROOKS A. S., 1995. L'Aurignacien de l'abri Pataud, niveaux 6 à 14. *In*: H. M. BRICKER (dir.), *Le Paléolithique supérieur de l'abri Pataud (Dordogne): les fouilles de H. L. Movius Jr., suivi d'un inventaire analytique des sites aurignaciens et périgordiens de Dordogne*. Paris, Éditions de la Maison des Sciences de l'Homme, DAF, **50**: 167-222.

BROU L., 1997. L'industrie aurignacienne du "Trou de la Mère Clochette" à Rochefort-sur-Nenon, Jura. Présentations des données. *In*: A. THEVENIN & A. VILLES (dir.), *Le Paléolithique supérieur de l'Est de la France: de l'Aurignacien à l'Ahrensbourgien*. Actes du colloque interrégional sur le Paléolithique de Chaumont (Chaumont, 17-18 septembre 1994), Mémoire de la Société Archéologique Champenoise, **13**: 15-35.

BROU L., 2001. Résultats des datations $^{14}$C AMS réalisées sur le mobilier osseux aurignacien du gisement du "Trou de la Mère Clochette", commune de Rochefort-sur-Nenon, Jura. *In*: P. BODU, F. BON & L. BROU (coord.), *Le Paléolithique supérieur ancien au centre et au sud du Bassin parisien. "Des systèmes techniques aux comportements"*. Projet Collectif de Recherche, Équipe d'Ethnologie Préhistorique: 52-57.

BROU L., LE BRUN-RICALENS F., LÖHR H., ZIESAIRE P. & GRIETTE M., 2013. Quid de l'Aurignacien entre les Vosges et l'Ardenne-Eifel? *In*: P. BODU, L. CHEHMANA, L. KLARIC, L. MEVEL, S. SORIANO & N. TEYSSANDIER (ed.), *Le Paléolithique supérieur ancien de l'Europe du Nord-Ouest. Réflexions et synthèses à partir d'un projet collectif de recherche sur le centre et le sud du Bassin parisien*. Actes du Colloque européen de Sens (15-18 avril 2009). Paris, Mémoire de la Société préhistorique française, **56**: 365-384.

BROU L., SZMIDT C. C. & FLOSS H., 2009. Quand du Magdalénien devient de l'Aurignacien. *In*: J.-L. MORDEFROY (ed.), *Les Recherches de Julien Feuvrier (1851-1936), Historien, Archéologue, Archiviste et Conservateur du Musée. Dole et sa Région, de la Préhistoire au 18[e] siècle*. Musée des Beaux-Arts de Dole, Édition des Amis des musées du Jura: 65-71.

CHADELLE J.-P., 2005. Productions "intriquées" de lames et de lamelles dans l'Aurignacien de Champ-Parel locus 3 (Bergerac, Dordogne). *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIV[e] congrès UISPP (Liège, 2001). Luxembourg, ArchéoLogiques, **1**: 193-208.

CHAZAN M., 2001. Bladelet Production in the Aurignacian of Hayonim Cave, Israel. *Paléorient*, **27** (1): 81-88.

CHIOTTI L., 2000. Lamelles Dufour et grattoirs aurignaciens (carénés et à museau) de la couche 8 de l'abri Pataud, Les Eyzies-de-Tayac, Dordogne. *L'Anthropologie*, **104**: 239-263.

CHIOTTI L., 2003. Les productions lamellaires dans l'Aurignacien de l'abri Pataud, Les Eyzies-de-Tayac (Dordogne). *Gallia Préhistoire*, **45**: 113-156.

CHIOTTI L., 2005. La production lamellaire du niveau 8 (Aurignacien évolué) de l'abri Pataud (Les Eyzies-de-Tayac, Dordogne, France). *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIV[e] congrès UISPP (Liège, 2001). Luxembourg, ArchéoLogiques, **1**: 227-243.

DE LOË A. & RAHIR E., 1911. Nouvelles fouilles à Spy, Grotte de la Betche-aux-Rotches. *Bulletin de la Société d'Anthropologie de Bruxelles*, **30**: 40-58.

DELPORTE H., 1968. L'abri du Facteur à Tursac (Dordogne). *Gallia Préhistoire*, **11** (1): 1-112.

DEMARS P.-Y. & LAURENT P., 1989. *Types d'outils lithiques du Paléolithique supérieur en Europe*. Paris, CNRS Editions: 165 p.

DE PUYDT M. & LOHEST M., 1887. L'homme contemporain du Mammouth à Spy (Namur). *Annales de la Fédération archéologique et historique de Belgique, Compte rendu des travaux du Congrès tenu à Namur les 17-19 août 1886*, **2**: 207-240, 10 pl. h.t.

DE SONNEVILLE-BORDES D., 1960. *Le Paléolithique supérieur en Périgord*. Bordeaux, Delmas, 2 vol.: 558 p.

DE SONNEVILLE-BORDES D., 1961. Le Paléolithique supérieur en Belgique. *L'Anthropologie*, **65** (5-6): 421-443.

DEWEZ M., 1969. Pointes à deux bords abattus de la Grotte de Spy. *Bulletin de la Société préhistorique française*, **66** (1): 19-22.

DINNIS R., 2008. On the technology of late Aurignacian burin and scraper production, and the importance of the Paviland lithic assemblage and the *Paviland burin*. *Lithics: The Journal of the Lithic Studies Society*, **29**: 18-35.

DINNIS R., 2010. *Understanding the British Aurignacian*. Unpublished Ph.D. Dissertation, University of Sheffield, 2 vol.: 287 p., 151 pl.

DINNIS R., 2013. L'Aurignacien de Grande Bretagne. *In*: P. BODU, L. CHEHMANA, L. KLARIC, L. MEVEL, S. SORIANO & N. TEYSSANDIER (ed.), *Le Paléolithique supérieur ancien de l'Europe du Nord-Ouest. Réflexions et synthèses à partir d'un projet collectif de recherche sur le centre et le sud du Bassin parisien*. Actes du Colloque européen de Sens (15-18 avril 2009). Paris, Mémoire de la Société préhistorique française, **56**: 473-484.

DJINDJIAN F., 1993a. L'Aurignacien du Périgord. Une révision. *Préhistoire Européenne*, **3**: 29-54.

DJINDJIAN F., 1993b. Les origines du peuplement aurignacien en Europe. *In*: L. BANESZ & J. K. KOZŁOWSKI (ed.), *Aurignacien en Europe occidentale et au Proche-Orient.* Actes du XII[e] Congrès International des Sciences Préhistoriques et Protohistoriques. Bratislava, Institut Archéologique de l'Académie Slovaque des Sciences: 136-154.

DJINDJIAN F., KOZŁOWSKI J. K. & BAZILE F., 2003. Europe during the Early Upper Paleolithic (40 000-30 000 BP): a synthesis. *In*: J. ZILHÃO & F. D'ERRICO (ed.), *The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications.* Proceedings of Symposium 6.1 of the XIVth Congress of the UISPP (Liège, 2001). Lisboa, Trabalhos de Arqueologia, **33**: 29-47.

DJINDJIAN F., KOZŁOWSKI J. & OTTE M., 1999. *Le Paléolithique Supérieur en Europe*. Paris, Armand Collin.

FLAS D., 2004a. Technologie du débitage laminaire. *In*: R. MILLER, P. HAESAERTS & M. OTTE (dir.), *L'atelier de taille aurignacien de Maisières-Canal (Belgique)*. Liège, ERAUL, **110**: 85-100.

FLAS D., 2004b. L'atelier de débitage de Maisières dans le contexte de l'Aurignacien du Nord-Ouest de l'Europe. *In*: R. MILLER, P. HAESAERTS & M. OTTE (dir.), *L'atelier de taille aurignacien de Maisières-Canal (Belgique)*. Liège, ERAUL, **110**: 113-120.

FLAS D., 2005. Nouvelles datations de deux ensembles aurignaciens du bassin mosan. *Anthropologica et Praehistorica*, **116**: 233-236.

FLAS D., 2006. *La transition du Paléolithique moyen au supérieur dans la plaine septentrionale de l'Europe. Les problématiques du Lincombien-Ranisien-Jerzmanowicien*. Thèse de doctorat inédite, Université de Liège, 2 vol.: 370 p., 315 pl.

FLAS D., 2008. La transition du Paléolithique moyen au supérieur dans la plaine septentrionale de l'Europe. Bruxelles, *Anthropologica et Præhistorica,* **119**: 254 p.

FLAS D., MILLER R. & JACOBS B., 2007. Les "burins" de l'atelier de débitage aurignacien de Maisières-Canal (Province du Hainaut, Belgique). *In*: M. DE ARAUJO IGREJA, J.-P. BRACCO & F. LE BRUN-RICALENS (ed.), *Burins préhistoriques: formes, fonctionnements, fonctions*. Actes de la Table Ronde d'Aix-en-Provence (3-5 mars 2003). Luxembourg, MNHA, ArchéoLogiques, **2**: 55-74.

GIOT P., TALEC L., MONNIER J.-L. & ALLARD M., 1975. Le Paléolithique supérieur du pays de Léon (Finistère). Le gisement de Beg-ar-C'hastel en Kerlouan. *L'Anthropologie*, **79** (1): 39-79.

GOUÉDO J.-M., LECOLLE F. & DRWILA G., avec la collab. de DEGUILLAUME S., FRENÉE E., LEROYER C., LIMONDIN N. & BARROIS B., 1996. Le gisement aurignacien de plein air d'Herbeville-le-Murger (Yvelines). Bilan des fouilles 1991-1992. *L'Anthropologie*, **100** (1): 15-41.

HAESAERTS P. & TEYSSANDIER N., 2003. 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. *In*: J. ZILHÃO & F. D'ERRICO (ed.), *The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications.* Proceedings of Symposium 6.1 of the XIVth Congress of the UISPP (Liège, 2001). Lisboa, Trabalhos de Arqueologia, **33**: 133-151.

HAHN J., 1977. *Aurignacien. Das ältere Jungpaläolithikum im Mittel- und Osteuropa*. Köln, Wien, Böhlau Verlag: 355 p., 187 pl.

HAHN J., 1989. *Genese und Funktion einer jungpaläolithischen Freilandstation: Lommersum im Rheinland*. Köln, Rheinische Ausgrabungen, **29**: 315 p.

JACOBI R., 2007. A collection of Early Upper Palaeolithic artefacts from Beedings, near Pulborough, West Sussex and the context of similar finds from the British Isles. *Proceedings of the Prehistoric Society*, **73**: 229-325.

JARDÓN GINER P., 2007. Mitoc-Malu Galben: analyse fonctionnelle et techno-économique de grattoirs aurignaciens. *In*: M. OTTE, V. CHRICA & P. HAESAERTS (dir.), *L'Aurignacien et le Gravettien de Mitoc-Malu Galben (Moldavie roumaine)*. Liège, ERAUL, **72**: 137-141.

JULIEN M., BAFFIER D. & LIOLIOS D., 2002. L'outillage en matières dures animales. *In*: B. SCHMIDER (dir.), *L'Aurignacien de la grotte du Renne. Les fouilles d'André Leroi-Gourhan à Arcy-sur-Cure (Yonne)*. Paris, CNRS Éditions, **XXXIV**e suppl. à *Gallia Préhistoire*: 217-250.

LE BRUN-RICALENS F., 1993. Réflexions préliminaires sur le comportement litho-technologique et l'occupation du territoire du pays des Serres à l'Aurignacien: le gisement de "Toulousète" à Beauville (Lot-et-Garonne), une occupation moustérienne et aurignacienne de plein air. *Paléo*, **5**: 127-153.

LE BRUN-RICALENS F., BORDES J.-G. & BON F. (ed.), 2005. *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIVe congrès UISPP (Liège, septembre 2001). Luxembourg, ArchéoLogiques, **1**: 568 p.

LE BRUN-RICALENS F., BORDES J.-G. & EIZENBERG L., 2009. A crossed-glance between southern European and Middle-Near Eastern early Upper Palaeolithic lithic technocomplexes: Existing models, new perspectives. *In*: M. CAMPS & C. SZMIDT (ed.), *The Mediterranean from 50 000 to 25 000 BP: Turning Points and New Directions*. Oxford, Oxbow Books: 11-34.

LE BRUN-RICALENS F., BRACCO J.-P. & BROU L., 2006. Burins carénés, grattoirs carénés et formes associées: un retournement! *In*: M. DE ARAUJO IGREJA, J.-P. BRACCO & F. LE BRUN-RICALENS (ed.), *Burins préhistoriques: formes, fonctionnements, fonctions*. Actes de la Table Ronde d'Aix-en-Provence (3-5 mars 2003). Luxembourg, MNHA, ArchéoLogiques, **2**: 345-376.

LE BRUN-RICALENS F. & BROU L., 2003. Burins carénés-nucléus à lamelles: identification d'une chaîne opératoire particulière à Thèmes (Yonne) et implications. *Bulletin de la Société préhistorique française*, **100** (1): 67-83.

LIOLIOS D., 1999. *Variabilité et caractéristiques du travail des matières osseuses au début de l'Aurignacien*. Thèse de doctorat inédite, Université de Paris X, Nanterre: 352 p.

LIOLIOS D., 2006. Reflections on the role of bone tools in the definition of the Early Aurignacian. *In*: O. BAR-YOSEF & J. ZILHÃO (ed.), *Towards a Definition of the Aurignacian*. Lisboa, American School of Prehistoric Research/Instituto Português de Arqueologia, Trabalhos de Arqueologia, **45**: 37-51.

LUCAS G., 1997. Les lamelles Dufour du Flageolet I (Bézenac, Dordogne), dans le contexte aurignacien. *Paléo*, **9**: 191-219.

MICHEL A., 2010. *L'Aurignacien récent (post-ancien) dans le Sud-Ouest de la France: variabilité des productions lithiques. Révision taphonomique et techno-économique des sites de Caminade-Est, abri Pataud, Roc-de-Combe, Le Flageolet I, La Ferrassie et Combemenue*. Thèse de doctorat inédite, Université de Bordeaux I, Bordeaux: 600 p.

MONNIER J.-L., 1980. *Le Paléolithique de la Bretagne dans son cadre géologique*. Université de Rennes, Laboratoire d'Anthropologie: 607 p.

MOREAU L., 2003. Les éléments de parure au Paléolithique supérieur en Belgique. *L'Anthropologie*, **107** (5): 603-614.

NORMAND C. & TURQ A., 2005. L'Aurignacien de la grotte d'Isturitz (France): la production lamellaire dans la séquence de la salle Saint-Martin. *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIVe congrès UISPP (Liège, septembre 2001). Luxembourg, ArchéoLogiques, **1**: 375-392.

ORTEGA COBOS D., SOLER MASFERER N. & MAROTO GENOVER J., 2005. La production des lamelles pendant l'Aurignacien archaïque dans la grotte de l'Arbreda: organisation de la production, variabilité des méthodes et des objectifs. *In*: F. LE BRUN-RICALENS, J.-G. BORDES & F. BON (ed.), *Productions lamellaires attribuées à l'Aurignacien. Chaînes opératoires et perspectives technoculturelles*. Actes du XIVe congrès UISPP (Liège, septembre 2001). Luxembourg, ArchéoLogiques, **1**: 359-373.

OTTE M., 1977. Les sagaies de l'Aurignaco-Périgordien en Belgique. *In*: *Méthodologie appliquée à l'industrie de l'os préhistorique*. Paris, CNRS Éditions: 193-203.

OTTE M., 1979. *Le Paléolithique supérieur ancien en Belgique*. Bruxelles, Musées royaux d'Art et d'Histoire, Monographies d'archéologie nationale, **5**: 684 p.

PERPÈRE M. & SCHMIDER B., 2002. L'outillage lithique. *In*: B. SCHMIDER (dir.), *L'Aurignacien de la grotte du Renne. Les fouilles d'André Leroi-Gourhan à Arcy-sur-Cure (Yonne)*. Paris, CNRS Éditions, **XXXIV**e suppl. à *Gallia Préhistoire*: 143-195.

PESESSE D., 2008. *Les premières sociétés gravettiennes, Analyse comparée des systèmes lithiques de la fin de l'Aurignacien aux débuts du Gravettien*. Thèse de doctorat inédite, Université de Provence, Aix-en-Provence: 278 p.

PESESSE D. & MICHEL A., 2006. Le burin des Vachons: apports d'une relecture technologique à la compréhension de l'Aurignacien récent du nord de l'Aquitaine et des Charentes. *Paléo*, **18**: 143-160.

SACHSE-KOZŁOWSKA E., 1978. Polish Aurignacian Assemblages. *Folia Quaternaria*, **50**: 1-37.

SEMAL P., JUNGELS C., CREVECOEUR I., ROUGIER H. & PIRSON P., 2009. Acquisition de la collection de Spy de François Beaufays (dit "l'Horloger") par l'Institut Royal des Sciences Naturelles de Belgique. *Notae Praehistoricae*, **29**: 157-164.

SOLLAS W. J., 1913. *Paviland Cave: An Aurignacian Station in Wales*. London, Royal Anthropological Institute of Great Britain and Ireland: 50 p. (first published in *Journal of the Royal Anthropological Institute*, **43**: 325-374).

SORIANO S., 1998. La production de lamelles torses dans les niveaux du Paléolithique supérieur ancien d'Umm el Tlel (Syrie). Exploration théorique et expérimentale de ses modalités. *In*: M. OTTE (dir.), *Préhistoire d'Anatolie. Genèse de deux mondes*. Liège, ERAUL, **85**, vol. 2: 731-748.

STREET M. & TERBERGER T., 2000. The German Upper Palaeolithic 35,000 - 15,000 BP. New dates and insights with emphasis on the Rhineland. *In*: W. ROEBROEKS, M. MUSSI, J. SVOBODA & K. FENNEMA (ed.), *Hunters of the Golden Age. The mid Upper Palaeolithic of Eurasia 30 000-20 000 BP*. University of Leiden: 281-297.

SWAINSTON S., 2000. The lithic artefacts from Paviland. *In*: S. ALDHOUSE-GREEN (ed.), *Paviland Cave and the "Red Lady". A Definitive Report*. Bristol, Western Academic & Specialist Press: 95-113.

SZMIDT C. C., BROU L. & JACCOTTEY L., 2010. Direct radiocarbon (AMS) dating of split-basedd points from the (Proto)Aurignacian of Trou de la Mère Clochette, Northeastern France. Implications for the characterization of the Aurignacian and the timing of technical innovations in Europe. *Journal of Archaeological Science*, **37** (12): 3320-3337.

SZMIDT C. C., NORMAND C., BURR G. S., HODGINS G. W. L. & LAMOTTA S., 2010. AMS 14C dating the Proto-Aurignacian/Early Aurignacian of Isturitz, France. Implications for Neanderthal-modern human interaction and the timing of technical and cultural innovations in Europe. *Journal of Archaeological Science*, **37** (4): 758-768.

TARTAR É., TEYSSANDIER N., BON F. & LIOLIOS D., 2006. Équipement de chasse, équipement domestique: une distinction efficace? Réflexion sur la notion d'investissement technique dans les industries aurignaciennes. *In*: L. ASTRUC, F. BON, V. LÉA, P.-Y. MILCENT & S. PHILIBERT (dir.), *Normes techniques et pratiques sociales. De la simplicité des outillages pré- et protohistotiques*. XXXVIe rencontres internationales d'Archéologie et d'Histoire d'Antibes. Antibes, Éditions APDCA: 107-117.

TEYSSANDIER N., 2003. *Les débuts de l'Aurignacien en Europe. Discussion à partir des sites de Geissenklösterle, Willendorf II, Krems-Hundssteig et Bacho-Kiro*. Thèse de doctorat inédite, Université de Paris X, Nanterre: 333 p.

TEYSSANDIER N., 2006. Questioning the first Aurignacian: mono or multi cultural phenomenon during the formation of the Upper Paleolithic in Central Europe and the Balkans. *Anthropologie*, **44** (1): 9-29.

TEYSSANDIER N., BOLUS M. & CONARD N. J., 2006. The Early Aurignacian in central Europe and its place in a European perspective. *In*: O. BAR-YOSEF & J. ZILHÃO (ed.), *Towards a Definition of the Aurignacian*. Lisboa, American School of Prehistoric Research/Instituto Português de Arqueologia, Trabalhos de Arqueologia, **45**: 241-256.

TEYSSANDIER N. & LIOLIOS D., 2003. Defining the earliest Aurignacian in the Swabian Alp: the relevance of the technological study of the Geissenklösterle (Baden-Württemberg, Germany) lithic and

organic productions. *In*: J. ZILHÃO & F. D'ERRICO (ed.), *The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications*. Actes du XIV[e] Congrès de l'UISPP (Liège, septembre 2001). Lisboa, Trabalhos de Arqueologia, **33**: 179-196.

TIXIER J., 1991. Et passez au pays des silex: rapportez-nous des lames! *In*: *25 ans d'études technologiques en Préhistoire. Bilans et perspectives*. 11[e] Rencontres Internationales d'Archéologie et d'Histoire d'Antibes. Juan-les-Pins, Éditions APDCA: 235-242.

VANHAEREN M. & D'ERRICO F., 2006. Aurignacian ethno-linguistic geography of Europe revealed by personal ornaments. *Journal of Archaeological Science*, **33** (8): 1105-1128.

WHITE R., 2002. Observations technologiques sur les objets de parure. *In*: B. SCHMIDER (dir.), *L'Aurignacien de la grotte du Renne. Les fouilles d'André Leroi-Gourhan à Arcy-sur-Cure (Yonne)*. Paris, CNRS Éditions, **XXXIV[e]** suppl. à *Gallia Préhistoire*: 257-270.

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