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AURIGNACIAN GENIUS

Art, Technology and Society of the First Modern Humans in Europe



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INTRODUCTION

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This volume is the outcome of an ambitious three-year program of educational and research exchanges between students and faculty of the *Center for the Study of Human Origins* at *New York University* (CSHO), allied with the *Center for International Research in the Humanities and Social Sciences* (CIRHUS - UMI 3199 CNRS-NYU), and the *CNRS-UMR 5608 TRACES* at the *Université Toulouse Jean Jaurès*. The collaboration has been generously funded by the *Partner University Fund* (PUF) with the help of additional contributions to that fund by the *Mellon Foundation*. The goal of the PUF is to foster collaboration and exchange between French and American researchers and students.

The current set of papers results from the PUF-funded international symposium held in New York in April, 2013 entitled, *Aurignacian Genius: Art, daily life and social identity of the first modern humans in Europe*. Because of the nature of the PUF enterprise, there was a predominately French presence within the *Aurignacian Genius* project. In order to broaden the geographic scope of researchers (Floss *et al.*; Álvarez; Garate *et al.*) and subjects at the symposium, we sought and received additional funding from CSHO at *New York University*. While the geographic scope of the symposium and the resulting volume of papers still lacks a certain geographic breadth, it was the best that could be accomplished with the resources available.

The focus of this collaboration and of the current set of papers is the Aurignacian phenomenon (ca. 43 000 to 33 000 BP cal.), a remarkable set of innovations that permitted modern *Homo sapiens* to replace the longstanding and successful populations of Neandertals across a vast area extending from the Arabian Peninsula and Central Asia in the East, to the area of France and the Iberian Peninsula in the West (Bon; Tryon). These new developments constitute what in Western Eurasia is known as the Middle to Upper Paleolithic transition.

Although there are some isolated glimmerings of modern human behavior among Neandertals and among Modern Human ancestors in Africa and the Near East extending back 100 000 years or more, the European Aurignacian saw a veritable explosion of innovations as it expanded northward and westward in the hands (and minds) of the first members of our species to set foot in Europe. In a zone extending through France, Germany, Belgium, Spain, Italy, Romania, the Czech Republic, Austria and European Russia, Aurignacians left behind a remarkable record of esthetic genius in the form of engraving, painting, stone and ivory sculpture (Floss), personal ornamentation and decorated clothing.

Like an old fashioned photograph, our knowledge of the Aurignacians has been "developing" over the past century with some elements being clearly in focus and others still emerging. Intense scholarly interest has relied heavily on an archeological record recovered decades ago when most important sites relevant to an understanding of this important cultural / biological threshold were excavated by means of techniques that did not allow for precise spatial and stratigraphic plotting of recovered artifacts. Fine-grained recovery was not practised. Early archeologists were also highly selective in the artifacts that they kept, and which constitute existing research collections. These highly subjective samples of artifacts are inappropriate for many modern forms of analysis (for example the detailed study of the spatial organization of activities across ancient campsites).

The slowly emerging image of the Aurignacians has been accelerated in recent years by the application of a wide range of new methods in archeology, in the context of new, longterm excavations and analyses of newly discovered painted caves (Fritz and Tosello; Garate *et al.*; Petrognani; Sauvet). A new generation of young and dynamic researchers, well represented in this volume, is dramatically changing our understanding of the Aurignacians.

With the aid of modern fine-grained recovery techniques and the study of reduction sequences and spatial distributions of artifacts, even our understanding of Aurignacian lithic and osseous technology and the way it is organized within sites and across regions, is being reconsidered (Chiotti *et al.*; Flas; Tartar). In addition, the more than thirty ^{14}C dates obtained in the course of the PUF project are beginning to chip away at some old assumptions about directional change through time.

Aurignacian weapon systems, using antler and stone projectiles, were characterized by ingenious fabrication and hafting systems for arming the tips of spears. Now much better understood thanks to ÉliseTartar's work in the *Aurignacian Genius* project (Tartar), the technological logic underlying Aurignacian split-based point technology remains puzzling.

The Aurignacians met the challenge of cold, glacial conditions with innovations in fire technology that included pit fireplaces lined with heat-reflecting stone slabs and fuelled with fat-containing bones and resinous woods. These fire features seem to have been the focal point for Aurignacian technical and social action. In some cases, such as at Abri Castanet, these fire features appear to have been sheltered behind draperies of skin, anchored by cords to free-standing stone blocks and to the overhang ceilings of caves and rock shelters. In other cases, such as at Régismont-le-Haut, there is evidence for pyrotechnology on a scale previously unknown for the Upper Paleolithic.

Awls and smoothing tools bear witness to clothing technology that made use of animal skins and plant / animal fibers for sewing them. There is now clear evidence that such garments were decorated with hundreds of sequin-like beads made of ivory and soapstone. This clothing technology allowed Aurignacian survival in some of the coldest, harshest environments of the past 100 000 years; yet it is always invested with ornamentation and symbolism.

Aurignacian personal ornaments are rich and variable in form, both through time and across space (Wolf and Conard). They were certainly visually stunning and tactilely evocative, composed of noble raw materials such as ivory, enamel, mother-of-pearl, soapstone and amber. In the context of their dispersal into Europe, Aurignacians invented the use of metallic abrasives (powdered hematite) for creating brilliant, lustrous and highly tactile surfaces.

Aurignacian cosmology was complex and imaginative, including the presence of mythological human-animal figures sculpted in ivory, painted on cave walls and engraved on rockshelter ceilings. Represented animals are almost never the same as the ones that were dietarily important, harking back to Levi-Strauss's old dictum that "some animals are good to eat and others good to think".

Aurignacian funerary practices leave us perplexed. No burials are known but there is new evidence of the recovery, perforation and wearing of teeth from human corpses (White and Normand).

Paintings are technically elaborate and made use of complex paint mixes. Construction of painted panels was highly structured and purposely (Fritz and Tosello). At Chauvet, the different panels coalesce into a narrative about lion hunting (Azéma). Even more remarkably, different panels on different planes were conceptualized to converge into a single three-dimensional image, part of what Marc Azéma refers to as “the prehistory of cinema”.

Far from Chauvet, in SW France, painted and engraved representations on shelter ceilings and on free-standing blocks within living sites speak to a more quotidien context. The stunning engraved aurochs from Abri Blanchard, discovered in the course of the *Aurignacian Genius* project, provides entirely new insights into the dating and context of Aurignacian graphic arts in the classic zone of Aurignacian research (Bourrillon and White).

It is not trivial that the sites excavated during the Aurignacian Genius project have yielded more than forty new engraved / painted / perforated limestone slabs, fourteen from Abri Cellier alone. These expand our understanding of the Aurignacian “repertoire” and, combined with experimental replication, have given us new insights into techniques of the earliest graphic representation.

The Aurignacians also invented the first known wind instruments, four-holed flutes generally manufactured of vulture wing-bones, but also of meticulously-worked mammoth ivory.

The greatest Aurignacian innovations may have been social ones, for example, far reaching social networks that involved long distance procurement of exotic materials such as amber, soapstone, marine shells and even flint. A rich corpus of personal ornamentation is patterned regionally and is best interpreted as a communicator of social identity at local, regional and inter-regional scales. The same is true of graphic and plastic representation, which shows clear regional variability against a common Aurignacian backdrop of subjects, forms and techniques. The study of lithic and osseous equipment leaves us to suspect important sociological changes at the beginning of the Aurignacian.

Many of the contributions to this volume, published simultaneously in French and English, present entirely new research programs, data and discoveries that result directly from the research undertaken during the PUF Aurignacian Genius project (O’hara *et al.*). Importantly, much of that new information about the Aurignacian is being produced by younger scientists, including doctoral students. There is still much to learn about the Aurignacian phenomenon, but *Aurignacian Genius* has certainly taken us a few steps forward in our understanding of these remarkable early European ancestors.

AT THE CROSSROADS

François BON

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AT THE CROSSROADS

François BON

Abstract

This paper contributes to the discussion of one of the central questions raised by the Aurignacian: can we really identify the mechanisms of a biological and behavioral coevolution in this key transitional culture between the Middle and Upper Paleolithic, associating anatomically modern humans with a range of accomplishments also readily described as "modern"? And if so, how did these different parameters influence each other? The analysis proposed here suggests that, above all, the reconfiguration of social relations was a decisive driving force behind evolution, directly influencing biological diversity through increased contact and intermingling between groups and populations.

Keywords

Biological and behavioral coevolution, behavioral modernity.

The Aurignacian sits at the crossroads of two main pathways that map Paleolithic humankind's evolution. The first of these corresponds to a significant reduction in human biological diversity, whereas the second involves a marked increase in cultural expression. The first of these pathways, the reduction in biological diversity, is directly linked to the success of *Homo sapiens* relative to other human anatomical forms including the Eurasian Neanderthals. As for the diversification of cultural expression, it is clear that important processes of behavioral innovation occurred in Paleolithic societies during a vast period extending roughly from OIS 5 to OIS 2. While this period sees a universal rise in novel behaviors, all assimilated into the concept of "behavioral modernity" (namely symbolic expression), a second important facet is the multiplication of cultural traditions. Besides the aforementioned rise in symbolic expression (graphic representations, personal ornaments, etc.), these changes are also reflected by the rhythms and ways in which technical equipment transforms, which seem be influenced by two complementary axes. On one hand, we observe the existence of, at times, very far-reaching (both chronologically and geographically) technological trends; on the other hand, we observe an effervescence of more localized technical traits characteristic of more tightly delimited cultural entities in time and in space. The first axis emphasizes connections between human groups, favoring the rapid diffusion of ideas, while the second reflects markers related to personal and group identity as well as the choices influenced by properties of the natural environments in which these groups lived.

It is clear that the divergence of these two pathways (biological reduction / cultural differentiation) did not occur at the same time everywhere. More specifically, each pathway followed different rhythms on different continents, with varied chronological sequences and non-synchronous intersection points. In Europe, this process unfolded during the Middle to Upper Paleolithic transition, centered around 45 to 40 000 cal BP. This is where the Aurignacian plays its role, laying out in large part our expectations for defining the modalities of this process and interpreting its meaning.

Strictly speaking, are both of these pathways co-evolutionary and if so, how do they mutually influence each other? Depending on how we reply to these questions, radically different visions of human evolution emerge.

1 - Aurignacian societies: the state of the debate

In order to develop this reasoning and to navigate through the different aspects of the Aurignacian phenomenon, it is first essential to establish a rapid overview of the current state of affairs, beginning with material culture. The objective of this first section is mainly to highlight topical questions, but also to underscore some obstacles in the literature, and to refer the reader to the abundant recent publications devoted to the Aurignacian (see in particular the bibliographic pointers in the following overviews: Bon, 2010; Otte, 2010).

Since early on in the development of the prehistoric discipline, the Aurignacian has received much attention, and the wide range of Aurignacian lithic and osseous industries has been patiently described. For a long time typological analysis was center stage, showcasing the diverse antler spear points (including the emblematic split-based form), the rich corpus of bone tools (lissoirs, awls, retouchers, etc.), the minute yet important Aurignacian bladelets (with diverse Dufour types and sub-types, in particular), and more significantly the robust retouched blades (namely, end scrapers and retouched blades). These descriptive analyses were refined throughout the 20th century, and continue to evolve presently, forming an ample and complex chronological and geographic series. The Aurignacian covers a period of nearly 10 000 years (or roughly speaking between 43 and 33 000 cal BP) and crosses many different environments, from the Mediterranean coast to the large North European Plain, from the Atlantic shores to the Levant and Zagros, even venturing beyond Central Asia, where scattered "Aurignacian-type" industries have been discovered. Although some of these markers cover vast geographical and chronological expanses, others remain more narrowly confined in time and space, and delimit diverse provinces (Delporte, 1998).

Over the past twenty years, the development of technological studies (Tixier, 1991; Le Brun-Ricalens, 1993; Liolios, 1999; Bon, 2002; Bordes, 2006; Teyssandier, 2007; Pesesse, 2008; Tartar, 2009; Michel, 2010) and more recently, of functional studies (O'Farrell, 2005; Normand *et al.*, 2009; Pasquini, 2013), has enabled us to assess some of the economic choices behind these industries. It is these economic choices – in terms of resource acquisition strategies and the equilibrium between the technical investment involved and the relative longevity of the concerned instruments – that provide the best interpretation of the relative success of particular technical solutions. In the lithic domain, bladelet production provides a good example of this as the development of this industry is flexible and displays environmental contrasts, without losing any techno-functional identity (Bon, 2005). For this reason, it is a precious marker of savoir-faire and specific intentions (Le Brun-Ricalens, 2005). This highlights the long-recognized – but not previously interpreted – value of this range of emblematic Aurignacian objects composed of carinated cores and all their variations. These techno-economic orientations tend to outline a certain number of rules, such as the differential management of hunting equipment and domestic equipment. This reasoning applies as much to lithic industries as to osseous industries (Tartar *et al.*, 2006). In this way, the Aurignacian plays a part in a decisive evolutionary pathway, with the progressive individualization of a range of activities, and possibly of individuals themselves, thus opening the way to paleosociological reasoning (Bon, 2009). In sum, little by little, we gain a better understanding of the nature and meaning of the Aurignacian economy as well as the possible social implications for the way in which the Aurignacians managed their equipment.

However, when we try to go any further with our interpretations we are faced with several problems. First of all, we have yet to develop a real palethnological approach that will enable us to assess the site types and functions and how they fit into the territorial exploitation of Aurignacian groups. In this way, we have not yet updated the mobility models governing seasonal routes (Bachellerie *et al*., 2011), as this approach requires the development of detailed archeozoological studies, which are still too few and far between for the period under study (Letourneux, 2007; Soulier, 2013). The chronological framework is still vague and, in spite of many efforts over these past years to multiply the dating of Aurignacian sites (cf. in particular the programs led by Carolyn Szmidt and Tom Higham), the radiochronological framework is still rather rough. The use of new methods for processing this information (i.e. Bayesian modelling) and the application of calibration curves to these early periods, where the slightest sample pollution results in significant deviations, have not, as of yet, brought major advances in this domain.

This chronological imprecision and relative deficit in palethnological approaches limits our capacity to construct accurate paleohistorical scenarios (*sensu* Valentin, 2008). We are thus limited to a mere “macrohistorical” perspective, or in other words, we must make do with several large divisions within the Aurignacian sequence without being able to assess the fluidity of spatio-temporal changes. While one can easily be defeatist under such circumstances, techno-economical approaches have nevertheless contributed significantly to an Aurignacian “macrohistory”. Most notably, the “classic” Aurignacian (or *princeps*), traditionally defined by an association between an important bone and antler based technology coupled with specific lithic technological markers can be mainly divided into two chronological phases: the Early Aurignacian (D. Peyrony’s Aurignacian I), characterized by split based antler points, carinated bladelet cores, and robust style blade production, which is followed by the Recent Aurignacian (D. Peyrony’s Aurignacian II), itself characterized by solid-based antler points, busked burin type bladelet cores, and again, robust style blade production. These two classic phases of the Aurignacian represent, however, the latter part of the Aurignacian story, both dating after 40 000 cal BP, whereas the first Aurignacian lineage, the Proto- or Archaic Aurignacian, appears in Europe by around 43 000 cal BP.

This means that the phases representative of the “classic” Aurignacian are a European invention and are not the result of the arrival of foreign populations, bringing with them a preexisting cultural baggage (Teyssandier *et al*., 2010). Therefore, besides the invention of a bone industry – partially linked to resources specific to the European territory as mammoth ivory or reindeer antler (Tartar, this volume) –, figurative art was truly invented in Europe during the course of the Aurignacian (Bourrillon and White, this volume). Figurative art explodes during the Early Aurignacian and even more so during the Recent Aurignacian, whereas it is absent (or practically absent) in clear association with the earliest forms of these industries, the Protoaurignacian.

The last point to be raised here is the rarity of human remains discovered in Aurignacian contexts and, when these remains are sparse, as is generally the case, the problems raised by their species-specific attributions (Henry-Gambier *et al*., 2004; Bailey, Hublin, 2005). However, there is little doubt that the Early Aurignacian, and even less so for the Recent Aurignacian, are both associated with individuals with *Sapiens* characteristics (Henry-Gambier and Sacchi, 2008; Ramirez Rozzi *et al*., 2009). The problem thus mainly concerns the first millennia of the Protoaurignacian, even if new results tend to prove its association to *Sapiens* (Benazzi *et al*., 2015).

2 - Behavioral modernity and the Aurignacian phenomenon

The development of the Aurignacian results from a complex process, involving the adoption of attractive technical solutions over vast territories (transcending environmental contrasts), with a whole mosaic of more firmly anchored practices in particular regions and specific resources (example: panoply of objects in ivory or in cervid antler). Although it may be the product of multiple interactions, and not the result of a wave of steady migration, it nonetheless remains the founding culture of the Upper Paleolithic civilization of Europe and part of Asia. And it ultimately encompasses all the attributes of "behavioral modernity"; a concept long used as a benchmark.

This concept has been widely used but also widely criticized, as hiding behind it is the enlightenment notion of progress, which social scientists have rightly grown to mistrust. Ultimately however, there is perhaps little need for mistrust when this notion is used to trace a limit between objectively fossil forms of societies (that is, societies that do not have any living present-day representatives) and others, equally historically rooted in prehistory, yet still having present-day correlations in the contemporary world. In other words, everyone agrees that there are no comparable human societies to the Acheulean; the latter is by definition a fossil society. On the other hand, who can affirm that Mesolithic-type societies are not the early expression of societies with contemporary hunter-fisher-gatherer counterparts? This does not mean that these societies are relics of prehistory, but simply underlines the fact that our modern world is made up of multiple traditions inherited from diverse pathways and contrasting historical layers. Moreover, if we refuse to acknowledge the "modernity" of Mesolithic-type societies, we run the risk of relegating their present-day homologs to the living museum category, as was the case for a long time. Dear colleagues and friends, we should thus be weary of the oft too easy liberal criticism of the concept of modernity; the road to hell is paved with good intentions. Obviously, the question becomes more complex as we draw nearer to the transition between the Middle Paleolithic and the Upper Paleolithic. I can already hear Mousterian specialists (quite understandably, I might add) sharpening their arguments, cordiform bifaces, and naturally backed knives, ready to attack the creation of any form of hierarchy between the Middle Paleolithic actors and their chronologically posterior counterparts. Nonetheless, while specific elements of the Neanderthal genome may remain extant within you or I, I truly think we can consider Middle Paleolithic forms of society as definitively extinct and only visible to us through fossil form; Upper Paleolithic societies, in contrast, contain many characteristics still representative of modern societies, in the sense of the term explained above.

There is, however, a catch (as there always should be). This Aurignacian, the founder, after a (not to be forgotten) long and complex process, is not the first culture to possess such characteristics. We now know that the African Middle Stone Age contains several precursory cultural expressions of the Aurignacian, including the famous Howiesons Poort in the southern part of the continent. Moreover, the current dominant model was established on the basis of these data, postulating that "behavioral modernity" takes root in Africa during OIS 5 and then emerges in Eurasia and in Oceania during OIS 3 (for an excellent overview on the history of interpretations on this subject see Stringer, 2014). However, is the evidence supporting this story so readily traceable? Currently, there are many lacunae between the quite different archeological contexts of the African MSA and the Upper Paleolithic in Europe and the Near East. We may choose to think that advances in research will fill in these gaps little by little and that the predicted pathway will progressively become less a hypothesis and more a confirmed archeological reality. The appearance of the first graphic expressions (cf. for example, the spectacular engraved ostrich eggshells from Diepkloof;

Texier *et al.*, 2010) or personal ornaments (cf. for example, perforated shells from Blombos; D'Errico, 2005) must clearly be extended to the MSA, but does continuity necessarily follow a first appearance? Must this be construed as the starting point of an irreversible phenomenon, in keeping with the postulate that there are *necessarily* milestones between the early African and later expressions in Europe? Is evolution truly both unilinear and unidirectional? Have we not moved beyond such a limited perspective?

We can confidently state that the elements that constitute our definition of behavioral modernity seem to have reached an irreversible threshold during the Aurignacian. Over the past 40 000 years, there is, as of yet, no culture that is not founded on some of the already perceptible orientations of the Aurignacian context. All cultures use symbolic expression to codify social relations and express the foundations of a society in relation to the surrounding universe. But what was the case beforehand? Can we concede that such orientations, first of all present in certain MSA African contexts, could have remained reversible for a long time and that the appearance of corporal ornaments as graphic manifestations could have been abandoned only to reappear at a later stage? This clearly raises a major theoretical problem. Personally, I simply wish to recall the hypothesis, however uncomfortable it may be, stating that the Aurignacian is fundamentally different from earlier experiences in that behavioral orientations are marked by the seal of irreversibility, which was not the case beforehand. Irreversibility gives the Aurignacian its full meaning.

3 - In what direction do the cogs of biological and behavioral coevolution turn?

Since the invention of the term Aurignacian by Henri Breuil, the vast majority of prehistorians accept that the success of *Sapiens* is partly linked to the network of behavioral transformations evoked above. We can even conclude that, as a direct result of the intellectual "battle" confirming the existence of the Aurignacian (Dubois, Bon, 2006), the invention of the Upper Paleolithic at the very beginning of the 20th century marks this paradigm in golden letters. From that time onwards, biological human transformation was fully accepted by the community of prehistorians, and only the ultimate stage of this transformation was considered as modern, thereby confirming the division between the Early Paleolithic[1] and the Upper Paleolithic (Breuil, 1913; Boule, 1921). In this way, Breuil and his generation set the terms for the debates that the 19th century had left open (Bon, 2009), when partisans and detractors of the theory of evolution confronted each other and when some of the most virulent critics of Paleolithic spirituality were engaged by its first supporters.

While we may choose to accept the "impossible coincidence" between these two processes (Mellars, 2005), the mechanisms of their reciprocal link still deeply divide prehistorians. Nonetheless, one model overtook all the others during the course of the 20th century, and remains dominant to this today. This is the model of biological, as opposed to behavioral primacy: *Sapiens* lit the world from the depths of caverns and created art as a result of new cognitive capacities. Of course, this biological supremacy of *Sapiens* over his Neanderthal counterparts also met with detractors, who postulate that the latter were also capable of "inventing" hence modern humans from a behavioral viewpoint (D'Errico *et al.*, 1998; D'Errico, 2003; Zilhao, 2007). But, if Neanderthals and *Sapiens* display similar aptitudes, how can we explain the success of one group and the decline of the other?

1. Recall that the concept of the Middle Paleolithic was only defined at a later stage during the course of the 20th century.

The most straightforward answer is to consider that they are simply from the same species and that Neanderthals did not actually disappear but that their attributes were gradually diluted among *Sapiens* traits (Trinkaus, 2005). Why this way around and not the other? If we accept that the Neanderthal settlement zone was more limited or less densely occupied than that of *Sapiens* then demographic factors of the respective populations undoubtedly played a role some 50 000 years ago. This vision was met with severe criticism several years ago, and partisans of such theories were readily seen as naive multi-regionalists (compare, for example: Stringer, 1994; Wolpoff *et al.*, 1994). But it has since been reinforced by paleogenetic approaches (Green *et al.*, 2010), which now suggest that some Neanderthal blood flows through our veins, showing the contacts developed by this plural humanity.

Therefore, the conditions are now in place for countering this trend and proposing a radical alternative model: the primacy of social behavior and its direct influence over biological otherness. If *Sapiens* and Neanderthal are part of the same species, if, in other words, humankind only possessed strong intra-specific variability, the reduction of this could have been the result of an increase in genetic exchanges between human groups rather than the disappearance of some of them. What conditions could have favored such exchanges? We can, for example, envisage that societies founded on strong endogamy during the Middle Paleolithic gave way to more exogamous societies, accounting for a stronger diffusion of genic flux at the dawn of the Upper Paleolithic. This hypothesis is naturally very difficult to prove. However, the development of corporal ornaments, considered to be one of the clearest markers of mutations in these human societies, could be interpreted as the result of an identity in need of assertion, as a corollary to increased contacts between human groups, according to classic anthropological models (White, 2007). The circulation of shell ornaments has moreover been proposed as evidence of matrimonial exchanges, in the fine pages written by Yvette Taborin on this subject (Taborin, 1993). These reflections, and the rest of this contribution, are in keeping with the abundant literature devoted to this question by Anglo-Saxon researchers, such as Clive Gamble (Gamble, 2007) or Chris Stringer (Stringer, 2014).

For my part, the principle of coevolution between biological and behavioral transformations appears to be unquestionable and I in turn suggest a reconsideration of the chain of causality leading to the invention of our humanity. For this, we need to question the available evidence in order to determine the paleosociological scope and the consequences of this on the biological structure of human groups. This concerns first of all marriage organization, and in particular the long and mid-distance circulation of corporal ornaments and other objects, if we accept that they are related to exogamy. In other words, if we accept that the development of the social codes symbolized by corporal ornaments, the invention of symbolic expression aiming to codify Man's role in his universe, the transformation of technical equipment in favor of an increased individuation of the players of these same groups, are symptoms of more profound social changes, then we are entitled to question the consequences that they may have had on the biological identity of populations. This is the question that must be raised today by all those focusing on Aurignacian culture, as well as by anthropologists seeking to explain this reduction in the biological diversity of humanity. It is clear that this hypothesis stems from a philosophical model proposing that human evolution arises more from reciprocal meetings and influences, however antagonistic they may be, than from a separation of the body and mind of its protagonists.

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THE AURIGNACIAN VIEWED FROM AFRICA

Christian A. TRYON

Abstract

The Aurignacian technocomplex in Eurasia, dated to ~43-28 ka, has no direct archeological taxonomic equivalent in Africa during the same time interval, which may reflect differences in inter-group communication or differences in archeological definitions currently in use. Extinct hominin taxa are present in both Eurasia and Africa during this interval, but the African archeological record has played little role in discussions of the demographic expansion of Homo sapiens, unlike the Aurignacian. Sites in Eurasia and Africa by 42 ka show the earliest examples of personal ornaments that result from extensive modification of raw materials, a greater investment of time that may reflect increased their use in increasingly diverse and complex social networks.

Keywords

Upper Paleolithic, Later Stone Age, Middle Stone Age, Homo sapiens, dispersals.

Introduction

The Aurignacian is a Eurasian Upper Paleolithic technocomplex with a current estimated age range of ~42-28 ka (Jacobi *et al.*, 2010; Higham *et al.*, 2011, 2012; Nigst *et al.*, 2014). Across ~15 kyr and >6 500 000 km^2 (estimated from Szmidt *et al.*, 2010: 3321), Aurignacian sites show reasonably well understood temporal and geographic variation in lithic and organic tool types, production methods, and in parietal art and personal ornament form and frequency (e.g., Knecht, 1991; Chiotti, 2005; Mellars, 2006a; Vanhaeren, d'Errico, 2006; Hoffecker, 2011). Although sparse and largely restricted to dental remains, the available fossil evidence suggests that the Aurignacian is the product of early populations of *Homo sapiens* (Bailey *et al.*, 2009). In many parts of Europe and the Levant, Aurignacian strata postdate a complex array of regionally specific late Mousterian and Initial Upper Paleolithic assemblages variably attributed to Neanderthals and *H. sapiens* that likely record an interval of profound behavioral and demographic changes (Slimak, 2008; Teyssandier *et al.*, 2010; Flas, 2011; Mellars, French, 2011; papers in Otte, 2014).

H. sapiens in Eurasia ultimately derive from dispersals out of Africa beginning ~70 ka (e.g., Soares *et al.*, 2012), but distinctly African archeological signatures of this dispersal remain elusive (see discussions in Tryon, Faith, 2013; Marks, Rose, 2014). A few tenuous links have been proposed between the northern African record and that of the Levant (e.g., Nubian Levallois methods, chamfered pieces, blade production) but none of these elements of lithic technology are specific to Upper Paleolithic industries in the Levant, or their place(s) of origin remains uncertain (see discussions in Belfer-Cohen, Goring-Morris, 2009; Ioviță, 2009; Vermeersch, 2009; Marks, Rose, 2014). The origins of the Aurignacian substantially post-date these initial dispersals, with hypothesized first appearances in eastern and central Europe and central Asia (Conard, Bolus, 2003; Mellars, 2006a; Otte *et al.*, 2011), with the Aurignacian in the Levant now considered to be intrusive to the region and one of the few archeologically manifested dispersal events from Europe to the Levant (Belfer-Cohen, Goring-Morris, 2009). My goal in comparing the Aurignacian record with that from Africa is not to suggest any direct connection between the African and Eurasian records, but rather to place the Aurignacian in a broader comparative context. The lack of direct connections is useful, as it allows a better recognition of each region's particular historical trajectory and emphasizes convergent behaviors among modern human foragers (cf. Kuhn, Hovers, 2013).

The African archeological record of 43-28 ka as a comparison

I will not attempt a comprehensive description and comparison of the Aurignacian and comparably aged African records, but will instead emphasize three features of similarity and difference that I think merit further consideration in future inter-regional comparisons.

1. The Aurignacian has no equivalent archeological taxonomic unit (*sensu* Gamble *et al.*, 2005) in Africa during the 43-28 ka interval;
2. The Aurignacian has historically played a prominent role as an archeological proxy for the dispersal of *H. sapiens* and the replacement or assimilation of Neanderthal populations, the latter persisting in parts of Europe until perhaps ~28 ka (Finlayson *et al.*, 2006; but see Galván *et al.*, 2014). Genetic data from Africa suggest the persistence of archaic taxa until ~38 ka, but the archeological record there has, as yet, played little role in contact or replacement scenarios;
3. In both Eurasia and Africa from ~43-28 ka, high-modification personal ornaments first appear, which I interpret as a signal of the increased number of roles or messages for which durable symbols are being used within a society.

A - The Aurignacian has no direct equivalent in Africa

While there remains discussion about the nature of internal variation within the Aurignacian, from the perspective of someone who does not work directly on Aurignacian material, it is the similarities among Aurignacian sites that most distinguish them from contemporaneous sites in Africa. To be blunt, there is nothing like the Aurignacian in Africa from ~42-28 ka. In Africa, the Stillbay, Howiesonspoort, and Iberomaurusian technocomplexes all have relatively narrow (< 10 kyr) temporal spans, wide (~350 000-1 500 000 km^2) geographic ranges, and a suite of shared features seen in lithic and organic tool production, symbol use, bodily ornaments or modifications, and settlement patterns (Humphrey, Bocaege, 2008; Jacobs *et al.*, 2008a; Close, 2009; Olszewski *et al.*, 2011; Henshilwood, 2012; Barton *et al.*, 2013). While these technocomplexes are comparable (or closer) in scale to the Aurignacian (figure 1), all pre- or post-date the temporal interval under consideration by several thousand years.

If the maintenance of similarities in material culture among Aurignacian sites across Eurasia signifies some general level of inter-group contact and communication, the record from Africa could be read as fragmentation and isolation, as many industries across Africa ~43-28 ka are poorly known and / or have very restricted geographic distributions. While sample size is certainly part of the problem, so too may be issues of definition. Archeological taxonomy, particularly defining new artifact industries and complexes, largely (but by no means entirely) fell out of favor after the 1965 Burg Wartenstein conference (Clark *et al.*, 1966; Bishop, Clark, 1967). Recently, a number of researchers have emphasized the importance of these basic units of comparison (e.g., industries) and returned to working towards their definition and application across a range of sites (e.g.,

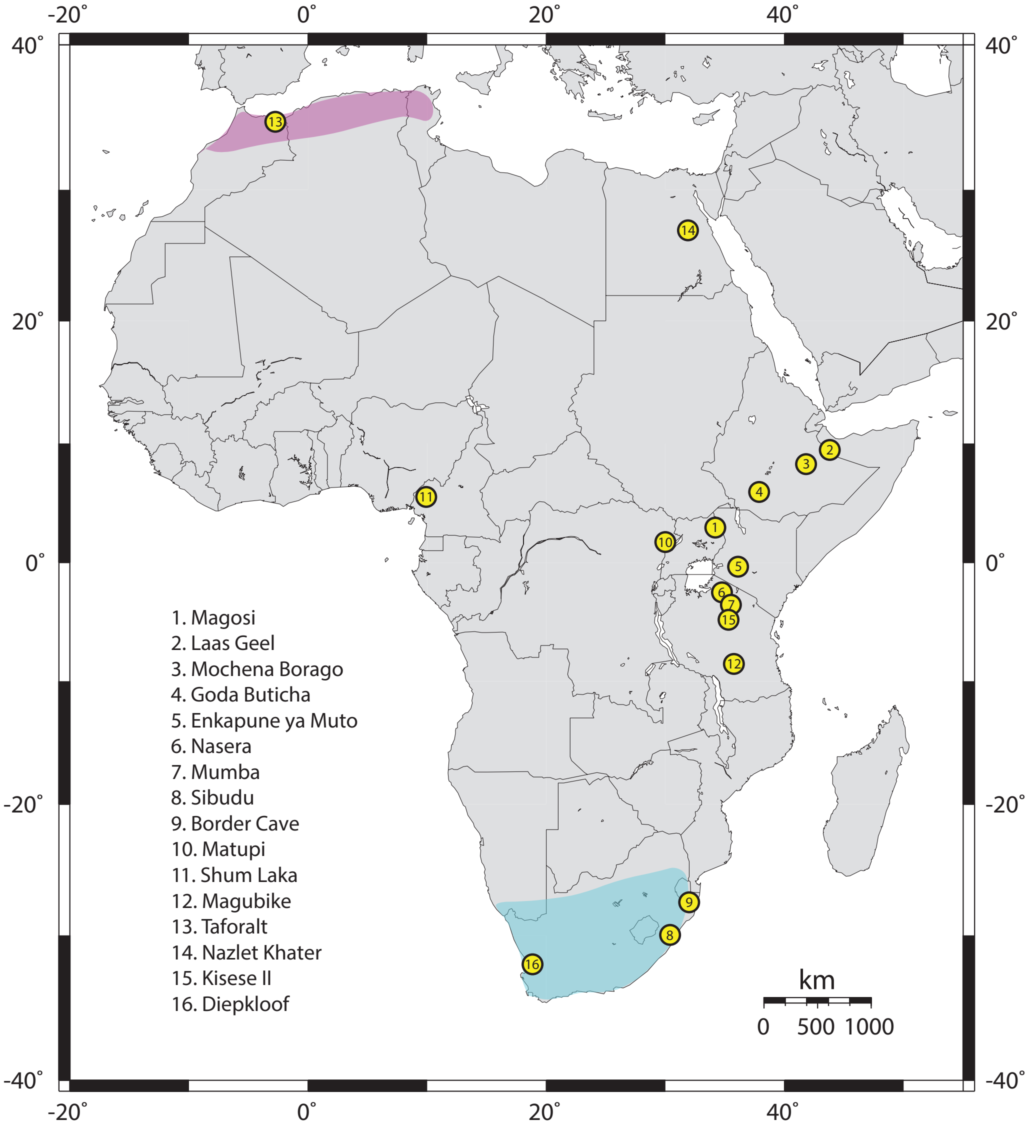

Figure 1 - Archeological sites discussed in text, listed in order of appearance. Also shown are the approximate geographic spans of the Iberomaurusian (in purple) and Still Bay / Howiesons Poort (in blue) archeological complexes.

Conard *et al*., 2012; Will *et al*., 2014). This trend is mirrored in the ongoing definition, comparison, and integration of sites variably attributed to the proto-Aurignacian, Ahmarian, and Intial Upper Paleolithic (IUP) (Bar-Yosef, Zilhão, 2006; Mellars, 2006a; Kuhn, Zwyns, 2014).

Prior to 1965, most sub-Saharan sites that we now know date to ~43-28 ka on the basis of radiometric age estimates would have been attributed to the 'Second Intermediate' on the basis of lithic artifact typology. The 'Second Intermediate' was an interval chronologically between the Middle Stone Age (MSA) and Later Stone Age (LSA), and sites attributed to it contained elements typical of both, such as Levallois technology, retouched points, and backed pieces or microliths. The 'Second Intermediate' terminology was abandoned in part because the combination of MSA and LSA artifact types at one of the second intermediate type-sites, Magosi (Uganda), was shown to result from stratigraphic admixture from horizontal excavation across steeply dipping strata (Hole, 1959; Cole, 1967).

Whatever the problems with Magosi, assemblages with the combination of prepared cores, points / small bifaces pieces, and backed elements are found in carefully excavated and radiometrically dated sequences from shelter 7 at Laas Geel in Somalia (Gutherz *et al*., 2014), Mochena Borago and Goda Buticha in Ethiopia (Brandt *et al*., 2012; Pleurdeau *et al*., 2014), Enkapune ya Muto in Kenya (Ambrose, 1998), Nasera and Mumba rockshelters in Tanzania (Mehlman, 1989; Marks, Conard 2008; Diez-Martín *et al*., 2009; Gliganic *et al*., 2012), and further south, at Sibudu Cave in South Africa (Wadley, 2005; Jacobs *et al*., 2008b). These and other sites from ~43-28 ka also preserve strata that lack MSA elements, and record the appearance of fully LSA technologies during this interval (often with an increased use of bipolar technology), as at Border Cave, South Africa (Beaumont *et al*. 1978; d'Errico *et al*., 2012; Villa *et al*., 2012), Matupi Cave in the Democratic Republic of the Congo (Van Noten, 1977) and Shum Laka in Cameroon (Cornelissen, 2003). The MSA / LSA technological shift was a prolonged (> 10 kyr) and in places erratic process, with sites from this period characterized not only by changes in flaked stone but also the widespread use of ochre, ground stone tools, and ostrich eggshell beads (d'Errico *et al*., 2012; Tryon, Faith, 2013), the oldest occurrence of which is now dated to > 50 ka at Magubike in Tanzania (Miller, Willoughby, 2014), as well as rare instances of figurative paintings (Vogelsang *et al*., 2010).

In Africa north of the Sahara, recent evidence from Taforalt Cave, Morocco, demonstrates the presence of a non-Levallois flake-based assemblage intermediate between the Iberomaurusian and Aterian ~35-25 ka (Barton *et al*., 2013); detailed formal descriptions are as yet unavailable but this assemblage is remarkable in suggesting population continuity for a period and region long considered to be characterized by a pronounced occupational hiatus (see Close, 2009). Nazlet Khater 4, Egypt, at ~30-35 ka, preserves unusual large bifacial axes possibly related to chert nodule extraction from subsurface quarries at the site, as well as clear evidence for diverse non-Levallois volumetric and 'planimetric' blade production unlike that found at other regional assemblages (Vermeersch, 2009; Lelongeon, Pleurdeau, 2011), a comparison hindered by the specialized nature of the site.

Although I have only reviewed a portion of them, well dated, carefully excavated and published assemblages from Africa ~43-28 ka are few in number. One prominent feature of the African record during this interval is the gradual abandonment of typical MSA technologies, and in terms of its length and complexity, the MSA/LSA transition may resemble the Middle/Upper Paleolithic transition in Eurasia. However, no regional entity approximating the Aurignacian exists during this interval in Africa, and a number of authors, particularly those working in southern Africa, have noted the informal and regional nature of assemblages from this interval (e.g., Vogelsang *et al*., 2010; Conard *et al*., 2012). For eastern Africa, Mehlman (1989) made the strongest efforts towards defining such an entity. He defined the quartz-based, scraper dominated Nasera Industry with its frequent use of bipolar technology, and rare points and backed pieces, ochre, ostrich eggshell beads and ground stone tools dated to ~26-38 ka (Mehlman, 1989; Gliganic *et al*., 2012). He recognized it at Nasera, Mumba, and Kisese II rockshelters in Tanzania, sites separated by ≤ 300 km (figure 1). Sadly, many of the artifacts from these sites have since been lost (Prendergast *et al*., 2007; Tryon, personal observation), making further comparisons difficult. We now need to build on this work by defining new industries, or reviving old ones (as with the 'Hargesian'; Gutherz *et al*., in press) as the first step towards more detailed inter-site comparisons. Only then will we better understand similarities and differences among these African sites and determine whether or not the Aurignacian record is truly profoundly different.

B - Archaic hominins persist in Africa through much of the Late Pleistocene

Genetic evidence suggests a number of dispersals of *H. sapiens* across and perhaps out of Africa ~43-28 ka (Soares *et al.*, 2012; Rito *et al.*, 2013), with environmental change throughout the Pleistocene facilitating both population isolation and subsequent expansion (e.g., Blome *et al.*, 2012; Lorenzen *et al.*, 2012; Pearson, 2013; Faith *et al.*, in press). All African fossils securely dated to ~43-28 ka (and younger) are attributed to *H. sapiens* (e.g., Grine *et al.*, 2007; Crevecouer, 2012; Willoughby, 2012; Pleurdeau *et al.*, in press). However, analyses of the modern human genome suggest contact ~38 ka in central Africa and introgression with populations of archaic hominins as distinct from modern humans as are Neanderthals (Hammer *et al.* 2011; Lachance *et al.*, 2012). As in Eurasia, one feature of the period of ~43-28 ka in Africa is the persistence but gradual disappearance of non-*sapiens* hominins. Unlike the Eurasian record, recent archeological scholarship in Africa has, as yet, contributed little to the discussion of the spread of modern humans across Africa (but see Jacobs, Roberts, 2009; Mellars, 2006b).

C - High modification symbolic artifacts in Africa and Eurasia

Claire Heckel (2015), in her recent dissertation research on proto- and Early Aurignacian personal ornamentation, distinguishes between low modification and high modification personal ornaments. I borrow these terms and concepts, although I use and define them slightly differently in an expanded comparison of non-utilitarian, modified and decorated objects presumed to convey symbolic information (see figure 2). Low modification objects are those where the original form of the raw material is minimally modified; examples include the use of naturally perforated shells at MSA and IUP sites around the Mediterranean (e.g., Bouzouggar *et al.*, 2007; Stiner, 2014) or the addition of geometric lines to ostrich eggshell containers, as at the MSA site of Diepkloof, South Africa (Texier *et al.*, 2013). By high modification objects, I refer to pieces where the final product does not resemble the raw material, such as is the case with Aurignacian basket-shaped beads and MSA / LSA ostrich eggshell beads.

Basket-shaped beads from early Aurignacian sites are predominantly made of mammoth ivory (but also other materials), produced through a physically demanding procedure of fragmentation using wedges and percussion, perhaps boiling or soaking, scraping, gouging, drilling, and grinding prior to use (White, 1997; Heckel, Wolf 2014; Heckel, 2015), a process that results in a bead morphologically dissimilar to the tusk of which it was a part. Ostrich eggshell beads from MSA, LSA and recent sites are made through a lengthy process of breaking, drilling, and grinding (Wingfield, 2003; Kandel, Conard, 2005; Orton, 2008), and no longer look like eggshells (figure 2). Beads (whether low modification or high modification) were selected or created for their shape, color, or some other property such as lustre (White, 1997), and were used singly or in combination with other beads or different media (e.g., leather or twine) to convey messages significant at a variety of personal and larger social scales (e.g., Gamble, 1999; Ambrose, 2002; Whallon, 2006; Kuhn, Stiner, 2007; Kuhn, in press). What differentiates the high modification from the low modification beads is the investment of time.

I suspect that the shared presence of high modification personal ornaments among Eurasian and African sites ~43-28 ka indicates similar social contexts characterized by a high demand for a wide array of material objects to convey diverse and complex messages. The complexity and importance of these messages is perhaps best seen in the use of locally available raw materials that mimic properties of possibly more rare or valuable items, as in the Aurignacian facsimiles of seashells made of ivory (White, 1997). In Africa, the use of marine shells as personal ornaments is

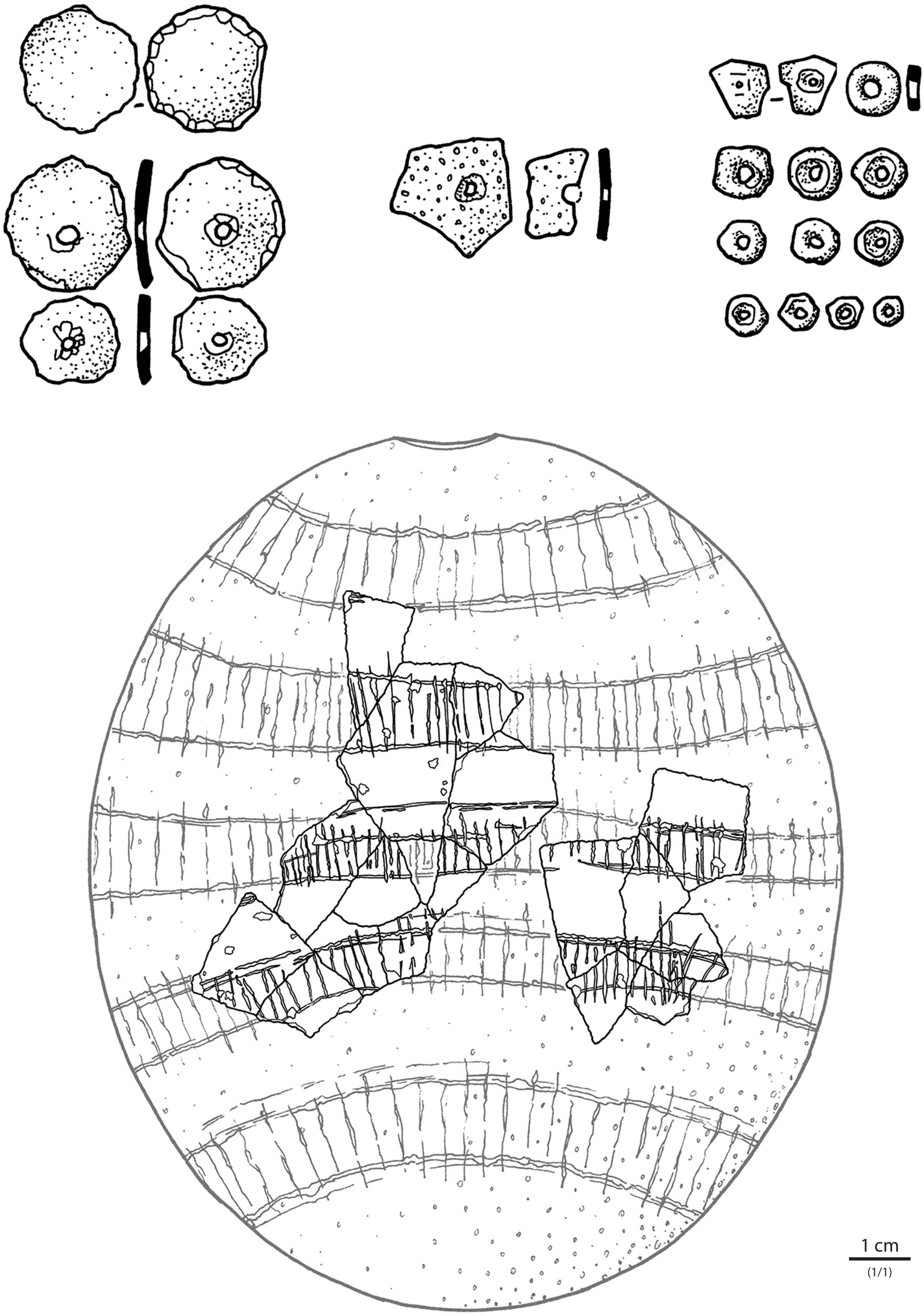

Figure 2 - High modification vs. low modification objects ~30-80 ka in comparative context: ostrich eggshell beads in various stages of production (original form not apparent) from Enkapune ya Muto and Mumba and a reconstructed engraved ostrich eggshell canteen (original form intact) from Diepkloof Rockshelter, South Africa. Illustration by Sheila Nightingale with portions after Ambrose, 1998; Mehlman, 1989; Texier *et al*., 2013.

≥15 kyr older on the coast than in the use of ostrich or snail shell beads in the interior (cf. Bouzouggar *et al*., 2007; Assefa *et al*., 2008; Miller, Willoughby, in press), which may well track the similar adoption of local raw materials to a concept of bead production and use introduced from the coast.

Of course, beads and other personal ornaments, often found as isolated fragments in excavation, form only one type of personal ornamentation that happened to survive. The 'low modification' *vs*. 'high modification' dichotomy probably fails to capture the investment of time or energy or the complexity of composite objects such as strings of beads, or their addition to perishable items such as clothing or bags, or even the time involved in the preparation of abrasives such as ochre (e.g., White, 1992; Rifkin, 2012). But by focusing on those portions of the archeological record that do survive, the 'low modification' *vs*. 'high modification' dichotomy is useful in identifying a change in human behavior beginning ~50 ka.

Conclusions

By comparing sites of the Aurignacian complex with those from Africa ~43-28 ka, I have explored a number of issues, all of which require further development elsewhere. The comparison has (I hope) been useful in emphasizing the lack of an equivalent to the Aurignacian in Africa type, at least based on our current understanding of the archeological taxonomy. I believe that the time is right to renew efforts at regional syntheses that begin to examine more closely the extent to which patterns of material culture are shared across sites in Africa. Given its size and environmental and topographic complexity, it should perhaps not come as a surprise that archaic hominin taxa persisted until relatively recently in Africa, but given the historical emphasis the Aurignacian has played in the demise of Neanderthals in Eurasia, the absence of comparable discussions from the African record is striking. A final theme that links the Aurignacian with the African records is the use of high modification personal ornaments. The time and energy investment in these materials suggest changes in the importance and role(s) of these items, changes that may well signify increasingly complex social relations within and among groups and the use of material culture to navigate them. In Eurasia and Africa, we are only just beginning to understand the full range of ways in which these materials were transformed, used, and shared (Ambrose, Slater, 2013; Slater *et al*., 2013; Heckel, Wolf, 2014).

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ORIGIN AND DEVELOPMENT OF AURIGNACIAN OSSEOUS TECHNOLOGY IN WESTERN EUROPE:

a Review of Current Knowledge

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ORIGIN AND DEVELOPMENT OF AURIGNACIAN OSSEOUS TECHNOLOGY IN WESTERN EUROPE:

a Review of Current Knowledge

Élise TARTAR

Abstract

The exploitation of osseous materials is one of the main innovations associated with the advent of the Upper Paleolithic in Europe. The concept of the Aurignacian, as defined by Abbé Breuil, was used for a long time as a strong argument in favor of a cognitive revolution: its "sudden" appearance was linked to the rapid and systematic diffusion of the Aurignacian culture and the widespread distribution of split-based points in Europe, and upheld the idea of a clear biological and conceptual rupture with the Middle Paleolithic. Since then, several factors have contributed to undermining this model. Renewed studies of Aurignacian osseous technology in Western Europe contribute to the ongoing redefinition of the mechanisms behind the construction of the Upper Paleolithic in Europe.

Early Aurignacian osseous production was by no means limited to split-based points, and involved a wide variety of activities. The production of the different materials was already well structured and centered around three main spheres: reindeer antlers were mainly used for weapons, bone for the fabrication of domestic equipment and ivory was mostly reserved for ornaments.

Although osseous technology was identified in some "transitional" groups, it spread and was durably integrated into techno-economical systems during the Aurignacian. It developed gradually in Europe and based on currently available knowledge, appears to have emerged in the Protoaurignacian societies of Western Europe. The emergence of this new technical domain seems to result from the transfer of wood working techniques to osseous materials, undoubtedly partly linked to a sudden shift in environmental conditions in Europe around 40 000 BP. The evolution of osseous production during the course of the first phases of the Aurignacian provides evidence of profound techno-economic changes, which, backed up by data from lithic studies, reveals powerful sociological changes during the transition between the Middle and Upper Paleolithic.

Keywords

Osseous industry, Early Aurignacian, Protoaurignacian, technical transfer, functional autonomy, technical investment, personal tools, social change.

The generalized working of osseous materials (cervid antler, ivory and bone) in Europe is one of the major innovations at the start of the Upper Paleolithic, and following the definition of the Aurignacian by Abbé Breuil at the beginning of the 20th century, was soon associated with this concept. This provided a strong argument in favor of the migrationist model, whereby the Aurignacian culture would have been spread very quickly and in a very uniform way across Europe by Modern Humans, leading to the demise of Neanderthal populations and their industries (Mellars, 1989; Demars, Hublin, 1989; Kozlowski, 1993; Davies, 2001; Harrold, Otte, 2001). Indeed, in the same way as other innovations attributed to the Aurignacian, osseous technology seems to have appeared very suddenly in Europe, which buttressed the idea of a clear technological and conceptual rupture with the Middle Paleolithic. Moreover, the widespread distribution of split-based points (from Spain to the Near East), considered to be the key index fossil for the early phase, reinforced the notion of a swift diffusion across Europe and the marked unity of the Aurignacian culture. However, over the past years, several factors have undermined this model, in particular, the absence of human remains from the beginning of the Aurignacian unanimously attributed to Modern Humans (Orschiedt, 2002; Conard *et al.*, 2004; Henry-Gambier *et al.*, 2004; Street *et al.*, 2006), the identification of the Protoaurignacian (or archaic Aurignacian), evidencing the early arrival and gradual development of the techno-complex in Europe (Laplace, 1966; Bazile, Sicard, 1999; Bon 2002; Bon, Bodu, 2002; Bordes, 2002; Teyssandier, 2007; Teyssandier *et al.*, 2010) and the multiplication of "transition" industries, suggesting an autonomous evolution of Neanderthals towards the Upper Paleolithic (Pelegrin, 1995; d'Errico *et al.*, 1998; Zilhão, d'Errico, 1999, 2003; Slimak, 2004).

Today, it is thus timely to redefine the mechanisms underlying the construction of the Upper Paleolithic in Europe and the place of the Aurignacian in this process. As part of this reflection, osseous industries first remained in the background, probably due to past emphasis on these industries in models arguing for a rupture between the Middle and Upper Paleolithic. But over the past few years, renewed studies have provided new insights. The present article proposes a review of existing data relating to Aurignacian osseous production. The first part will deal with osseous production in the Aurignacian *type-assemblage*, the Early Aurignacian, as some of these materials are still little known. Then the question of the emergence and development of osseous technology in Western Europe will be approached, to discuss the social implications of techno-economic changes recorded for the first phases of the Aurignacian.

1 - Osseous technology of the Aurignacian *type-assemblage*

It is still widely believed that the Early Aurignacian osseous toolkit consists mainly of antler working – "... Early Aurignacian organic technology is primarily an antler working technology" (Knecht, 1993: 140) – for making hunting weapons – "While most Aurignacian bone tools are deer antler sagaie points..." (Zilhão, 2011: 336). This stems from the emphasis placed on split-based points for a long period of time. These emblematic Aurignacian tools were identified very early on (Lartet, 1861) and were used as characteristic fossils for dating the archeological assemblages containing them well before Peyrony's classification. The latter definitively acknowledged them as a strong marker of the early phase of the Aurignacian (Peyrony, 1933). The function of these pieces as projectile points also contributed to this situation. Up until the 2000s, the role of lithic bladelets in hunting weapons was widely ignored and contributed to maintaining the notion of the economic and functional complementarity of the lithic and osseous industries. The first was considered to supply domestic tools and the second was believed to be reserved for hunting (Rigaud, 1993). Since then, the increase in technological studies and the economic and functional reinterpretation of several categories of remains have resulted in a reappraisal of the functional spheres of lithic and osseous productions (Tartar *et al.*, 2006; Tejero 2010).

A - A rich and diversified industry

Osseous technology during the Early Aurignacian is by no means limited to split-based points. As shown by the composition of the assemblages from south-western France, and in particular the rich assemblages from Abri Castanet (Dordogne), Grotte des hyènes at Brassempouy (Landes), Gatzarria (Pyrénées-Atlantiques) and les Abeilles (Haute-Garonne), split-based points are well represented but still only account for a minority of the total number of pieces (figure 1); representing between 4 and 22% of the finished objects in osseous materials. The proportions of finished ivory pieces vary widely from one assemblage to another whereas bone technology is always very well represented.

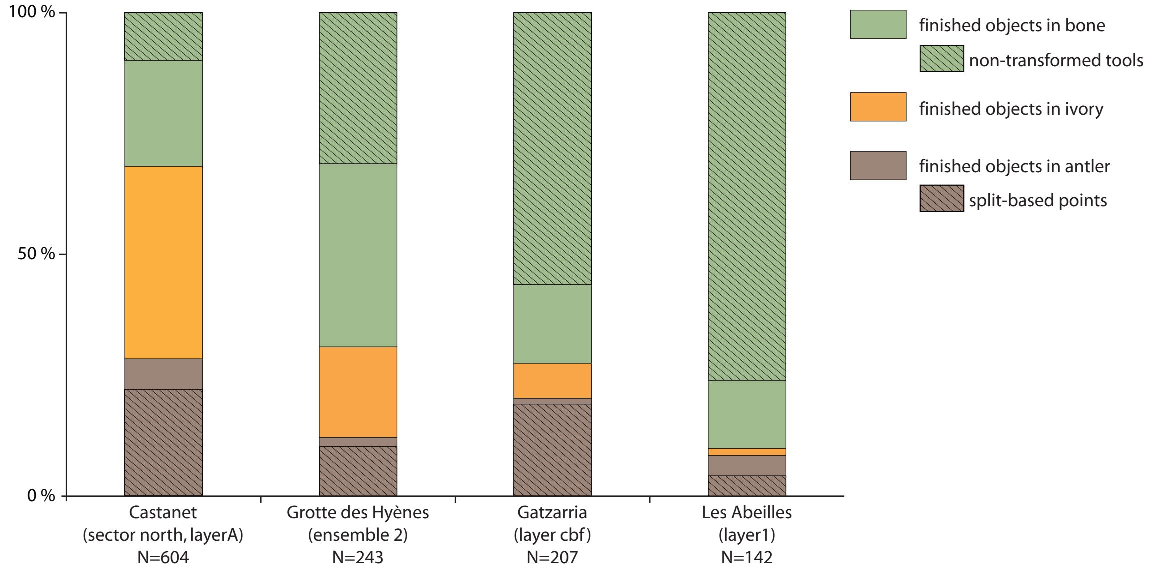

Figure 1 - Relative proportions of finished objects in cervid antler, ivory and bone in osseous industries from four Early Aurignacian assemblages.

Antler technology during the Early Aurignacian is mainly centered on the production of split-based points (Liolios, 1999; figure 2[1-2]). Antler was also used for making tools, such as wedges used for splitting and *bâtons percés*, which were probably used for straightening points (Lompré 2003; figure 2[3-4]). Antler tools are generally scarce, apart from in assemblages with very abundant material (Castanet, Blanchard, Isturitz).

In south-western France, ivory technology is mainly made up of ornaments:[1] mostly of beads and in particular, the famous basket-shaped beads, but also headbands, pendants, etc. (White, 2007, figure 3).

1. In other Aurignacian provinces, ivory exploitation is much more diversified and abundant. This is the case in particular in the Swabian Jura (Germany) where it was used for personal ornaments, portable art and abundant tools (Conard, Bolus, 2006; Floss, this volume; Wolf, Conard, this volume).

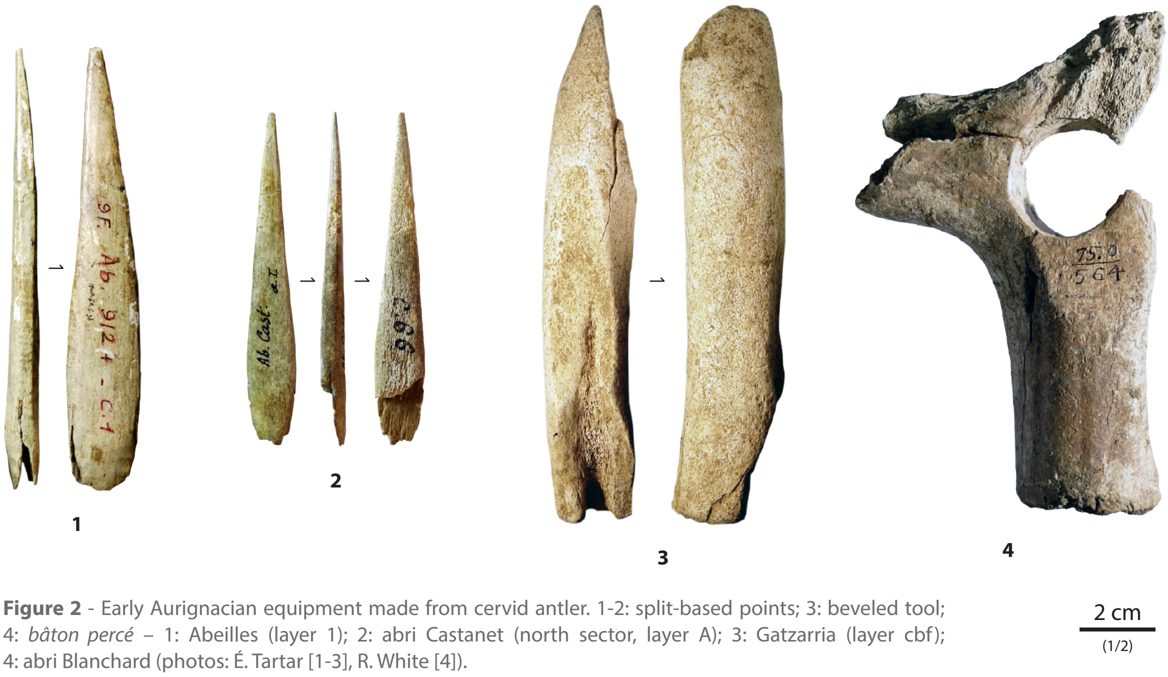

Figure 2 - Early Aurignacian equipment made from cervid antler. 1-2: split-based points; 3: beveled tool; 4: *bâton percé* – 1: Abeilles (layer 1); 2: abri Castanet (north sector, layer A); 3: Gatzarria (layer cbf); 4: abri Blanchard (photos: É. Tartar [1-3], R. White [4]).

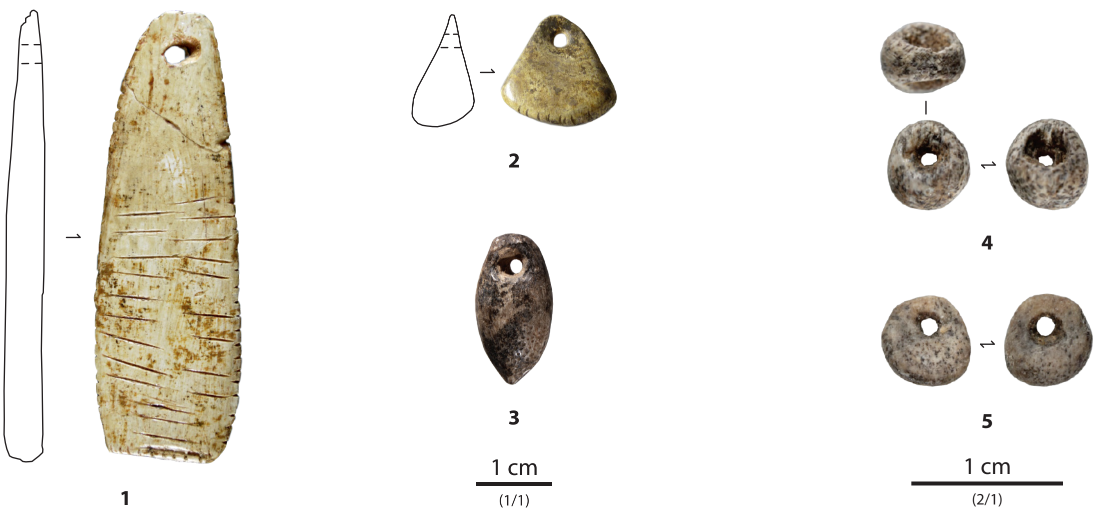

Figure 3 - Early Aurignacian personal ornaments in ivory. 1: pendant with decorative incisions; 2: bead with decorative incisions; 3: bead with decorative dots; 4-5: basket-shaped beads – 1: Abeilles (layer 1); 2: Gatzarria (layer cbf); 3: abri Cellier; 4-5: abri Castanet (photos: É. Tartar [1-2], R. White [3-5]).

Bone industry on the other hand, is much more diversified. It includes the classical Upper Paleolithic tools associated with processing skins: *lissoirs* or smoothers made on ribs, some of which are decorated with incisions (figure 4[1-2]), as well as a variety of awls made on different anatomical parts (figure 4[3-5, 13]). Other pieces, such as small pointed elements (double points, awls, etc.), sticks and tubes, with as of yet enigmatic functions, complete the assemblage (figure 4[6-12]). But the bone industry also includes a significant quantity of non-transformed tools, or bone fragments retrieved after butchery operations and used without any further modification. These tools are less well known. Until recently, they went largely unnoticed in these assemblages as no comprehensive studies of all the remains were conducted. As they often bear subtle use marks, they were generally not identified during excavations and must thus be sought out among faunal remains. In recently and extensively excavated sites (Grotte des Hyènes, Gatzarria and Abeilles)[2], these tools represent 30 to 77% of the finished bone objects (figure 1)! They include different functional categories. The most represented are the retouchers, identified a long time ago (Leguay, 1877; Henri-Martin 1907-10), but which are still often associated with the Middle Paleolithic (figure 5[1]). They are very well represented in the Early Aurignacian assemblages where they were used for retouching lithic tools and undoubtedly also for bladelet debitage (Tartar, 2012a). The non-transformed tools also include intermediate tools, which were totally ignored until quite recently (figure 5[2]). The Aurignacians selected bone fragments with naturally beveled ends to use as wedges for splitting sections of antler and wood (Tartar, 2012b). Other non-transformed tools are also present in variable quantities in these assemblages. At Abri Castanet, for example, excavations yielded picks and objects with blunted and abraded points. These tools may have been used for engraving limestone, as shown by the abundant graphic representations documented at Castanet and Blanchard (White *et al.*, 2012; Bourrillon, White, this volume): the picks could have been used to prepare the stone surface by pecking and the blunted objects to regularize the engraved lines. Ongoing experiments are currently testing these hypotheses (research program, R. Bourrillon).

Thus the osseous industry is by no means limited to split-based points and involves a wide range of activities. It is noteworthy that the functional analysis of the sites used as examples suggests residential camp type occupations (Grotte des Hyènes, Gatzarria, Abeilles)[3], or even *aggregations* (Abri Castanet?), which are, by definition sites with varied activities. The high representation of domestic equipment (as well as the important quantity of waste from diverse fabrication) is perfectly coherent with this view. Tool composition would undoubtedly be very different in hunting camps, but no such occupations have as of yet been identified for the Early Aurignacian (Bon, 2006; Bachellerie *et al.*, 2011).

2. The percentage of pieces from the north sector of Abri Castanet is not included here considering the drastic selection of artefacts during the excavations conducted by D. Peyrony.
3. Apart from several debitage workshops, this is the case for the majority of occupations attributed to the Early Aurignacian (Chadelle, 1990; Bordes, Tixier, 2006; Bachellerie *et al.*, 2011).

Figure 4 - Early Aurignacian bone equipment. 1-2: lissoirs (smoothers); 3-5, 13: awls; 6: pin; 7: double point; 8-10: sticks; 11-12: decorated tubes – 1, 5, 11, 12: Gatzarria (layer cbf); 2, 3, 6, 7, 13: grotte des Hyènes (complex 2); 4, 8-10: abri Castanet (north sector, layer A) (photos: É. Tartar).

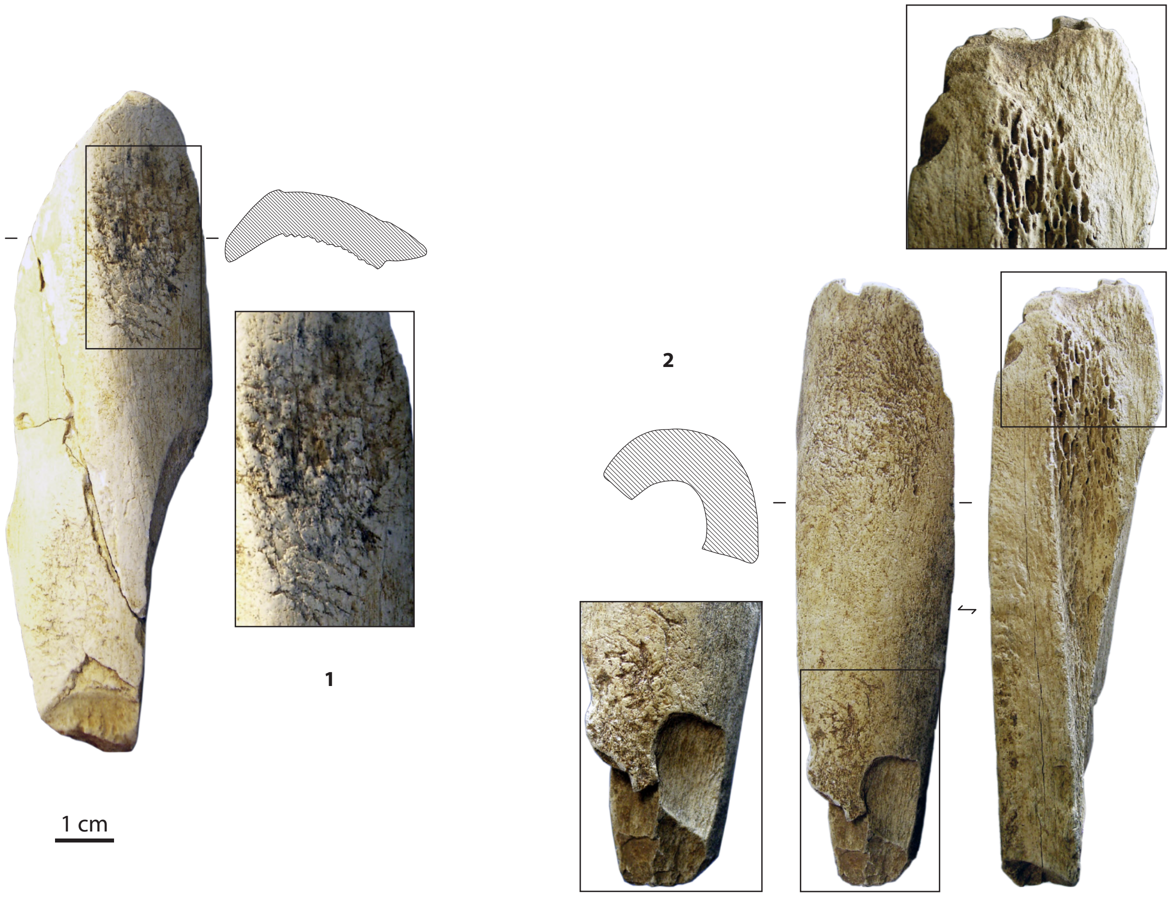

Figure 5 - Non-modified bone tools from the Early Aurignacian. 1: retoucher; 2: intermediate tool used as a wedge (the piece also bears traces of use as a retoucher). 1-2: abri Castanet (north sector, layer A) (photos: É. Tartar).

B - Characterizing the different sectors of activity

The exploitation of the different osseous materials during the Early Aurignacian is very well structured and centered around three main spheres: antlers (mostly reindeer antlers) were used mainly for weapons, bone for the fabrication of domestic equipment and ivory was mostly reserved for ornaments (Liolios, 1999; Tartar *et al.*, 2006). This differential treatment of the different materials can be linked to their unique physical and mechanical properties. Reindeer antler, for example, is the most resistant osseous material to impact (Albrecht, 1977). In the same way, many bones or bone fragments are naturally pointed and only require minimum transformation to be used as awls. The properties of the raw materials thus play a predetermining role and also imply that there is flexibility in this partition. This is illustrated by the occasional use of antler for making tools (beveled pieces, *bâtons percés*, etc.), as the morphology and resistant qualities of this material make it suitable for making beveled pieces to be used as wedges, for example. However, the possibility of a more symbolic choice cannot be ruled out, as the use of reindeer antler for making hunting tools to be used on reindeer themselves must be significant (Liolios, 1999; Otte, 2001). A symbolic dimension was also invoked for ivory, as the use of this material for personal ornaments may be linked to subjective, esthetic considerations, and to the image of the animal itself (Hahn, 1986; Jelinek, 1988; Liolios, 1999).

This differential treatment of antler, bone and ivory during the Early Aurignacian indicates the clear economic structuring of osseous technology, which is also manifest in the lithic domain (Tartar *et al.*, 2006). During the Early Aurignacian, the lithic equipment was based mainly on the independent production of two categories of blanks: blades, widely used for the diversified domestic toolkit (mainly endscrapers and retouched blades) and bladelets, used for making hunting weapons such as lateral armatures for equipping projectiles (Bon, 2002; O'Farrell, 2005; Pelegrin, O'Farrell, 2005).

C - Differentiated technical investment

Depending on their sphere of activity, productions were not all subject to the same level of technical investment during the course of fabrication.

The highest level of technical investment was reserved for split-based points. The experimental production of replicas of pieces from Abri Castanet and Blanchard, conducted as part of the *Aurignacian genius* research program, showed that these points are the outcome of a long operational sequence involving several sequences and techniques, as well as a certain know-how (Tartar, White, 2013). At Castanet, Blanchard and most of the Early Aurignacian sites, reindeer antler used for making points derives from large and medium-sized shed antlers. The antlers were processed by separating the beam into sections: It consists in chopping the antler beam perpendicular to its long axis in order to extract roughly cylindrical segments and then to split these by use of wedges to obtain semi-cylindrical blanks (Liolios, 2003; Tejero *et al.*, 2012). These blanks were of variable size and shape and were then roughly shaped by regularizing the edges and surfaces. The following stage consisted in splitting the base, following a procedure called the *IFC* (for Incision, Flexion and Cleavage). It will not be described in detail here (see Tartar, White, 2013), but it is important to note that this rather complex procedure is based on a series of precise operations and requires previous preparation (prolonged soaking) and the use of specific equipment (wedging system for bending the rod). Once the base was split, points were then shaped by scraping to give them their final shape.

Ivory productions, and particularly basket-shaped beads, were also subject to a high level of technical investment. According to R. White (2007), the ivory used is sub-fossil and was thus collected. It was sectioned by cleaving following the desiccation lines of the raw material. The obtained fragments were shaped by scraping to produce rods, then sectioned by circular incision and snapping by flexion. Rough-outs were scraped, perforated and abraded to obtain the final bead shape.

The bone industry, on the other hand, displays much more variable technical investment. Raw material acquisition is less restrictive as bone comes from hunting by-products, and is widely available in the sites. Tools can be extremely basic. This is the case for non-transformed tools, which are simple bone fragments selected from food waste and used directly. However, other tools, such as *lissoirs*, or smoothers, are from more complex operative sequences. They were obtained from ribs with broken ends to produce sections, then split lengthwise to produce half-ribs. These reduction processes are not fundamentally different from those used for making points. The half-ribs were then totally shaped and often decorated with incisions. Some of the awls were also more complex and were made from horse metapodials, although most of them were made from simple, rapidly pointed bone flakes. The horse metapodials were split in order to obtain blanks with specific morphometric criteria: sturdy, regular, elongated blanks retaining a portion of the joint to be used as a prehensile zone.

If we classify the various products in terms of technical investment, split-based points and basket-shaped beads are at the highest end of the scale. This does not necessarily imply that these products were more highly valued than the others, but indicates that strict standards governed their fabrication (Tartar *et al.*, 2006). Split-based points are part of a composite system of hunting weapons and as projectile points, they require careful and complete shaping and must be interchangeable on wooden shafts. Ivory beads are ornamental elements and bear a message with social connotations to be seen and understood by all. These requirements entail morphometric standardization. On the other hand, for bone technology, there is much more diversity in terms of the level of technical investment. Generally speaking, the use of these pieces involves fewer restrictions and food practices produce a wide range of suitable forms for the rapid shaping of standard tools. However, some tools were given special technical care which cannot necessarily be explained in functional terms. These tools with added value provide, as we shall see, precious information for appraising the socio-economic structure of Aurignacian groups.

2 - Advent and development of working osseous materials in Western Europe

In the light of current knowledge, the work of osseous materials in Europe can no longer be considered to be an Aurignacian innovation. Several assemblages from distinct transition technocomplexes (Szeletian, Bohunician, Uluzzian, etc.) have yielded a variable quantity of artefacts in osseous materials. Thus, in Western Europe, some Uluzzian and Châtelperronian groups were already transforming bone, as well as ivory for the latter, before the arrival of the first Aurignacian populations (Gioia, 1990; Gambassini, 1997; Baffier, Julien, 1990; d'Errico *et al.*, 1998). On the other hand, the generalized spread of osseous technology is a unique Aurignacian feature (Liolios, 2010). It is during the Aurignacian that production becomes systematic and is permanently integrated into the techno-economic system. This new technical domain does not appear suddenly, but develops gradually during the early phases of the Aurignacian.

A - Protoaurignacian osseous technology

The generalization of osseous technology seems to occur during the Protoaurignacian, a technical tradition considered by recent lithic technology studies to be the first expression of the Aurignacian in Europe (Bon *et al.*, 2006; Teyssandier *et al.*, 2010). Up until now, the Protoaurignacian has been identified at about twenty sites, extending from the north of Spain to the Balkans, but only the western sites (most of which are French) have yielded osseous productions.

In the current state of knowledge,[4] assemblage composition sometimes displays marked differences. Although the majority of the corpuses are small, some of them contain more abundant artifacts (particularly Trou de la mère Clochette, Grotte du Renne and Isturitz). From a qualitative viewpoint, we also note differences in raw material representation (no cervid antler industry in Abeilles, a lot of ivory working in Trou de la mère Clochette) and documented functional spheres (strictly domestic equipment in Grotte du Renne, etc.), which could in some cases, reflect regional differences and different types of site occupation. Nonetheless, the corpuses display a number of common typo-technological characteristics.

4. The data presented here are mainly based on studies by M. Julien and her colleagues for Grotte du Renne (Yonne, layer VII, Julien *et al.*, 2002), N. Goutas for Isturitz (Pyrénées-Atlantiques, layers C4d1 and C4III, Soulier *et al.*, 2014) and our study of the material from Gatzarria (Pyrénées-Atlantiques, cjn1 and cjn2), Abeilles (Haute-Garonne, layer 2), and Grotte du Renne (*ibid.*) and Trou de la mère Clochette (Jura, red serie) (unpublished data).

Antler working (mostly reindeer antler) is similar to that of the Early Aurignacian. It is centered on the production of blanks by splitting beam segments and applied to making points, as well as intermediate tools or burnishers. Split-based points (figure 6[1-2]) were identified in the collection from Trou de la mère Clochette (5 pieces and 3 wings), in addition to those already identified in Spain (Arbreda, Ortega Cobos *et al.*, 2005) and Italy (Fumane, Broglio *et al.*, 1996). Mesial-distal

Figure 6 - Protoaurignacian objects in osseous materials. 1-2: split-based points (in cervid antler); 3-4: ivory points; 5: ivory rod; 6: bone awl; 7: bone smoother; 8: decorated bone tube; 9: ivory ring – 1-2 and 8: Trou de la mère Clochette (red series); 3-4 and 6: Gatzarria (complex cj); 7 and 9: grotte du Renne (layer VII) (photos: É. Tartar [3-7, 9], C. Weber © CNRA-MNHA Luxembourg [1, 2], P. Guenat © Musée des beaux-arts de Dole [8]).

fragments with a flattened section suggesting this type of point were also identified in the material from Isturitz (Soulier *et al.*, 2014), Grotte du Renne (Julien *et al.*, 2002) and Gatzarria (*pers. obs*). It is also important to note that tongued pieces, which are characteristic waste products associated with point manufacture (Peyrony, 1928; Tartar, White, 2013), were identified at Trou de la mère Clochette and Isturitz.

The transformation of bone is also similar to Early Aurignacian bone technology. It is mainly geared towards the production of domestic tools, such as *lissoirs* (smoothers) and awls (some of which are decorated), double-pointed objects and tubes (figure 6[6-8]), completed by a variable quantity of non-transformed blanks (retouchers and intermediate tools). These pieces were made from bones gathered from food waste. As for the Early Aurignacian, some blanks were subject to specific debitage (cleaving ribs for smoothers, controlled fragmentation of metapodials for some awls).

As far as we can judge, ivory working also followed similar modalities to Early Aurignacian methods (splitting of sub-fossil ivory). However, ivory products are more diversified and are used for hunting (points), domestic activities (tools), as well as symbolic purposes (ornaments). The structural and mechanical properties of ivory indicate that the fragmentary points are not split-based (figure 6[3-4]), as the low elasticity of ivory makes it impossible to make splits in this way (Flas *et al.*, 2013)[5]. The tools consist mainly of intermediate tools and perforating tools. Personal ornaments are rarer and include several beads and rings (figure 6[9]). Note also that several assemblages contain long, very regular rods with a circular to oval section and an as of yet enigmatic status (Trou de la mère Clochette, Arcy-sur-Cure, Abeilles), with no equivalents in more recent Western European Aurignacian assemblages (figure 6[5]).

B - A gradual evolution during the first phases of the Aurignacian

This brief overview of Protoaurignacian osseous technology highlights the typo-technological similarities between this production and Early Aurignacian technology. These parallels are manifest in the transformation modalities applied to the different materials, but they are most obvious for cervid antler working, for which the most characteristic element is the presence of split-based points as early as the Protoaurignacian, having been considered for a long time to be an exclusive marker of the Early Aurignacian (*cf. supra*). These data corroborate the comparisons made on the basis of the study of lithic industries (see in particular Bon, 2002; Bon *et al.*, 2006; Teyssandier, 2007; Teyssandier *et al.*, 2010).

During the course of the first phases of the Aurignacian, osseous technology developed gradually in Europe, as shown by richer assemblages and an evolution in raw material processing (Teyssandier, Liolios, 2008). In the early phase, each raw material is reserved for a specific functional domain, whereas during the Protoaurignacian, production is not yet clearly structured, as shown by ivory manufacture, which shifts from a diversified range of pieces (points, tools, ornaments) to the almost exclusive fabrication of personal ornaments. This individualization of the functional spheres also extends to the lithic domain, where lamellar and laminar productions are respectively reserved for hunting and domestic activities. Initially, these two technologies were part of the same operative sequence before separating completely during the Early Aurignacian. This confirms an important modification of the economic structure of groups and also undoubtedly major sociological changes. Before broaching this aspect, we will first of all evaluate the factors that might have contributed to the emergence of osseous technology.

5. In this respect, the base of the only currently known split-based ivory point was made by sawing and not splitting (El Castillo; Liolios, 2006; Tejero, 2013).

C - Underlying factors

The reconstruction of the exact circumstances underlying the emergence of osseous technology in Europe presents us with an intricate challenge. However, the different techniques used imply that a sudden change in environmental conditions may have contributed to the emergence of this new technical domain.

This reflection is based on the hypothesis of D. Liolios, stating that the work of osseous materials is the result of the transfer of wood working techniques (Liolios, 1999, 2003, 2010). The author accurately demonstrates the fact that the transformation of osseous materials during the Aurignacian is based on techniques applied to wood working for a long time (sawing, scraping, chopping, splitting, etc.). The exceptional discoveries of javelins in Schöningen (Germany) and spears at Clacton-on-sea (Great Britain) and Lehringen (Germany) provide proof of this (Oakley *et al.*, 1977; Thieme, Veil, 1985; Thieme, 1997). Although evidence of this type is rare, micro-wear analyses of lithic equipment (use-wear on working edges and hafting marks) show that wood has long been a frequently used material (Keeley, 1980; Anderson, 1980; Beyries, 1987; Marquez *et al.*, 2001). Several other elements from the early phases of the Aurignacian, apart from data from use-wear studies, show that wood played an important role in the Aurignacian economy. The first is the need to make shafts onto which projectile points were hafted. In addition, in spite of a very wide geographic distribution, Early Aurignacian split-based points are only really abundant in certain sites of the Franco-Cantabrian region (Isturitz, la Tuto de Camalhot, Castanet, la Quina) and Central Europe (Geißenklösterle, Vogelherd, Istallösko). Beyond these regions, they are often only represented by a handful of pieces (Liolios, 1999). As these corpuses cannot be representative of actual production, it is likely that they coexisted with wooden points. This hypothesis is also backed up by lithic studies suggesting that some of the Aurignacian bladelets would have been used as lateral projectile components (Bon, 2002; O'Farrell, 2005; Pelegrin, O'Farrell, 2005). Indeed, due to the elliptical cross-section and the absence of grooves on split-based points, it is unlikely that they were equipped with bladelets. It appears more plausible to attach bladelets to wooden points.

Given these different elements, it seems likely that the fabrication of projectile points, tools and ornaments in osseous materials developed from a progressive transfer of wood working techniques, alongside well-established wood working and the use of bone with no further transformation. According to this model, the use of osseous raw materials would initially have seconded wood working and would have progressively become more dominant. The work of osseous materials would not thus result from new competences or even from technical innovation, but would rather be rooted in early know-how. The main innovation concerns the technical transfer and the incorporation of osseous material in the corpus of the raw materials worked during the Upper Paleolithic.

However, the question of the causes prompting this transfer remains unanswered. As access to vegetal and animal resources is directly regulated by climatic conditions, a sudden change in environmental conditions could provide a first element of response. Between 40 and 30ka BP, Western Europe underwent rapid climatic fluctuations, including a particularly cold phase, the Heinrich 4 event, between 40.2 and 38.3ka BP (Sánchez Goñi, Harrison, 2010). This phase marks a major decline in forest species and the concomitant progression of a grassland steppe with a high concentration of *Artemisia*. The rarity of forest species could account for the technical transfer of wood working to osseous materials. Furthermore, this steppic environment with *Artemisia* is conducive to the development of reindeer, which are increasingly hunted between the end of the Mousterian and the beginning of the Aurignacian complex (Discamps *et al.*, 2014). The wider availability of reindeer antler, which plays a central role in the Aurignacian economy, could have facilitated this technical transfer. It is imperative to further evaluate this hypothesis through a more detailed correlation of archeological and environmental data.

3 - Techno-economic changes and their social implications at the onset of the Upper Paleolithic

The evolution of osseous and lithic technology during the first phases of the Aurignacian confirms the autonomy of the different functional spheres. The functional partition of osseous material into hunting equipment, domestic equipment and personal ornaments mirrors the separate production of flint blades and bladelets, respectively devoted to domestic tool making and elements for projectiles (Tartar *et al.*, 2006). F. Bon and his colleagues (Bon, 2009; Bon *et al.*, 2010) suggested that this techno-economic independence of the different spheres of activities denotes sociological changes whereby the individualization of the spheres of activity would be a response to the individuation of group members. Up until now, this hypothesis was almost exclusively applied to lithic equipment, and in particular to projectiles, which are considered to be one of the driving forces behind the technical evolution initiated during the course of the Middle to Upper Paleolithic transition (Bon, 2005; Teyssandier, 2007; Teyssandier *et al.*, 2010). In this way, the individuality of Early Aurignacian (lithic) weapons would be linked to the individuation of the hunter (Bon, 2009; Bachellerie *et al.*, 2011).[6] Besides the aforementioned raw material economy, data relating to the equipment in osseous materials will contribute to this discussion.

The study of the bone tools associated with processing skins points to a clear individualization of this activity and also to the individuation of those involved in this work. Within the different Early Aurignacian osseous series, a significant fraction of smoothers (*lissoirs*) and a specific category of awls (awls on horse metapodials) were subject to particular technical attention with no functional corollary, implying that this equipment was part of personal toolkits (figure 7) (Tartar, 2009). Apart from the technical investment involved in the fabrication of these tools, the incised decorative lines frequently observed on the smoothers (figure 7[4-5]) tend to back up this hypothesis. As with all modifications of the aspect of an object, this decoration is visible and destined to be: it is a sign and bears a message with social connotations (White, 1992; Taborin, 2004). There is only one decorative theme, but this can consist of a variety of different configurations. In this way, the frequent smoothers in the Grotte des Hyènes all bear different decorations. These decorations thus appear to denote individual initiatives in order to mark property, so that personal belongings displayed the identity of the person who made them. Note that in this respect, no purely ornamental decoration is present on any other production apart from certain personal ornaments, the medium par excellence used to convey social identity. Moreover, these smoothers record a high rate of recycling: they were frequently reused as small wedges, retouchers or awls, even though these tool types can easily be made from non-transformed blanks (figure 7[5]). This recycling denotes a desire to prolong the life cycle of these tools, which is also clear in the care involved in maintaining awls on horse metapodials. Micro-wear analysis of surfaces and the evolution of

6. « Cette interprétation s'inspire de réflexions ethnologiques, selon lesquelles il existe une relation étroite entre la nature des armes et la sociologie de la chasse (Testart, 1985). À partir de cette idée, on peut en effet suggérer que les armes moustériennes – s'il s'agit bien d'épieux utilisés en armes de hast (Shea, *op. cit.* ; Villa, Lenoir, *op. cit.*) – étaient employées dans le cadre de chasses collectives, tandis que des armes de jet, dont l'invention pourrait avoir justement entraîné le développement d'armatures en pierre ou en os, sont de nature à favoriser la pratique de chasses plus individuelles ».
["This interpretation is inspired by ethnological reflections, which point to a close relationship between the nature of the weapons and the sociology of the hunt (Testart, 1985). Based on this, we can suggest that Mousterian weapons – if they were indeed spears used as hast weapons (Shea, *op. cit.*; Villa, Lenoir, *op. cit.*) – were used in the sphere of collective hunting, whereas projectiles, which could have given rise to the development of projectile elements in stone or in bone, tend to favor the practice of individual hunting"] (Bachellerie *et al.*, 2011: 134).

the morphometric characteristics of these awls show regular and multiple cases of resharpening (figure 7[1-3]). This will to make tools last is part of behavior reserved for high yield, familiar, ... and personal tools (referred to by A. Choyke as "*individual favorite tools*": Choyke, 2001, 2006).

If we acknowledge the existence of personal and individual toolkits devoted to skin processing, then that implies the recognition of a certain identity of the group members practicing this activity, or even a certain autonomy. In this respect, smoothers and awls on horse metapodials are the only tools to have been used frequently for different tasks in a versatile way. The study of

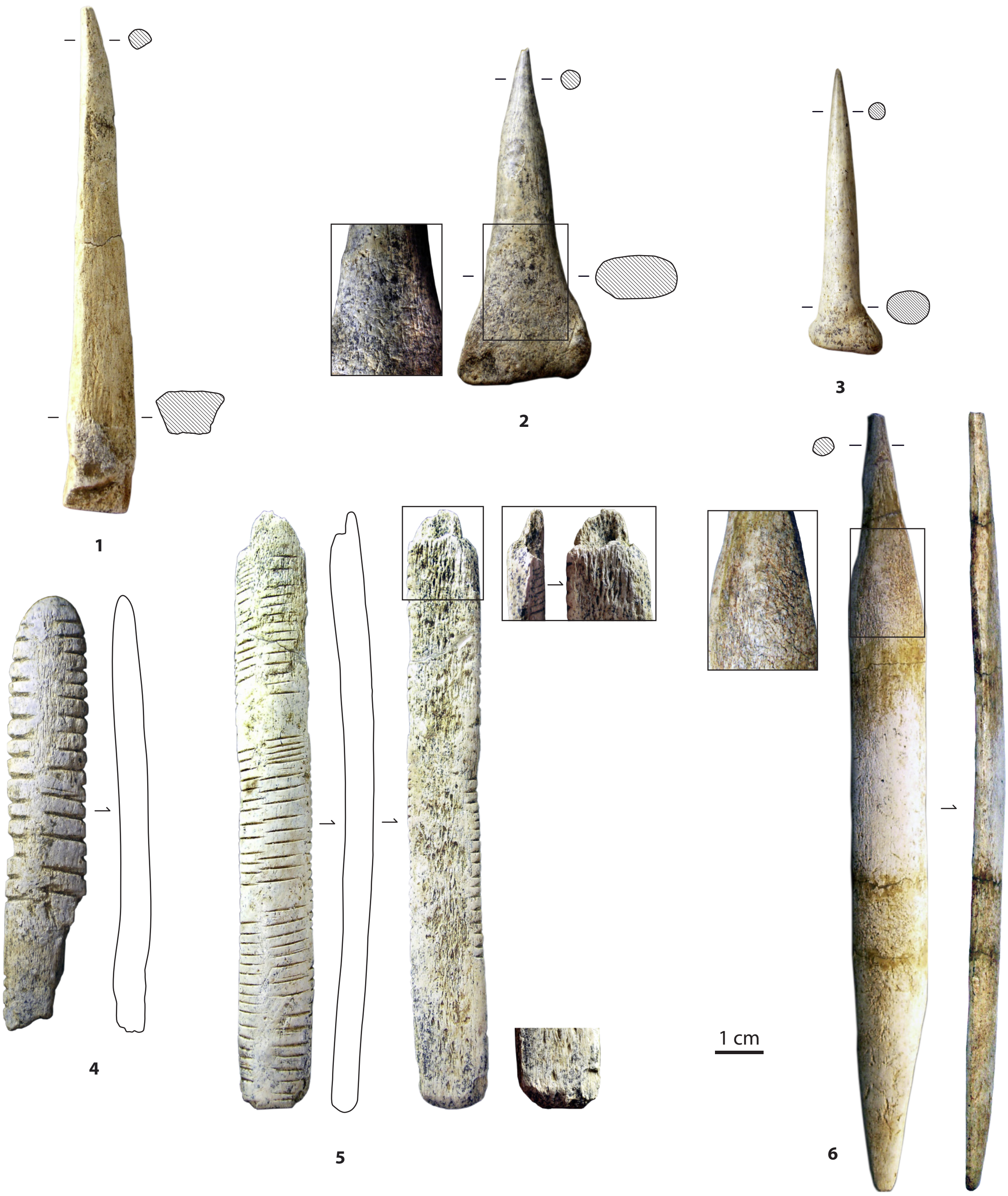

Figure 7 - Awls on metapodials and smoothers: personal tools? 1-3: awls at different stages of use, no. 2 was occasionally used as a retoucher; 4-6: smoothers, no. 5 was recycled as a wedge, no. 6 was occasionally used as a retoucher and one end was pointed for used as an awl. 1, 6: abri Castanet (north sector, layer A); 2-5: grotte des Hyènes (complex 2) (photos: É. Tartar).

the chronology of the fabrication, use and maintenance marks on tools has shown that several awls and smoothers could have occasionally been used as retouchers (figure 7[2]). A piece from Abri Castanet was even used alternately as a smoother, an awl and a retoucher (figure 7[6]). Yet these different uses are all part of the sum of actions involved in skin processing: the use of the retoucher for making and resharpening endscrapers used for scraping skins, the use of the smoother and the awl for softening and assembling (sewing) skins. This implies that the same individual could carry out all the technical operations involved in the same operative sequence autonomously. Naturally, this does not imply the craftsmanship in the strict sense of the term, but suggests a similar tendency to the presumed individuation of the hunter: other technical activities can also be part of a comparable and complementary process.

Work organization and the social division of tasks are still difficult themes to broach for prehistoric periods. However, the study of Aurignacian lithic and osseous equipment points to powerful sociological changes during the course of the transition between the Middle and Upper Paleolithic.

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THE CHRONOCULTURAL SEQUENCE OF BELGIAN COMPLEXES IN THE EUROPEAN AURIGNACIAN CONTEXT

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THE CHRONOCULTURAL SEQUENCE OF BELGIAN COMPLEXES IN THE EUROPEAN AURIGNACIAN CONTEXT

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Abstract

The study of Aurignacian collections from the Meuse Basin, associated with recent fieldwork data, has led to a new overview of the Aurignacian in this region. This work discredits some of the hypotheses advanced for the earliest Aurignacian occupations in north-western Europe and proposes a hypothetical chronocultural sequence based on the most reliable data for this period. The Meuse Basin presents an important concentration of Aurignacian occupations, some of them very rich and this zone is therefore conducive to large scale comparisons, in particular with regions with a better defined chronostratigraphic framework. The existence of technical and artistic similarities between these different European regions also highlights the strong links binding the Aurignacian complex, and is probably an important element for understanding the transition from the Middle Paleolithic to the Upper Paleolithic in Europe.

Keywords

Aurignacian, northwest Europe, lithic industry, symbolic production.

Introduction

Aurignacian occupations are generally rare in the northwest of Europe and are represented by rather sparse assemblages, apart from in the Meuse Basin, in the southern part of Belgium. These traces of the Aurignacian complex are important as they probably correspond to the first dispersals of anatomically modern populations into northern latitudes. Due to the abundance of these assemblages, comparisons with other European regions can be undertaken.

The Belgian Meuse Basin presents a remarkable concentration of Aurignacian occupations in relation to the rest of north-western Europe. In comparison, evidence of the Aurignacian in Great Britain is limited to several artefacts (Dinnis, 2012), the plains of the North of France are scattered with rare assemblages, often with no chronostratigraphic context (Bodu *et al.*, 2013; Brou *et al.*, 2013; Fagnart *et al.*, 2013), and northern Germany, from the Rhine to the Oder, only contains several important sites (Wildscheuer, Lommersum, Breitenbach; Hahn, 1977, 1989; figure 1). Conversely, at least sixteen Belgian sites are attributable to the Aurignacian (Flas, 2008), including several particularly rich sites. The density of Aurignacian occupations in this region could be linked to the fact that intensive research has long been carried out in the Meuse karst (Otte, Noiret, 2013). Nonetheless, this cannot fully account for differences between regions with much scanter remains, such as Great Britain, where equally intensive research has been conducted since the first half of the 19^{th} century (Flas, 2009; Dinnis, 2013), and the north of France where numerous rescue archeology operations have only yielded very rare traces of the early Upper

Figure 1 - Map showing the main sites mentioned in the text (CAD: D. Flas, F. Tessier).

Paleolithic (Goval, Hérisson, 2012; Fagnart *et al.*, 2013). However, it is important to recall that taphonomic conditions in the latter region are not very conducive to the preservation and discovery of early Upper Paleolithic sites (Soriano, 2013).

However, most of the Aurignacian assemblages from the Meuse Basin are from early excavations, dating mainly from the end of the 19th and the beginning of the 20th centuries, and thus present inaccurate and unreliable data. Moreover, the last detailed study of these assemblages was conducted about forty years ago (Otte, 1979). Since that time, major developments have changed our perception and approach to Aurignacian lithic complexes, particularly as far as bladelet production methods are concerned, leading to a renewed understanding of the chronological and technological structure of the different phases or facies of the Aurignacian complex (Le Brun-Ricalens *et al.*, 2005). Furthermore, a growing awareness of taphonomic factors has underlined problems of reliability in archeological assemblages and opened the way to a critical revision of formerly advanced hypotheses. In addition, recent excavations (Maisières-Canal; Miller *et al.*, 2004) and chronological and stratigraphic data (Trou Walou and Trou Al'Wesse; Pirson *et al.*, 2012; Miller *et al.*, 2011) have also enhanced our vision of the Belgian Aurignacian.

A program of study for the collections from early excavations was thus initiated and is currently in progress. This revision of the Aurignacian of the Meuse Basin, and in particular the lithic component, began with the study of the Spy Cave collections (Flas *et al.*, 2013) and continued with the examination of the main Aurignacian sites (Trou Magrite, Goyet, Trou du Renard, Trou du Sureau, Trou Al'Wesse, Grand-Abri at Ben-Ahin). The preliminary results of these studies are presented here. This new approach to lithic assemblages is mainly based on recent advances in Aurignacian techno-typology, developed over the course of the past fifteen years for sequences from the South of France. These have resulted in a more accurate description of the technical evolution sequencing of the Aurignacian complex (Bon, 2002; Bordes, 2006; Chiotti, 2003; Le Brun-Ricalens *et al.*, 2005; Michel, 2010; Pesesse, Michel, 2006).

1 - A very early Aurignacian in the northwest of Europe?

Most of the work on Le Trou Magrite was carried out at the end of the 19th and beginning of the 20th centuries, and yielded considerable Mousterian (Ulrix-Closset, 1975), Aurignacian and Gravettian industries (Otte, 1979), as well as several more recent elements from the Magdalenian to the Iron Age (Dewez, 1985, 1987). More recent operations were conducted on the terrace of Le Trou Magrite in 1991-1992, resulting in the identification of several archeological layers. Among these, *stratum* 3 yielded material attributed to the Aurignacian and radiocarbon dated to 41 300 ± 1 690 BP (CAMS-10352)[1] (Straus, 1995). As a result of this attribution, certain researchers assumed that anatomically modern humans and the Aurignacian spread across northern Europe at an early stage (Churchill, Smith, 2000; Davies, 2001; Harrold, Otte, 2000; Klein, 2000). However, others expressed reservations as to the reliability of the association between the dated bones and the lithic assemblage (Jacobi, Pettitt, 2000); whereas others suggested ascribing this assemblage to a transitional industry with leaf-shaped points rather than to the Aurignacian (Djindjian *et al.*, 2003; Zilhão, d'Errico, 1999).

The revised study of the material curated at the University of Liège, shows that the attribution of the assemblage from *stratum* 3 to the Aurignacian can be ruled out. Contrary to the typological interpretations advanced up until now (Straus, 1995), no characteristic Aurignacian artefacts, such as carinated pieces or Dufour bladelets, are present in this assemblage. Practically all of the collection displays typological and technological attributes compatible with the Middle Paleolithic (figure 2). Only a few elements (30 out of 2 319 artefacts) may possibly be ascribed to the Upper Paleolithic (bladelet fragments, light blades, a crested blade), but are not typical of the Aurignacian.

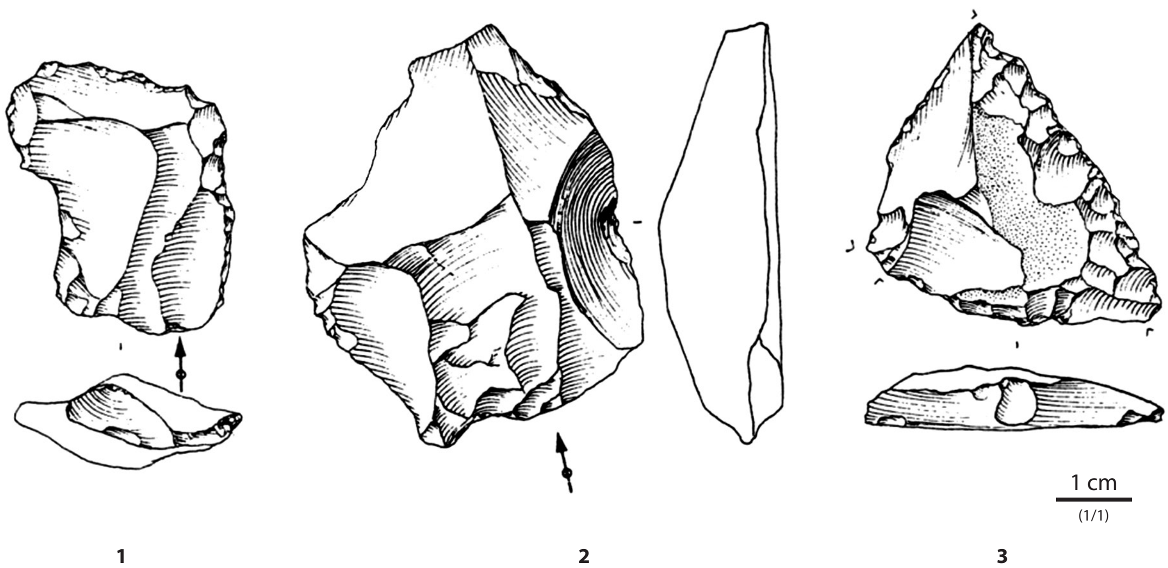

Figure 2 - Trou Magrite, *stratum* 3 (after Straus, 1995).
1: side scraper; 2: side scraper (classified as a nosed end scraper by L. Straus); 3: side scraper fragment.

1. All the dates cited are in non-calibrated radiocarbon chronology.

Moreover, these elements include a mesial fragment of a stemmed piece, similar to the Font-Robert points from earlier excavations (Otte, 1979) and probably Gravettian. In addition, most of the artefacts from *stratum* 3 display significant damage (chipped edges, blunted surfaces), pointing to substantial post-depositional disturbance. This zone also appears to have been affected by bioturbation, leading to the intrusion of much more recent elements, as shown by the presence of metallic slag. These observations show that this assemblage probably corresponds to Mousterian material comprising several intrusive pieces (in particular a Gravettian one), and that given the considerable damage to the material, it may not be in primary position. Therefore the bone dated to 40 000 BP is not incoherent with the lithic material but cannot be used to date the Mousterian occupation on account of the apparent displacement of the deposits.

This research thus confirms previously expressed doubts as to the Aurignacian nature of this assemblage and thereby calls into question the presence of this complex at such an early stage in north-western Europe. This latter question is particularly pertinent in the light of the recently advanced hypotheses founded on the new age estimate of the human remains from Kent's Cavern in England (Higham *et al.*, 2011a). This estimate, which is solely based on a Bayesian model established from the radiocarbon dates of faunal remains, postulates that the fragment of anatomically modern maxillary found in this cave during the 1920s, should be older than ~37 000 BP and thus corresponds to a starting date for the diffusion of the Aurignacian complex into the British Isles. However, the stratigraphic context of this discovery is not reliable (Flas, 2013; White, Pettitt, 2012), as shown by blade fragment refits demonstrating the secondary position of these deposits. Furthermore, no evidence of early Aurignacian occupation is known in Great Britain, only later Aurignacian stages (Dinnis, 2012).

The absence of a very early Aurignacian in north-western Europe is also compatible with data pointing to the presence of another complex in this region; the Lincombian-Ranisian-Jerzmanowician, and the persistence of the Neanderthal population until around 36 000 BP in Spy Cave (Flas, 2014; Semal *et al.*, 2013).

2 - Is there a proto-Aurignacian north of Arcy-sur-Cure?

In certain stratigraphic sequences in the southwest of France, assemblages with retouched bladelets beneath Aurignacian levels were initially classified as "Perigordian II" by Denis Peyrony (1946). Later, similarities with the Aurignacian complex were taken into account and these assemblages were described as "Proto-Aurignacian" by Georges Laplace (1966). However, this concept was subsequently seldom used and some of these assemblages, at times mixed with heterogenous collections, were classified into diverse categories, namely the "Aurignacian 0" (Djindjian, 1993). Recently, renewed technological approaches to Aurignacian lithic industries have confirmed the differences between the Proto-Aurignacian and the early Aurignacian (or Aurignacian I), in particular concerning the typology of retouched bladelets and the technical relationships between bladelet and blade production (Bon, 2002; Bordes, 2006). The same differences observed in French assemblages have also been documented in Central Europe (Teyssandier, 2008), where the "Krems-Dufour" type Aurignacian, defined by Joachim Hahn (1977), partly corresponds to the Proto-Aurignacian. These early Upper Paleolithic assemblages with large retouched bladelets are part of a far-reaching phenomenon identified from the North of Spain to the Balkans and present similarities with some industries from the Near East (Tsanova *et al.*, 2012). In a European context, the geographic distribution of the Proto-Aurignacian thus appears to be based in the south, and the Grotte du Renne at Arcy-sur-Cure, with an abundant Proto-Aurignacian assemblage in layer VII (Bon, Bodu, 2002), seems to represent its northernmost extension.

The presence of this Proto-Aurignacian in the northwest of Europe might well be a particularly important element for discussions concerning the transition processes from the Middle to the Upper Paleolithic and the dispersal of modern humans in these regions. However, the presence of large Dufour bladelets in several lithic assemblages from the Meuse Basin had only been occasionally pointed out up until now (Otte, 1979). During the recent revision of the material from Spy Cave, two long and rectilinear fragments of Dufour bladelets were identified (Flas *et al.*, 2013). These pieces were similar to Proto-Aurignacian elements and equivalent pieces have also been identified in collections from Goyet, Abri Sandron, Trou du Chêne (Otte, 1979), Scladina Cave (Otte, 1998) and Franquenies (figure 3). However, in all these cases, these pieces lack a precise stratigraphic context and nothing allows us to confirm that they are from an early Upper Paleolithic occupation. It is imperative to continue the examination of collections comprising such bladelets with inverse retouch but caution must be applied to the interpretation of rare elements with no well-defined chronological and stratigraphic context due to the risk of confusion with pieces from the recent Upper Paleolithic. Indeed, similar bladelets with inverse retouch have been identified in the final Magdalenian in the North of France (Valentin, 1995) and in Belgium (Dewez, 1987).

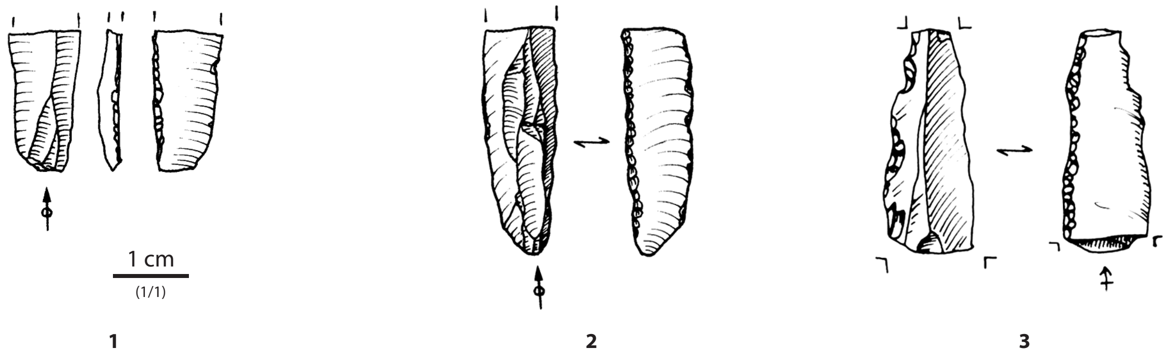

Figure 3 - Fragments of rectilinear bladelets with inverse retouch on the right edge, similar to Proto-Aurignacian Dufour bladelets. 1 and 2: Spy Cave (after Flas *et al.*, 2013); 3: Trou du Chêne (after Otte, 1979).

For the time being, it would be hasty to affirm the presence of the Proto-Aurignacian in the Meuse Basin on the basis of these few artefacts. However, the existence of these pieces should be taken into account in the study of other assemblages from north-western Europe as a more northern Proto-Aurignacian presence remains possible. This is the case, in particular for Beg-ar-C'hastel, on the north coast of Brittany. This site yielded an assemblage with numerous Dufour bladelets strongly evoking the Proto-Aurignacian, in a stratigraphic context preceding the last glacial maximum (Giot *et al.*, 1975; Hinguant, Monnier, 2013). In any event, if the Proto-Aurignacian extended north of the Paris Basin, it could probably only have done so during a period contemporaneous with the northernmost Proto-Aurignacian assemblages currently known, between *ca.* 36 and 34 000 BP (layer VII of Grotte du Renne, lower unit 04 of Les Cottés; Higham *et al.*, 2010; Hublin *et al.*, 2012; Talamo *et al.*, 2012).

3 - A chronocultural proposition for the Aurignacian sequence in the Meuse Basin

A - The early Aurignacian with split-based points

Unlike the Proto-Aurignacian, the presence of occupations attributable to the early Aurignacian appears more certain. However, for the time being, no consistent occupation or clearly identified archeological level backs up this affirmation, which is solely based on artefacts from diffuse collections probably including artefacts from different phases of the Aurignacian. Nonetheless, comparisons with reliable industries enable us to identify an early Aurignacian component in these mixed assemblages. The presence of carinated "end scrapers" with a wide debitage surface used to produce curved bladelets over 2 cm long, some of which are transformed by retouch into Dufour sub-type Dufour bladelets, evokes assemblages from the early Aurignacian in other regions (Bon, 2002; Bordes, 2006; Chiotti, 2003; Le Brun-Ricalens, 2005; Pelegrin, O'Farrell, 2005; Teyssandier, 2008). Moreover, several caves from the Meuse Basin have yielded split-based osseous points. The strict correlation between this type of point and the early Aurignacian is subject to debate, as it may also be present in Proto-Aurignacian assemblages, in particular (Ortega Cobos *et al.*, 2005; Tartar, White, 2013). However, to our knowledge, when only homogeneous assemblages are taken into account, no split-based osseous points have been recorded more recently than the early Aurignacian. It thus appears that the several split-based points from the Meuse Basin may be consistent with the previously described lithic elements and probably correspond to an early Aurignacian occupation. These early traces of the Aurignacian complex in this region have been identified in several caves: Spy (Flas *et al.*, 2013), Goyet, Trou Magrite, Trou du Sureau and Trou Al'Wesse (Otte, 1979) (figure 4).

It is difficult to directly date this phase, given the mixed character of the assemblages. At Trou Al'Wesse, a recently discovered bone tool was dated to 33 600 ± 550 BP (OxA-19969; Miller *et al.*, 2011) and could hypothetically correspond to previously discovered early Aurignacian elements (Otte, 1979). At Spy, a point fragment, probably from a split-based antler point, was dated to 32 800 +200/-190 BP (GrA-32619), which is probably a rather young age (C/N ratio = 3.6; Semal *et al.*, 2013). Near the Belgian Meuse Basin, the open-air site of Lommersum (Rhineland) yielded an occupation with similar bladelet production to early Aurignacian productions, dated between *ca.* 35 and 33 000 BP (Hahn, 1989; Matthies, 2012). Up until now, this was the earliest known Aurignacian occupation in these northern regions.

These chronological data are also coherent with the dates for the split-based point assemblages in France, as in layers 14 to 9 at Abri Pataud, *ca.* 35 000 to 33 500 (Higham *et al.*, 2011b), Abri Castanet from *ca.* 33 to 32 000 BP (White *et al.*, 2012) and Trou de la Mère Clochette between *ca.* 35 500 and 33 500 BP (Szmidt *et al.*, 2010).

B - The middle Aurignacian with nosed scrapers

The sequences from the southwest of France, between the early "classic" Aurignacian and the recent Aurignacian with carinated burins (*burins busqués*, Vachons burins), often comprise levels characterized by the predominance of carinated "nosed" end scrapers, cores producing frequently twisted and smaller bladelets than during the previous phase (Bordes, 2005, 2006; Chiotti, 2003; Michel, 2010). These elements are frequent in Belgian Aurignacian assemblages (figure 5). They account for the majority of carinated pieces observed during the recent revision of the collections from Spy Cave (Flas *et al.*, 2013). They are also abundant in many other assemblages, in particular at Trou Magrite, Goyet, Grotte de la Princesse Pauline and Trou du Diable (Otte, 1979). However

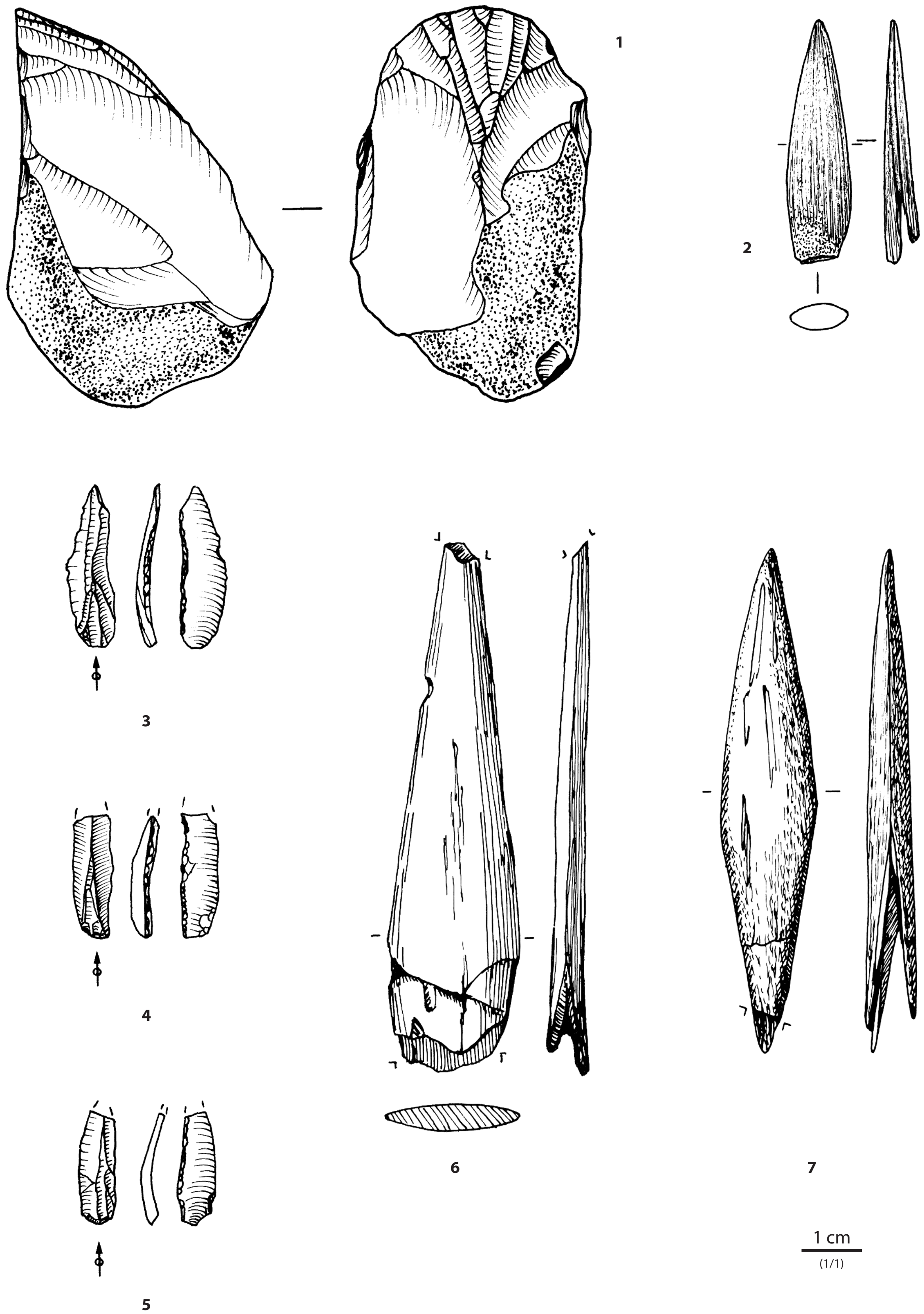

Figure 4 - Elements attributable to the early Aurignacian. 1: carinated end scraper (Spy Cave); 2, 6 and 7: split-based points (2, 6: Spy Cave; 7: Trou du Sureau); 3 to 5: Dufour bladelets (Dufour sub-type), Spy caves (1 to 5 after Flas *et al.*, 2013; 6 and 7 after Otte, 1979).

this phase never occurs in consistent and chronologically well-defined assemblages. One of the rare assemblages with a middle Aurignacian series showing little evidence of contamination by other phases of the same complex is Grand-Abri at Ben-Ahin (Destexhe-Jamotte, 1973). The direct dating of the bone material from this latter site could thus potentially shed light on the chronology of this phase in the Meuse Basin. In comparison, in the Abri Pataud sequence (layer 8), this middle phase of the Aurignacian complex was recently dated to approximately 33 000 BP (Higham *et al.*, 2011b).

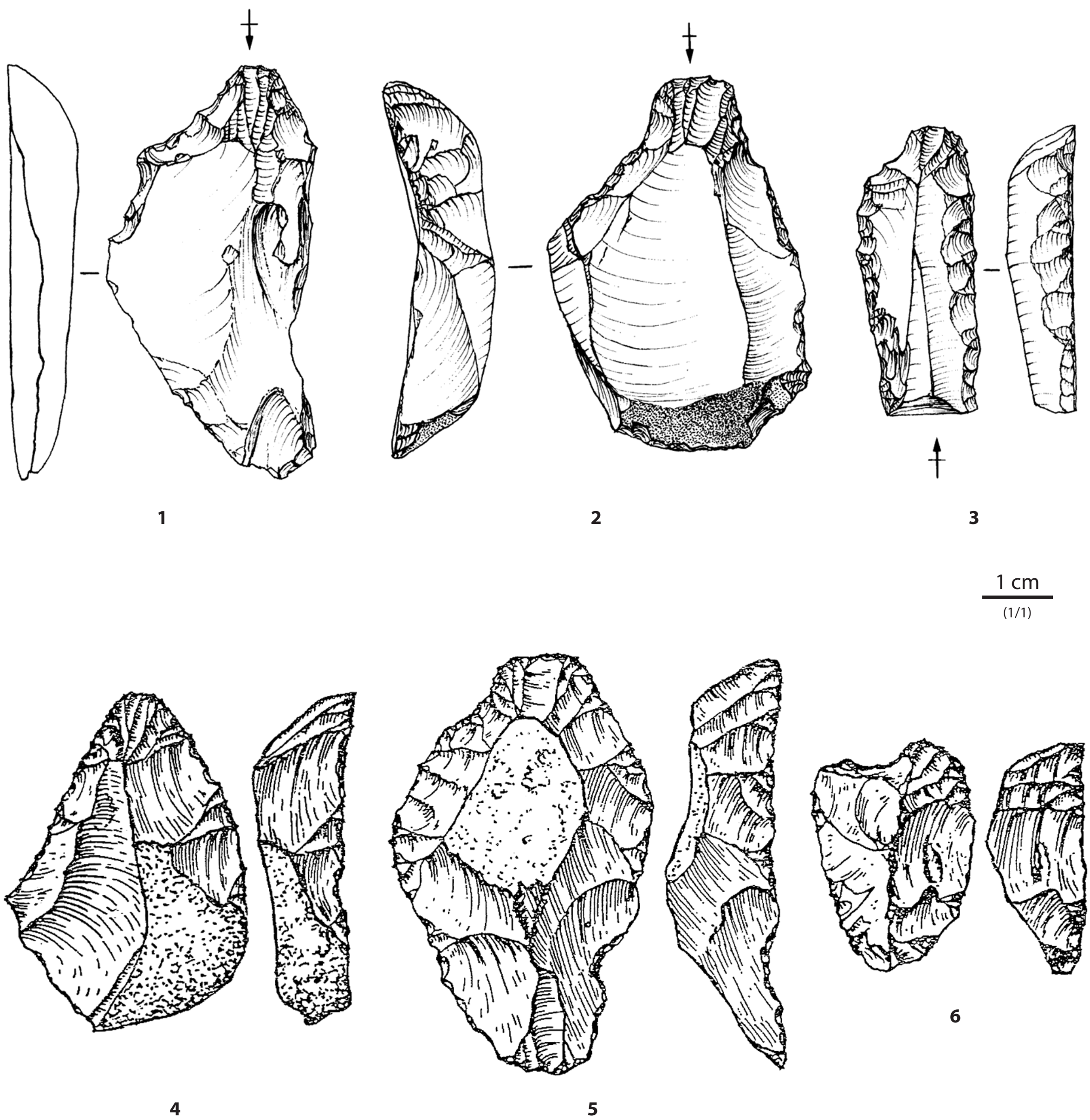

Figure 5 - Nosed end scrapers. 1 to 3: Spy Cave (after Flas *et al.*, 2013);
4 to 6: Grand-Abri (or grotte de la Cave, Ben-Ahin) (after Destexhe-Jamotte, 1973).

C - The recent Aurignacian with burins busqués

In the Aquitaine sequences, "carinated burin" type cores develop in the most recent levels, particularly burins busqués and Vachons burins (Bordes, Lenoble, 2002; Chiotti, 2003; Lucas, 1997; Michel, 2010; Pesesse, Michel, 2006). In Belgium, similar technologies have been identified and show, once again, the strong ties between the different regions of Europe during the Aurignacian period (figure 6). In this way, layer NB at Maisières-Canal revealed a brief occupation corresponding mainly to debitage activities, including a series of burins busqués and Roc-de-Combe-type Dufour bladelets. The latter are identical to those described in assemblages from the southwest (Flas *et al.*, 2006). A very detailed study of the chronostratigraphic sequence of the site (Haesaerts, 2004) indicates that layer NB probably corresponds to the Huneborg II Interstadial, dated to 32 500 BP (van der Hammen, 1995).

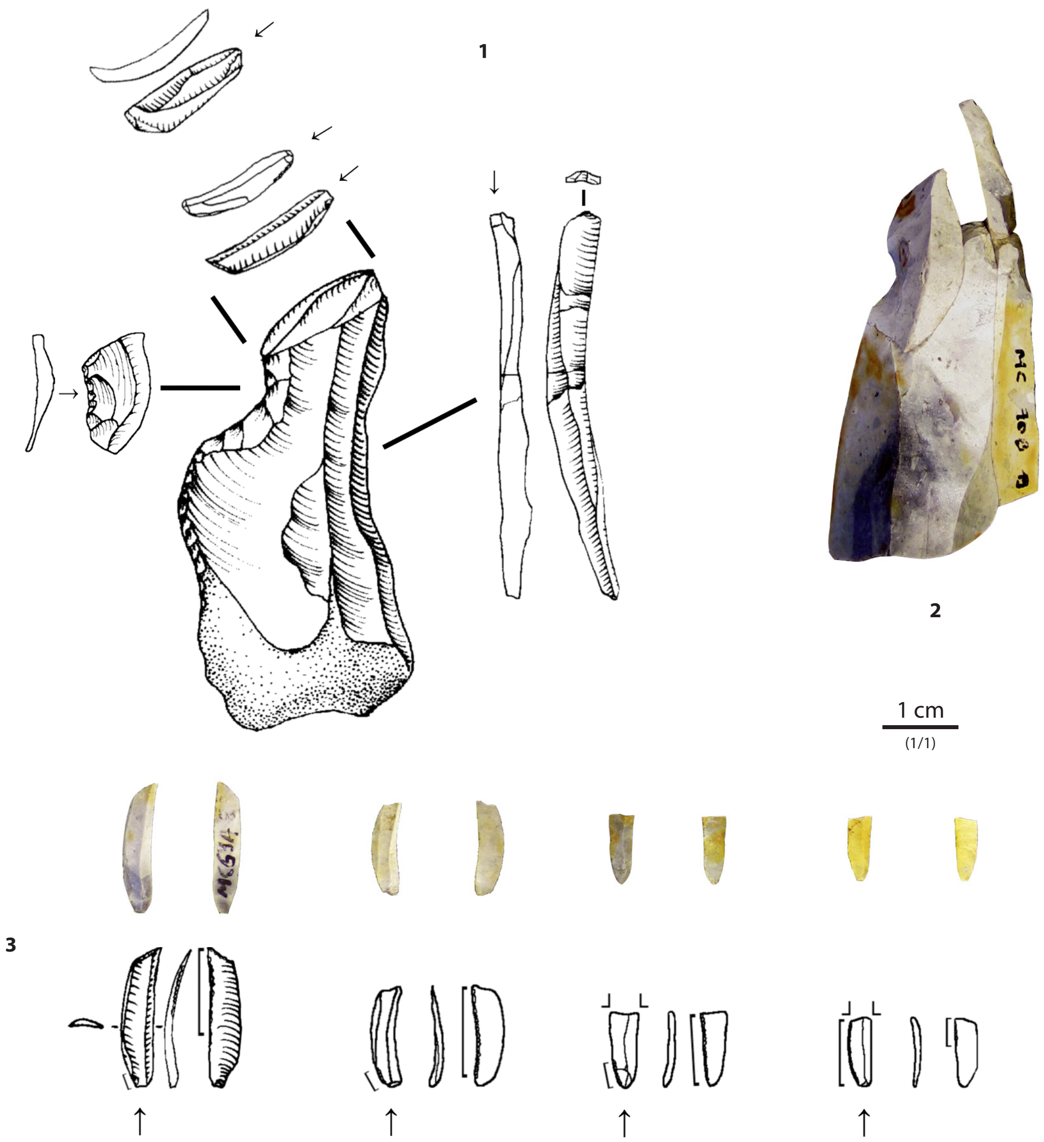

Figure 6 - Maisières-Canal, layer NB, bladelet production on burins busqués (after Flas *et al.*, 2006). 1: nosed burin and bladelet production products and by products; 2: nosed burin refit, of a burin spall and a notch resharpening flake limiting the length of the bladelet products; 3: Dufour bladelets (Roc-de-Combe sub-type), the retouched zones are underlined.

Another relatively limited but apparently consistent assemblage comes from layer CI-1 from Trou Walou. It is marked by the presence of carinated burins and also yielded a losange-shaped point with a massive base as well as decorative elements (Dewez, 1993). The chronostratigraphy and a former radiocarbon date [29 800 ± 760 BP (Lv-1587) on charcoal] point to an estimation of about 30 000 BP for this occupation (Pirson *et al.*, 2011a, 2011b), which is still in keeping with a recent Aurignacian phase. Trou du Renard is another limited assemblage dominated by carinated burins and burins busqués, alongside Roc-de-Combe-type Dufour bladelets (Otte, 1976), with a hypothetical age of 28 000 BP (Flas, 2005). However, this assemblage may be mixed with elements from more recent periods (recent Upper Paleolithic, Holocene?; Dinnis, Flas, in progress). Carinated burins and burins busqués are also present in the heterogeneous assemblages from Spy, Trou Magrite, Goyet and Fonds-de-Forêt (Otte, 1979).

Several Vachons burins have also been identified in the Belgian series, namely at Spy (Flas *et al.*, 2013), Goyet and Trou Magrite (Flas, *in progress*). These are probably from the final Aurignacian phase (Pesesse, Michel, 2006), or at least they correspond to this period in the southwest. These three sites also yielded “Paviland burins”, similar to those identified in certain British assemblages and probably part of the recent Aurignacian (Dinnis, 2011; Flas *et al.*, 2013).

The chronology of the end of the Aurignacian in the Meuse Basin is unclear due to the unreliable dates from Trou du Renard and the absence of chronological data for the assemblages with Vachons burins and “Paviland burins”. In the Aquitaine sequences, the Aurignacian with burins busqués is dated between *ca.* 33 and 32 000 BP at Abri Pataud and precedes the phase with Vachons burins (Chiotti, 2003; Higham *et al.*, 2011b; Michel, 2010). These data are consistent with the rare reliable chronological elements available for the British and Belgian Aurignacian occupations (Dinnis, 2012) bearing the same technologies, between *ca.* 33 and 30 000 BP. From 28 000 BP onwards, another complex emerges, known as the Maisierian, characterized by the presence of stemmed pieces similar to the early Gravettian Font-Robert points and with a very different technology to that of the Aurignacian (Pesesse, Flas, 2012).

4 - The role of symbolic production

Symbolic elements (ornaments, figurines, bone engravings) attributed to the Aurignacian are relatively frequent in the Meuse Basin (Dewez, 1985; Otte, 1979; Lejeune, 1987), but layer CI-1 from Trou Walou seems to be the only consistent assemblage with symbolic productions. These are represented by two perforated cervid teeth and a reindeer bone engraved with regular incisions (Dewez, 1993).

It is likely that symbolic production is associated with Aurignacian occupations in other less reliable stratigraphic contexts but as these assemblages probably comprise different Aurignacian assemblages it is impossible to link them to a specific phase (early, middle or recent) of this complex. This is the case, in particular, at Spy and Grotte de la Princesse Pauline (Otte, 1979). At Spy, ocher-covered ivory “ear-shaped” pendants, spherical ivory beads (represented by all the different production stages from ivory rods to finished products), ivory rings, numerous perforated animal teeth (fox, cervid) and bone tubes decorated with regular incisions are attributed to Aurignacian occupations (Otte, 1974; White, 1995; Khlopatchev, 2013). In the grotte de la Princesse Pauline, an antler pendant and an ivory ring decorated with incisions were found associated with perforated animal teeth (Otte, 1979). The ivory rings from Spy and Grotte de la Princesse Pauline have often been compared to pieces from other sites, such as Paviland Cave, Bockstein-Törle and Arcy-sur-Cure (Otte, 1979; White, 2002). Some of these ivory beads and decorated bone tubes from Spy also display analogies with decorative Aurignacian elements from Les Cottés (Rigaud *et al.*, 2014).

At other sites, such as Trou Magrite and Goyet, caution is called for as regards the association of symbolic elements with Aurignacian occupations. Certain items, namely beads and fragments of ivory rings, appear to be similar to those mentioned above in other sites and their attribution to the Aurignacian seems to be plausible. But it is more difficult to ascribe other elements to a specific period, in particular the anthropomorphic figurine from Trou Magrite (Otte, 1979; Dewez, 1985), especially considering the fact that this material was mixed with Gravettian and Magdalenian components.

Conclusion

The Aurignacian from the Meuse Basin is the only Aurignacian from northern Europe capable of being compared to other regions, such as the Aquitaine and the Swabian Jura. Nonetheless, assemblages derived from early excavations are often mixed and due to a lack of accuracy and reliability, the propositions outlined here remain hypothetical.

Contrary to postulates concerning Kent's Cavern or Trou Magrite, no assemblage from these regions can be attributed to the Aurignacian between 40 and 35 000 BP. During this period, the Lincombian-Ranisian-Jerzmanowician complex is present and probably corresponds to the last Neanderthal populations of the region. Moreover, Proto-Aurignacian occupations, probably more recent than 36 000 BP, remain too hypothetical in the light of current data and the only strong candidate is the Beg-ar-C'hastel assemblage.

On the other hand, from 35 000 BP onwards, as indicated by the Lommersum dates, the presence of early Aurignacian occupations is probable. This affirmation is based on lithic elements and the presence of split-based spear points in several sites in the Meuse Basin. Finally, the Aurignacian complex seems to display a similar evolution of bladelet technology to that described in the southwest of France: development of carinated "end scrapers" with a narrow debitage surface (particularly "nosed scrapers"), then a transition to different forms of carinated burins after 33 000 BP, including burins busqués and Vachons burins. As the chronology of the end of the Aurignacian in northwestern Europe is not clearly established, the existence of a gap before the development of the following phase, the Maisierian, at around 28 000 BP, cannot be excluded.

Although the Aurignacian complex seems to break down into different European regional clusters, these regions are connected by contacts, the flow of ideas and population movements, in the same way as an archipelago made up of different islands. These connections are illustrated by the wide diffusion of certain technical practices, such as split-based spear points during the early phase, or the production of Dufour Roc-de-Combe sub-type bladelets from burins busqués during the recent phase, clearly unifying the different Western European regions (Aquitaine, Meuse Basin, Great Britain). The circulation of raw material also indicates extensive networks and trans-regional routes (Le Brun-Ricalens, Bordes, 2007). In addition, the similarity between certain decorative elements from the Meuse Basin and the Swabian Jura or the southwest of France (Khlopachev, 2013; Rigaud *et al.*, 2014; Vanhaeren, d'Errico, 2006) clearly shows strong links between the different regions of the European Aurignacian. This view contrasts with what is known before the Aurignacian, when very different complexes divided Europe, with no apparent contact with each other (Châtelperronian, Lincombian-Ranisian-Jerzmanowician, Uluzzian, Szeletian, to cite but a few).

Nonetheless, we cannot deny that differences exist between the different European regions and it would be misleading to depict the Aurignacian as a monolithic entity (Liolios, Teyssandier, 2008). Although strong similarities link certain regions during certain phases, these connections are variable and probably evolved during the course of the sequence, perhaps with more marked regionalization phenomena during certain periods (where are the burins busqués east of the Rhine?, Flas *et al.*, 2006). In this respect, even older, low resolution Aurignacian collections from the Meuse Basin enable us to broach these questions and shed light on the history of this complex.

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THE LITHIC INDUSTRIES FROM BLANCHARD AND CASTANET ROCK SHELTERS (DORDOGNE, FRANCE):

Data from the 2005-2012 Excavations

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THE LITHIC INDUSTRIES FROM BLANCHARD AND CASTANET ROCK SHELTERS (DORDOGNE, FRANCE):

Data from the 2005-2012 Excavations

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Abstract

Renewed excavations directed by R. White in two Aurignacian rock shelters in the Vallon des Roches (Sergeac, Dordogne, France), Castanet (2005-2012) and Blanchard (2011-2012), have yielded reliable new series, and have improved our knowledge and reflections of the Aurignacian from these two reference sites.

Castanet Rock shelter was excavated over a surface of several square meters and yielded a single level, lying directly on the rocky substratum. Blanchard Rock shelter had been practically emptied by early excavations, but nonetheless contained two relatively rich archeological vestigial deposits, without stratigraphic overlap. Excavations in these two contiguous rock shelters, at the foot of the same cliff, yielded sufficient collections for a reliable typo-technological analysis and an updated cultural attribution.

Consequently, one of the series from Blanchard and the series from Castanet can be attributed to an Early Aurignacian, whereas the second series from Blanchard corresponds to a Recent Aurignacian. This provides us with a number of new observations concerning technical behaviors, raw material procurement and chronocultural informations that were not possible to affirm on the older collections.

Keywords

Aurignacian, Castanet, Blanchard, typology, technology, bladelet production, raw materials.

Introduction

The study of the beginning of the Upper Paleolithic in Europe raises fundamental questions concerning the identity and the cultural specificity of modern humans, the colonization of Europe and the establishment of modern human dominance on all of the occupied continents. The Aurignacian is the first Pan-European culture attributed to *Homo sapiens sapiens* and comprises original components that extend throughout the whole Upper Paleolithic: the first figurative representations, generalization and diversification of personal ornaments, generalization and organization of technical systems for osseous and lithic materials (including blades and bladelets), etc. Apart from these material aspects, social organization modes and the economic exploitation of the environment also appear to be specific to modern humans, or at least different to those of Neanderthals, their predecessors (for a discussion on the cultural differences between Neanderthals and modern humans, see for example D'Errico, 2003; Henshilwood *et al.*, 2003; Teyssandier *et al.*, 2010; Zilhão, 2011; Banks *et al.*, 2013).

These issues are as fundamental for prehistoric research as they are for human evolution and require the acquisition of new data. Old series are often dispersed, present biases due to sorting and are frequently associated with insufficient stratigraphic data. Here, we have the opportunity to evaluate our knowledge from the early pioneering work at Blanchard and Castanet with new and reliable observations from excavations conducted between 2005 and 2012.

A - The sites and their environment

The Blanchard and Castanet sites are located 25 m apart, in the commune of Sergeac (Dordogne, France). Both sites are collapsed rock shelters, carved into the Upper Cretaceous limestone of the eastern cliff of the vallon des Roches. This small valley, perpendicular to the Vézère River, contains ten or more Paleolithic sites (Sonneville-Bordes, 1960; figures 1-2).

The surrounding Cretaceous limestone massif contains good quality flint deposits, particularly in the Santonian horizons, providing abundant raw materials within a radius of several kilometers. These materials are accumulated at the base of the slopes in the colluviums. The color, cortex and structure of these rocks were modified in Tertiary detrital deposits with high concentrations of iron. They are also found in alluvial formations, where they are mixed with pebbles from more distant sources (quartz, gneiss, granite, schist, basalt, sandstone, ...) and associated with silicifications (flint and jasper) from the southwest foothills of the Massif Central (Demars, 1994; Morala, 2010, in press).

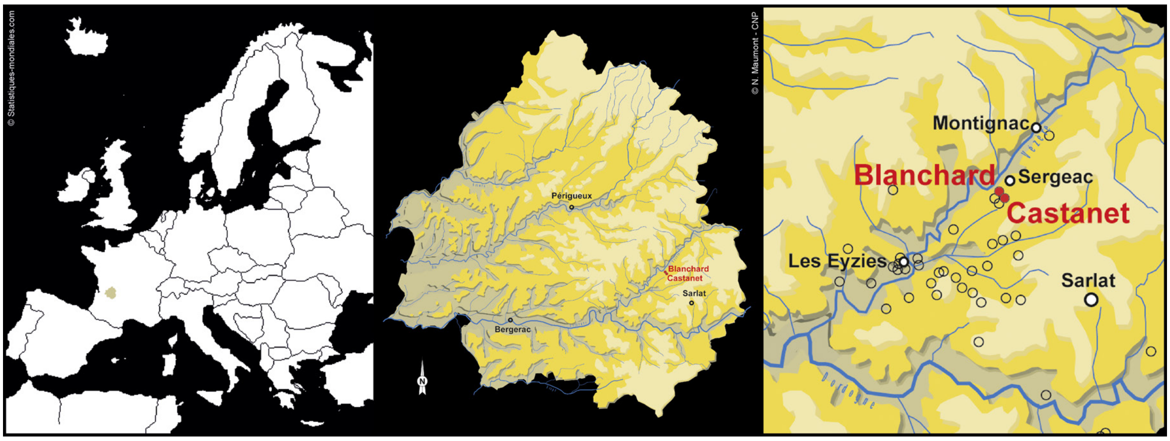

Figure 1 - Map showing the location of abri Castanet and abri Blanchard (CAD: N. Cahoreau, CNP).

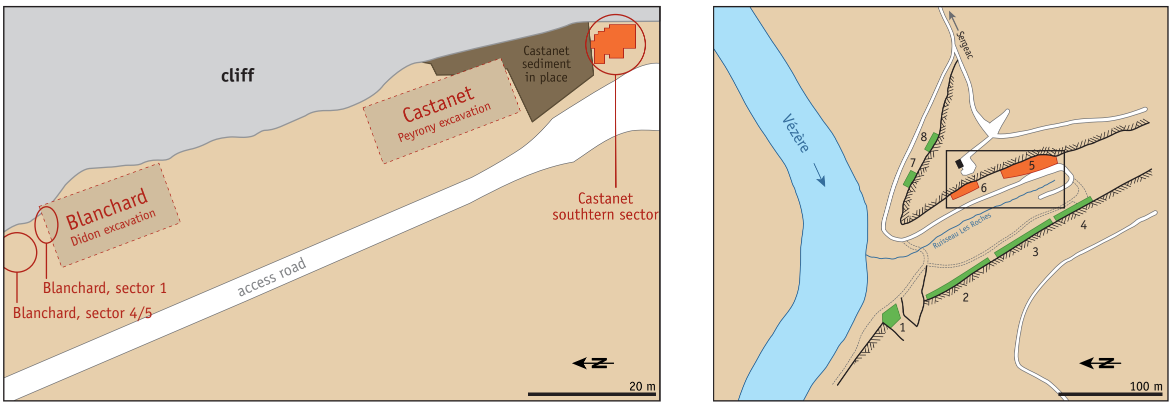

Figure 2 - Map of the vallon des Roches (after Sonneville-Bordes, 1960, modified) and the location of the different excavated sectors at Castanet and Blanchard (CAD: L. Chiotti). 1: abri de La Souquette; 2: abri Labattut; 3: abri du Roc de l'Acier ; 4: abri Reverdit; 5: abri Castanet; 6: abri Blanchard; 7: abri Blanchard II; 8: abri des Merveilles.

B - Excavation history

Blanchard Rock shelter was excavated in 1910-1911 by L. Didon (Didon, 1911; Delluc, Delluc, 1981a) and Castanet in 1911-1912 and 1924-1925 by D. Peyrony (1910, 1935). For both sites, M. Castanet was "the right-hand man", who identified the sites, conducted the excavations and wrote detailed reports of his work for L. Didon and D. Peyrony.

Two levels were identified in both shelters, and the base levels in both sites were clearly attributed to the Aurignacian I (or Early Aurignacian). The upper levels were more difficult to determine and were considered by D. Peyrony, then by D. de Sonneville-Bordes, as Aurignacian II (or Recent Aurignacian[1]) on the basis of the presence of several lozenge-shaped points (Peyrony, 1935; Sonneville-Bordes, 1960).

After the excavations, the collections from these sites underwent different treatment: the collections from Blanchard were mixed up by L. Didon and then scattered among various French and foreign institutions (Delluc, Delluc, 1981b; White, 1992). The D. Peyrony collections from Castanet were curated at the Musée national de Préhistoire in Les Eyzies. They are thus more completely preserved.

The opposite occurred for the excavation archives: M. Castanet's reports from Blanchard were kept by the Didon family (Delluc, Delluc, 1981a), whereas those from Castanet have not been located, as is true of a large part of D. Peyrony's archives.

From 1995 to 1998, research resumed at Castanet, directed by J. Pelegrin and R. White, and resulted in the identification of the location of D. Peyrony's trench and the excavation of a still intact sector in the south, which had however been truncated by the widening of the nearby road. These excavations were then pursued by R. White from 2005 to 2012. In this sector, only the Early Aurignacian level was identified. Investigations conducted in the valley (test pits, geophysical prospection, etc.) identified several small strips of layers with archeological remains at the northern end of the Blanchard Rock shelter, which were then excavated in 2011-2012. Two sectors, Blanchard 1 and Blanchard 4/5, yielded sufficient quantities of objects for a chronocultural attribution and a reliable analysis.

C - The recent lithic series from Castanet and Blanchard

It is difficult to assess how representative the recent series are of the original site content. From a quantitative point of view, they only represent a very limited portion of the site. In Castanet, the recently excavated southern sector extends over less than 25 m², as opposed to 120 m² for D. Peyrony's excavation. From a qualitative viewpoint, on the other hand, these series did not undergo any technological or dimensional sorting.[2] It is important to note that for the southern sector of Castanet, the proportion of remains less than 15 mm long reaches 96%. These lithic complexes are thus much more representative of the techno-economic activities carried out in the excavated sectors.

1. The term Recent Aurignacian corresponds to the most frequently used appellation in current literature to designate D. Peyrony's stages II, III and IV (Peyrony, 1933, 1934) and the middle, recent and final phases of H. Delporte (Delporte, 1991). For Castanet and Blanchard, the upper levels are attributed to D. Peyrony's Aurignacian II (corresponding to H. Delporte's middle phase). However, for the purposes of this article, we prefer to use the more generic term "Recent Aurignacian", rather than the "Middle Aurignacian" to designate this phase, especially as the term Middle Aurignacian was recently re-used with a different definition to that of H. Delporte (Michel, 2010).
2. During the recent excavations (southern sector of Castanet and sectors 1 and 4/5 of Blanchard), the archeological remains were recorded up to a lower limit of 1.5 cm and the sediments were sieved using two different superimposed sieves: one with mesh 4 (6.14 mm) and the other with mesh 12 (0.91 mm).

2 - Castanet southern sector

Between 2005 and 2010, 115 518 lithic pieces were unearthed in the southern sector of Castanet. Most of these (110 999 objects, or 96% of the series) correspond to pieces less than 15 mm long found in sieve residues (table 1). Among these pieces, 7 090 objects were analyzed, 4 519 of which were recorded on-site (superior to 15 mm) and 2 571 of which were extracted from sieve residues. The latter correspond mainly to bladelets, or to specific pieces such as burin spalls or proximal blade fragments. The rest of the objects collected from sieve residues were counted but not analyzed.

<table>
<tr><th colspan="2">Lithic materiel</th><th colspan="2">Number of pieces</th></tr>
<tr><td rowspan="2">Studied pieces</td><td>Coordinate pieces</td><td rowspan="2">7 090</td><td>4 519</td></tr>
<tr><td>Pieces coming from sieve refusal</td><td>2 571</td></tr>
<tr><td rowspan="2">Sieve refusal
(< 15 mm)</td><td>Studied pieces</td><td rowspan="2">110 999</td><td>2 571</td></tr>
<tr><td>Pieces counted by dimensional classes</td><td>108 428</td></tr>
</table>

Table 1 - Inventory of the lithic material from the 2005-2010 series from Castanet southern sector.

A - Raw material economy

The assemblage includes local and more distant raw materials.

The local materials are all derived from the Senonian and represent 96% of all the analyzed objects. All the identified raw materials were found during field survey within two to three kilometers of the site (Morala, in press). The mineral environment around the Castanet site was thus favorable and the Aurignacian populations occupying the site did not necessarily have to cross the river to collect raw materials (figure 3).

The group of non-local flint (4%) is mainly made up of Upper Campanian flint (Fernandes *et al.*, 2012), known as Bergeracois (3%) and orange-yellow jaspers from the Infralias from Brive Basin (1%). The former are from about 50 km upstream of the site and the latter from about 40 km downstream. The Vézère River cut through the original formations of these rocks, but given the non-altered aspect of the cortex, they were not gathered in alluviums, but were collected from or beside primary outcrops.

Several materials from further away were also identified in small frequencies: Turonian flint from Fumel (Lot-et-Garonne; 60 km), Tertiary flint from Aurillac (Cantal; 100 km) and Grains de Mil flint from Saintes-Jonzac (Charente Maritime; 140 km).

B - The toolkit

The lithic toolkit from the 2005-2010 excavations includes 374 tools, or 5.3% of the overall material (table 2).

Most of these are end scrapers (33.3%), and they are generally flat and often on retouched blades. The Aurignacian scrapers[3] (8.4%) are mainly made up of carinates with rather wide retouch fronts (26.5 mm on average).

3. We include the end scrapers / cores in both the toolkit and the technological analysis. Although we consider them primarily as cores, they are present in typological lists and removing them would thus hinder comparisons with counts from other sites. In addition, if we excluded them from the typological counts, we would have to be sure that they were not used as tools, yet certain use-wear studies (still too few and far between) tend to prove the opposite (Hays, Lucas, 2000). Lastly, it is important to bear in mind that these tool categories / technological pieces are present-day interpretative guides and do not correspond to Paleolithic realities.

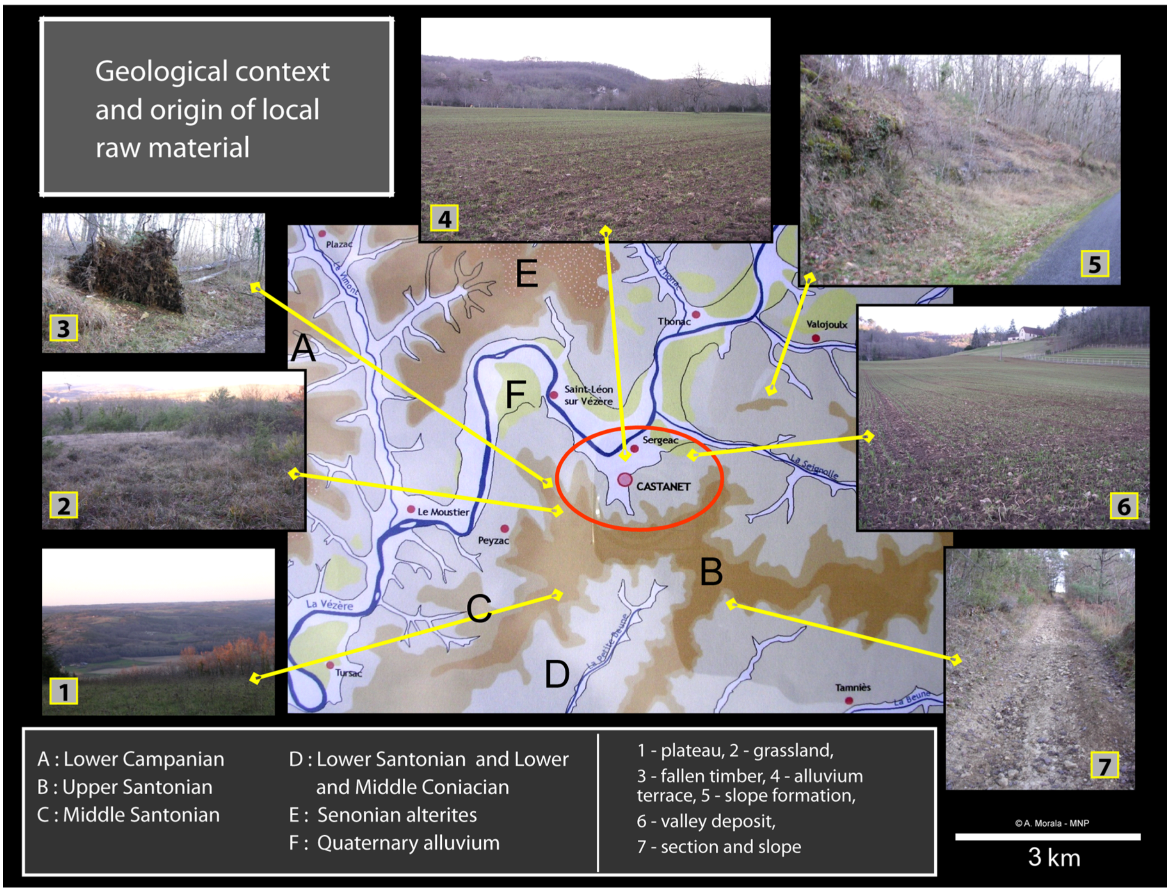

Figure 3 - Origins and lithological conditions of the local raw materials present in Castanet southern sector (photos and CAD: A. Morala).

	Tool (Sonneville-Bordes, Perrot type list)	Nb.	%
1	End scraper	21	6,3
2	Atypical end scraper	10	3,0
3	Double end scraper	8	2,4
5	End scraper on retouched blade	30	9,0
6	End scraper on Aurignacian blade	7	2,1
8	End scraper on flake	5	1,5
11	Carinate scraper	20	6,0
12	Atypical carinate scraper	6	1,8
13	Nose-ended scraper	2	0,6
14	Flat nosed scraper or shouldered end-scraper	2	0,6
17	End scraper / burin	1	0,3
18	End scraper / truncated blade	1	0,3
20	Borer or point / truncated blade	1	0,3
21	End scraper / beak	1	0,3
23	Borer or point	9	2,7
30	Burin on break	1	0,3
40	Multiple burin on truncation	1	0,3
41	Mixed multiple burin	2	0,6
44	Flat burin	1	0,3
60	Piece with straight truncation	4	1,2
61	Piece with oblique truncation	2	0,6
62	Piece with concave truncation	2	0,6

	Tool (Sonneville-Bordes, Perrot type list)	Nb.	%
65	Piece with continuous retouch on one edge	57	17,1
66	Piece with continuous retouch on both edges	21	6,3
67	Aurignacian blade	11	3,3
68	Strangled blade	1	0,3
73	Pick	1	0,3
74	Notched piece	22	6,6
75	Denticulate piece	2	0,6
76	Splintered piece	9	2,7
77	Side-scraper	3	0,9
89	Notched bladelet	9	2,7
90	Dufour bladelet	8	2,4
92	Various	52	15,6
	Total liste type	**333**	**100,0**

Outside Sonneville-Bordes, Perrot type list	Nb.
Flake with discontinuous or partial retouch	18
Blade with discontinuous or partial retouch	12
Bladelet with discontinuous or partial retouch	11
Total outside type list	**41**
Total	**374**

Table 2 - Typological count of the 2005-2010 series from Castanet southern sector.

The rare burins (1.5%) are not standardized and are made on natural surfaces or fractures. Retouched blades are well represented (27%), with several Aurignacian or strangled blades (3.6%).

Tools on bladelets represent 10.2%. They bear irregular, often discontinuous or partial retouch, which generally seems to result from bladelet use rather than intentional retouch.

The typological characteristics of this assemblage are similar to those of the Peyrony series (layers A and C; Sonneville-Bordes, 1960) and Pelegrin / White (1995-1998; Pelegrin, O'Farrell, 1998). The main difference is the rarity of retouched bladelets in the Peyrony series, which is due to the excavation methods used.

C - The blanks

By order of importance, the lithic material is made up of bladelets, flakes, and then blades, in much smaller quantities. As a result of the careful examination of the lithic material fine fraction, 76% of the counted bladelets are from sieve residues.

The fragmentation rate is lowest for flakes (34.2%). Blades are practically never whole and present a fracture rate of 94.4%, with abundant multiple fractures (57.3% of medial fragments). Fragmentation rates are lower for bladelets (75.5%).

The taphonomic origin of bladelet fragmentation is probably very significant. On the other hand, the very high blade fragmentation rate could be of anthropogenic origin. The blade category is clearly different from all the other categories of blanks on account of a high transformation rate (44.3%). On the other hand, flakes are very seldom used in the toolkit (only 3.5%). In spite of considerable bladelet production (44.3% of the studied material), very few of them were transformed into tools (4.4%).

D - Bladelet production

Chaîne opératoire *and bladelet production*

The best documented knapping activity (45.4% of the pieces) is bladelet production from carinate scrapers/cores. All the techno-economic phases of this activity are represented in the series.

Recent refitting revealed knapping of large thick flakes, used as blanks for carinate scrapers/cores. Several thick pieces (N = 7) with no bladelet scars are interpreted as carinate pre-forms (Chiotti, Cretin, 2011). Flakes derived from lateral shaping, maintenance and resharpening of carinate cores were found along with more than 3 000 bladelets.

Bladelet morphometry

We distinguished two categories of bladelets from carinate scrapers / cores on the basis of morphometric and technological criteria (figure 4):

- small regular bladelets (10 to 20 mm long and 3 to 10 mm wide), representing the primary production aim;
- larger bladelets from the shaping or maintenance of the debitage surface (end scraper front), considered as by-products of the *chaîne opératoire* rather than the main goal of the reduction sequence.

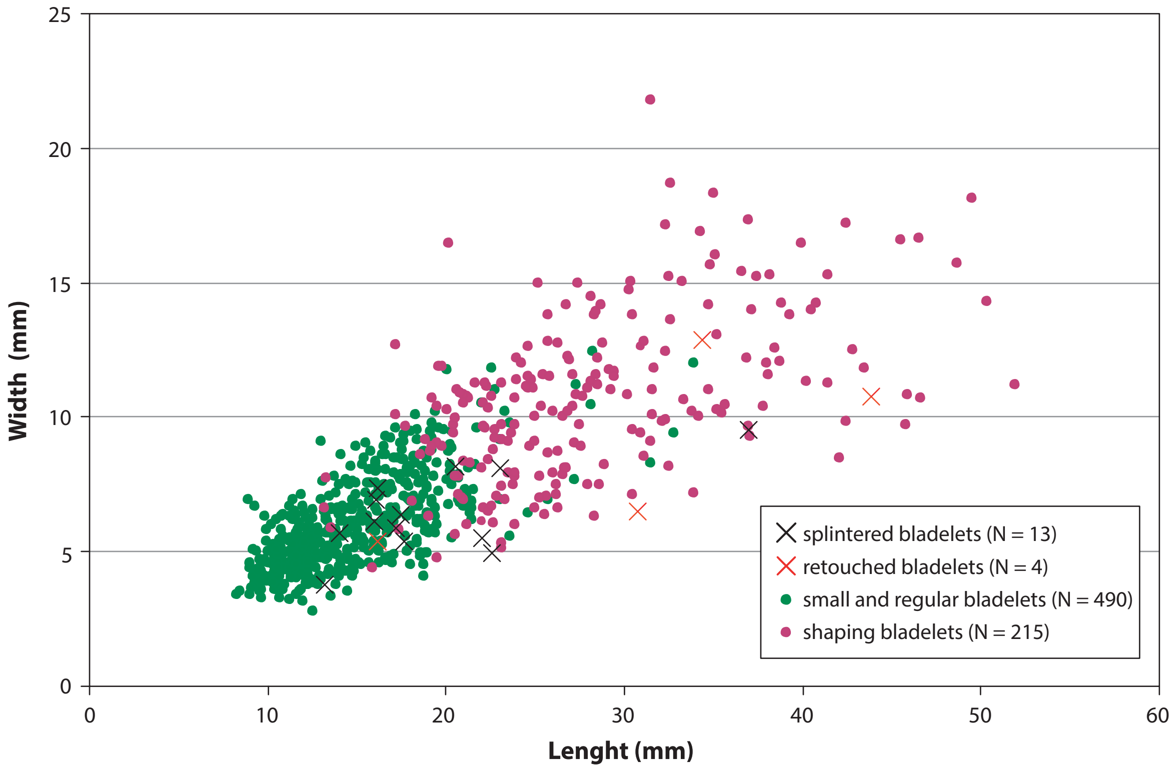

Figure 4 - Length / width ratio of the different types of bladelets derived from carinate scraper production from Castanet southern sector, excavated from 2005-2010. Only whole pieces are considered.

What were bladelets used for?

The very low number of retouched bladelets (N = 33) raises questions as to the aims of this production. Although some pieces (N = 101) show use damage (figure 5), the total number of retouched and/or utilised pieces represents but a small portion of overall bladelet production; less than 4.3%.

After a first analysis of the macroscopic traces present on the bladelets, several types of multiple or isolated use damage were observed:

- axial micro-flaking on the central axis of the piece, or on one of the edges;
- lateral transverse or oblique micro-flaking, generally confined to a single edge (figure 6).

The former may correspond to impact marks. On the other hand, the origin of lateral and oblique micro-flaking is less clear. Are these traces directly linked to the use of the cutting edge of the bladelets, do they result from impacts and hafting methods, or are these marks due to contact with bone when they penetrated into the animal?

In order to reply to these questions, a use-wear study is in progress, as well as hafting and propulsion experiments.[4]

4. Use-wear analysis is conducted by Joseba Rios, University of Burgos and the experiments by Élise Tartar and Florent Le Mené.

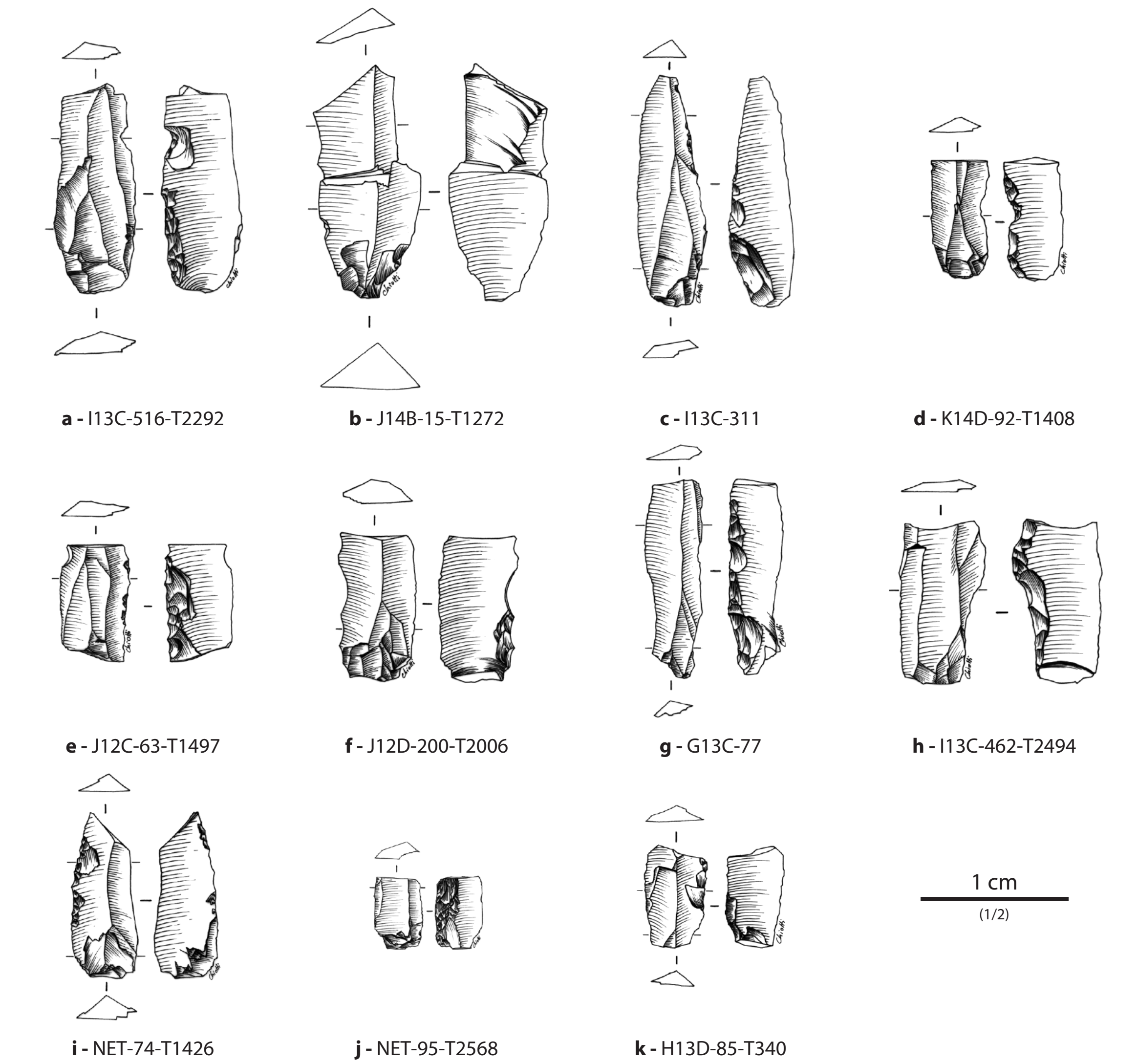

Figure 5 - Use-damaged bladelets from Castanet southern sector (drawings: L. Chiotti).

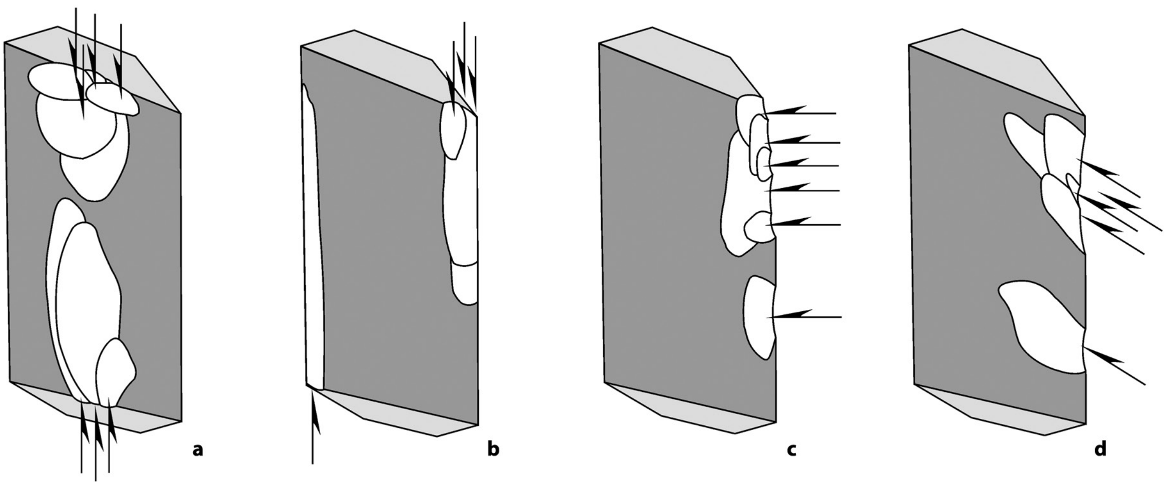

Figure 6 - Types of use damage (*esquillements*) on the bladelets from the southern sector of Castanet. a: axial micro-flaking on the central axis of the bladelet; b: axial micro-flakes on the edges of the bladelet; c: transverse lateral micro-flaking; d: oblique lateral micro-flaking (CAD: L. Chiotti).

The distribution of the length and width of whole bladelets, all categories combined, shows that use-damaged bladelets are similar to the small bladelets targeted by the production process (cf. figure 4). This could be an argument in favor of the use of these elements with no further transformation, whereby micro-flaking would result from use.

Retouched bladelets do not make up a coherent typological group but are similar to large bladelets, considered to be by-products. Although these pieces do not correspond to the aim of bladelet production, they may correspond to the opportunistic use of existing blanks.

E - Blade production

Evidence of blade production is not very frequent in the southern sector of Castanet, with only 431 blades, or 6.1% of all the blanks. These blades are practically all fragmented (95.4%). The length of the 20 whole blades is between 46.8 and 93.1 mm. We did not identify any distinct populations within the blade group.

Most of them were produced by unipolar debitage with a soft hammer. Particular care was taken with the striking platform, and the striking surface was practically systematically prepared, and very frequently displays edge abrasion.

As for the other blank categories, local flint is predominant, but the proportion of imported flint, and particularly Bergeracois flint, is higher for this category of pieces (11.8%).

Given that a large proportion of the products are absent, in particular the cores, this series only provides a fragmentary vision of blade debitage. Almost all of the production seems to have occurred outside the excavated zone (outside the site or in another sector of the habitat?).

3 - Blanchard sector 4/5

Discovery conditions were not *a priori* ideal as this series comes from a very limited, more or less concreted layer fragment, in contact with the bedrock, in an uncertain sedimentary context with very different patinas. Three stratigraphic units were identified at the excavation, mainly on the basis of sedimentological criteria. However, the refits (which concern 8.7% of the objects over 15 mm) linking these three units show the integrity of this series.

These results, combined with those from the geoarcheological analysis, point to a chronologically consistent series subject to post-depositional water percolation.

This series of 2 566 lithic pieces is mainly made up of bladelets (43.2%) and flakes (31.1%), then blades (12.5%). Blades are thus better represented than in the southern sector of Castanet (6%), but relative blank proportions remain very similar.

A - The toolkit

Sector 4/5 yielded 112 tools, representing 4.5% of the series (table 3). Retouched blades make up the main category, including three Aurignacian blades. End scrapers represent the second most important category, with a majority of flat end scrapers, more than half of which are on retouched blades or Aurignacian blades. There are also seven carinate scrapers. They have wide fronts, on average 26 mm, very similar to those from the southern sector of Castanet. There are no nosed scrapers. Six burins are present, but there are no Aurignacian burins (*busqué*, carinate or Vachons).

The bladelet toolkit is made up of 11 pieces with rather irregular retouch (including several Dufour bladelets). Four other bladelets present very marked use damage. All of these characteristics are relatively similar to those from the southern sector of Castanet.

	Tool (Sonneville-Bordes, Perrot type list)	Nb.	%
1	End scraper	6	5,9
2	Atypical end scraper	1	1,0
3	Double end scraper on Aurignacian blade	1	1,0
5	End scraper on retouched blade	9	8,9
6	End scraper on Aurignacian blade	1	1,0
11	Carinate scraper	7	6,9
17	End scraper / burin	1	1,0
21	End scraper / point	2	2,0
22	Burin / point	1	1,0
23	Point or beak	6	5,9
27	Straight dihedral burin	1	1,0
30	Burin on natural surface	3	3,0
37	Burin on truncation	1	1,0
41	Mixed multiple burin	1	1,0
60	Piece with straight truncation	2	2,0
62	Piece with concave truncation	1	1,0
65	Piece with continuous retouch on one edge	11	10,9
65	Bladelet with continuous retouch on one edge	5	5,0
66	Piece with continuous retouch on both edges	12	11,9
66	Bladelet with continuous retouch on both edges	1	1,0
67	Aurignacian blade	3	3,0
73	Pick	1	1,0
74	Notched piece	1	1,0
76	Splintered piece	7	6,9
89	Notched bladelet	1	1,0
90	Dufour bladelet	3	3,0
92	Various (tool fragments)	12	11,9
	Total liste type	**101**	**100,0**

Outside Sonneville-Bordes, Perrot type list	Nb.
Flake with discontinuous or partial retouch	3
Blade with discontinuous or partial retouch	7
Bladelet with discontinuous or partial retouch	1
Total outside type list	**11**
Total	**112**

Table 3 - Typological count of the 2011-2012 series from Blanchard sector 4/5.

B - Bladelet production

A large proportion of the bladelets, 43.1%, were produced from Aurignacian scrapers.

The whole *chaîne opératoire* is represented, including pre-forms, shaping flakes and bladelets and resharpening flakes.

Several generally larger and more rectilinear bladelets (8.3%), seem to come from another production system. In addition, four bladelet cores are present: two relatively flat cores, with two alternating opposed striking platforms, and two unipolar cores with a single striking platform on a flake and a block fragment.

C - Blade production

Three-hundred and twenty-two blades, most of which are unipolar, were counted in this series. Only 31 of them are whole, with lengths ranging between 23 and 104 mm.

The refits brought to light evidence of on-site production of large blades, with lengths superior to 150 mm and widths of over 35 mm (figure 7), and of smaller blades representing most of the blade production (figure 8). Refits of smaller blades reveal the use of blocks of average dimensions, which could not have been used earlier for the production of large blades. On the other hand, we do not have enough elements to determine whether the cores producing the large blades were subsequently reduced in order to produce smaller blades. In other words, we cannot assess whether there is a single production system, with progressive core reduction, or whether there are two independent production systems.

The large blades are in local Senonian flint, which represents the majority of the raw materials used at the site. There is thus no selection of specific materials for the production of these large modules.

Figure 7 - Refit of a large blade debitage sequence from Blanchard sector 4/5 (photos: L. Chiotti).

Figure 8 - Refit of a small blade debitage sequence from Blanchard sector 4/5 (photos: L. Chiotti).

4 - Blanchard sector 1

The series from sector 1 contains a total of 1 494 lithic pieces, mainly made up of bladelets (44.4%) and flakes (36.8%). Blades are relatively rare (6.8%).

A - The toolkit

The series is comprised of 103 tools (table 4), or 7% of the lithic assemblage.

The best-represented category is by far the Roc de Combe subtype Dufour bladelets, which represent 34.4% of the tools. Overall, the proportion of tools on bladelets is 40.6%.

The end scraper group is dominated by thick Aurignacian scrapers: carinate scrapers (6.2%) and nosed scrapers (7.3%). They all show much narrower fronts than the preceding series, with an average width of 17 mm.

Burins are also well represented, and include four Aurignacian burins: three carinate burins (including a multiple dihedral burin) and a Vachons burin (figures 9-10). These are all irregular, relatively atypical objects. There are no *busked burins*.

Figure 9 - Carinate burins from Blanchard sector 1 (photos: L. Chiotti).

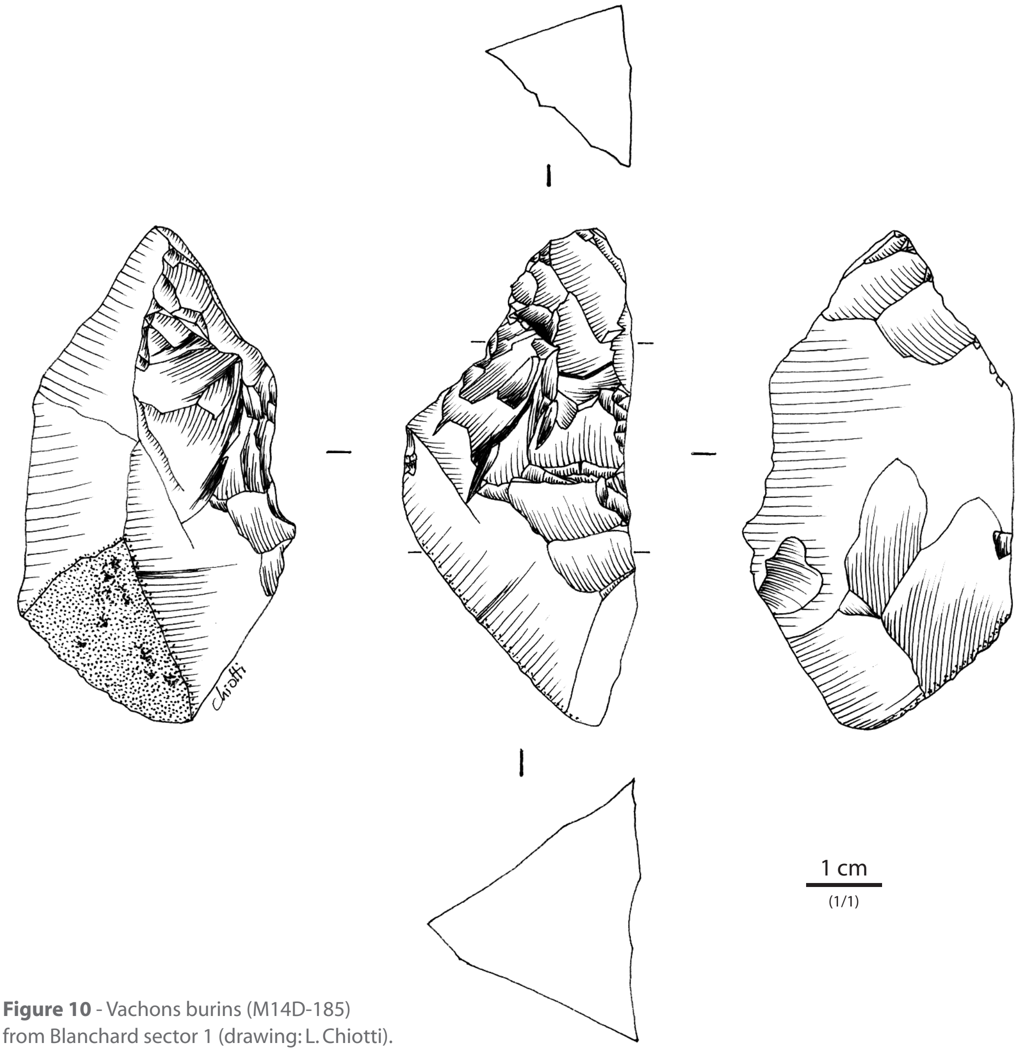

Figure 10 - Vachons burins (M14D-185) from Blanchard sector 1 (drawing: L. Chiotti).

	Tool (Sonneville-Bordes, Perrot type list)	Nb.	%
1	End scraper	5	5,2
2	Atypical end scraper	2	2,1
5	End scraper on retouched blade	2	2,1
11	Carinate scraper	5	5,2
12	Atypical carinate scraper	1	1,0
13	Nosed scraper	7	7,3
17	End scraper / burin	1	1,0
27	Straight dihedral burin	1	1,0
28	Asymmetrical dihedral burin	1	1,0
29	Dihedral burin on angle	1	1,0
30	Burin on natural surface	2	2,1
31	Multiple dihedral burin	3	3,1
32	Carinate burin	2	2,1
32	Vachons burin	1	1,0
35	Burin on oblique truncation	2	2,1
60	Piece with straight truncation	2	2,1
61	Piece with oblique truncation	1	1,0
65	Piece with continuous retouch on one edge	9	9,4
65	Bladelet with continuous retouch on one edge	5	5,2
66	Piece with continuous retouch on both edges	2	2,1
66	Bladelet with continuous retouch on both edges	1	1,0
74	Notched piece	3	3,1
90	Dufour bladelet	33	34,4
92	Various (tool fragments)	4	4,2
	Total liste type	**96**	**100,0**

Outside Sonneville-Bordes, Perrot type list	Nb.
Flake with discontinuous or partial retouch	2
Blade with discontinuous or partial retouch	3
Bladelet with discontinuous or partial retouch	2
Total outside type list	**7**
Total	**103**

Table 4 - Typological count of the 2011-2012 series from Blanchard sector 1.

The series contains ten other burins, dihedral, on natural surfaces, on truncations or on breaks. Four of them are on blades, and the others are on relatively thick flakes.

Continuously retouched pieces represent 11.5% of the toolkit, but no Aurignacian blades were identified.

The 33 Dufour bladelets are all Roc de Combe subtype, with a very specific morphology, showing a clear selection from within the bladelet group. They are small in size, with a maximum length of 16 mm, an average width of 3.2 mm and an average thickness of 1.1 mm. They are produced on Aurignacian scrapers or Aurignacian burins and are mainly curved, twisted and offset to the right. They bear fine inverse retouch on the right edge, generally on the whole edge and sometimes with more intense retouch on the proximal part. Some of them also bear retouch on the left edge, which is generally direct.

Eight other bladelets are retouched. When blank morphology can be determined, it is similar to that of the Dufour bladelets. Retouch is generally very regular, and thus comparable to retouch on Dufour bladelets.

B - Bladelet production

The majority of the bladelets, or 76.5%, were produced from Aurignacian scrapers (carinate and nosed scrapers) and Aurignacian burins (carinate and Vachons). For most of them (375 pieces), it is impossible to distinguish between end scraper or burin production. Only 12 determinable pieces clearly derive from Aurignacian scrapers and 121 from Aurignacian burins. The latter are identifiable thanks to the presence of an abrupt surface on one of the edges which corresponds to part of the lower surface of the burin blank (Chiotti, 2003).

The Aurignacian scraper *chaîne opératoire* is comparable to that described in the southern sector of Castanet (2005-2010), although front width is much narrower. Similar shaping procedures to those applied to carinate scraper / core pre-forms from Castanet were also observed (Chiotti, Cretin, 2011).

As well as the bladelets themselves, the production of Aurignacian burins is clearly evidenced by the presence of four (carinate and Vachons) burins.

Several generally larger and more rectilinear bladelets (28 pieces, 4.2%) come from a different type of debitage, represented by knapping along the thickness of four cores on small plaques or blocks.

C - Blade production

Out of the 102 blades from sector 1, only 13 are whole and present lengths ranging between 29 and 92 mm. Average blade width and thickness are 24.1 mm and 8.4 mm, respectively.

Four blade cores were found. These are unipolar prismatic cores, some of which have a secondary striking platform for core maintenance. No large blades, comparable to those from sector 4/5 were found in this series.

D - Chronocultural attribution

The overall characteristics from sector 1 at Blanchard thus clearly differentiate this assemblage from the southern sector of Castanet and from sector 4/5 at Blanchard, due to the presence of:

- a much higher proportion of nosed scrapers;
- more elongated carinate scrapers/cores with narrower fronts than those from the other two series;

- a higher proportions of all types of burins;
- Aurignacian burins (carinate and Vachons burins);
- abundant bladelets from Aurignacian burins;
- large quantities of small Roc de Combe subtype Dufour bladelets.

These different elements point towards a Recent Aurignacian attribution for this industry.

The presence of a Vachons burin, which is an element from the end of the Aurignacian sequence (Pesesse, Michel 2006; Michel, 2010) and the absence of busked *burins* would argue in favor of a more recent Aurignacian than the "Aurignacian II". However, on account of the small number of pieces in the series, the depositional conditions (level in secondary position; Tartar *et al.*, 2014) and the existence of other badly characterized facies for the end of the Aurignacian, we will cautiously advance a *sensu lato* Recent Aurignacian attribution.

5 - Contribution of new data

The study of the recent lithic material series from Abri Castanet and Abri Blanchard provides us with a number of new observations concerning technical behaviors, the exploitation of the lithic environment and chronocultural data.

A - Technical behavior

At Castanet and Blanchard, similar behavior in relation to the Aurignacian lithic material indicates close technical proximity. However, some differences can be discerned for the technical procedures and the toolkit.

In all cases, lithic production is oriented towards bladelet production from thick end scrapers, generally made on flakes. Some of the carinate scrapers / cores underwent specific shaping to create a precise volume for long sequences, thereby limiting debitage surface maintenance (Chiotti, Cretin, 2011). This volumetric construction of carinate scrapers / cores is present in all of the studied series. However, the carinate scrapers / cores from the recent level present a morphological difference, as they are more elongated with a much narrower front. In this same recent level, bladelet production diversifies to include productions on nosed scrapers and Aurignacian burins.

Bladelet production is thus a fundamental element of Aurignacian industrial identity, with technological and typological variations within Early and Recent Aurignacian assemblages.

The production of blades is well represented, with characteristic thick and slightly curved Aurignacian products. Other types of blade debitage produce much smaller and thinner blades. Both of these productions only partially occurred on-site (or on the recently excavated parts of the sites).

Although production clearly targets bladelets, consumption is oriented towards blades, which are the most widely-used blanks for the toolkit. The fragmentary state of these pieces shows that they were often intensively used, resharpened and sometimes deliberately fractured.

Flake debitage occurs in the southern sector of Castanet and Blanchard 4/5, and was partly oriented towards blank production for carinate scrapers / cores.[5]

5. We do not yet have these data for the Recent Aurignacian from sector 1 at Blanchard.

B - Exploitation of the lithic environment

Lithic raw material acquisition patterns for Castanet show that flint procurement was mostly centered on in situ or nearly in situ Santonian horizons in the surrounding valleys, whereas materials from fluvial deposits were not often used. Debitage methods for these local materials are not very elaborate. Whole or tested nodules were probably brought to the site where they were used to produce modest-sized blades and thick flakes, future blanks for carinate scrapers / cores.

More occasionally, better quality local raw materials were selected, such as blond or black Upper Santonian flints from plateau deposits on the left bank of the Vézère a little further away.

The lithic inventory also includes raw materials from more distant sources, raising the broader questions of the territorial economies and cultural choices. The presence of flint from the Upper Campanian (known as Bergeracois), of jasper from the Brive Basin, of Charente flint and rare occurrences of flint from the Fumel region and the Lot, points either to mobility throughout these territories, or to direct contact with individuals occupying these different zones.

Regardless of how they were brought there, their presence necessarily implies detailed knowledge of these materials and their properties as they are perfectly integrated into the exploitation and consumption systems. Moreover, some of them were preferentially used.

Blade blanks were favored for the Bergeracois flint. A number of pre-knapped blanks were brought to the site where most of them were transformed into tools. Practically all of them were produced on different cores. Although on-site production is minimal, the presence of abundant retouch flakes indicates high blade and tool consumption.

Corrèze jasper was brought to the site as small elements and was then used for perfectly controlled bladelet production, showing the appeal of this material for bladelet fabrication.

C - Chronocultural setting

The typo-technological study of the lithic material leads to the differentiation of two main chronocultural complexes: an Early Aurignacian in both sites, the southern sector of Castanet and sector 4/5 of Blanchard and a Recent Aurignacian in sector 1 from Blanchard.

Recent excavations in the southern sector at Castanet only yielded Early Aurignacian pieces. As we did not observe the second level during recent excavations we have no new elements to add to the study by D. de Sonneville-Bordes of the Peyrony series (Sonneville-Bordes, 1960). We examined the Peyrony series rapidly and no elements cast doubt on the conclusions of the former study. However, the absence of bladelets in the early series is detrimental to this sort of attribution.

About fifteen radiocarbon dates were conducted, yielding well-grouped results, centered around 37 000 cal BP (White *et al.*, 2012a).

These dates are very recent for an Early Aurignacian chronocultural attribution, as most dates for this chronocultural level are on average between 38 000 and 40 000 cal BP (for the question of early Aurignacian dates, see for example Higham *et al.*, 2009; 2011; Higham, 2011; Wood *et al.*, 2014).

At sector 4/5 at Blanchard, the identified Early Aurignacian corresponds to L. Didon's lower level (B) (1911).

Four dates were obtained for this sector. Two of them are centered around 36 000 cal BP and two around 34 000 cal BP (White *et al.*, 2012b). These dates are even more recent than those for Castanet, whereas, once again, this complex clearly presents Early Aurignacian characteristics.

This discrepancy between the industrial facies and the radiometric dates has yet to be explained.

At Blanchard in sector 1, a Recent Aurignacian is now well evidenced from the study of the lithic material from recent excavations. This probably represents a strip of a layer related to L. Didon's upper layer (D) (1911).

Therefore, the study of this lithic industry confirms the presence of a Recent Aurignacian level at Blanchard, which had up until now only been suggested by isolated markers: presence of several characteristic tools, losenge-shaped points (Leroy-Prost, 1975) or nosed scrapers (Sonneville-Bordes, 1960). The study of a coherent assemblage now enables us to confirm this attribution. However, due to an insufficient number of pieces, it is not possible to attribute an exact Recent Aurignacian facies to the series.

The first samples taken from Blanchard sector 1 did not contain enough collagen and thus for now, there is no date for this small complex. However, new dating analyses are in progress.

Conclusion

Recent excavations at Castanet, and Blanchard provide us with representative samples (quantitatively, qualitatively, including the fine fraction) from the Aurignacian levels of these two rock shelters.

The technological analysis of the lithic material enabled us to propose chronocultural attributions for the series from Blanchard with very few pieces, and unfortunately with very little bone industry. It also highlights the fundamental contribution, already pointed out by other authors (Bon, 2002; Le Brun-Ricalens *et al.*, 2005; …) of the bladelet component of these lithic complexes during the two main Aurignacian phases.

Continued analyses (economic, spatial and use-wear), as well as the assessment of other material cultural elements, will undoubtedly enable us to refine these first comparisons.

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THE AURIGNACIAN SITE OF THE ABRI DE LA SOUQUETTE (COMMUNE DE SERGEAC, DORDOGNE):

A History of Archeology

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A History of Archeology

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Abstract

The Abri de la Souquette is little known today when compared with the neighboring sites of Abri Castanet and Abri Blanchard. A long history of investigation at the Abri de la Souquette has led not to a wider understanding of a site with significant Aurignacian deposits, but rather to scholarly obscurity as a site devoid of further research potential. In this paper, we attempt to lift some of this obscurity by chronicling the history of research at this site, and provide new radiocarbon dates demonstrating contemporaneity with the Castanet Aurignacian.

Keywords

Abri de la Souquette, Castel-Merle, Aurignacian, Vézère Valley, Otto Hauser, Marcel Castanet.

Introduction

The Abri de la Souquette is a rockshelter located on the western flank of the small valley of Castel-Merle, situated approximately 50 m from the Vézère river (figure 1), in the Dordogne department of south-west France. Celebrated for its extensive Upper Paleolithic deposits, the Castel-Merle valley is one of the numerous karstic dry valleys found in the region, formed by the collapse of a subterranean cavity. Differential erosion rates of the Cretaceous limestone beds in the cliffs flanking the valley resulted in numerous rockshelters, which proved attractive habitation sites during the Paleolithic; the Abri de la Souquette itself faces south-east, is 16m long and 5 m deep, and today offers a sheltered area of approximately 60 m^2.

On the opposing, eastern flank of the Castel-Merle valley lie the seminal Aurignacian sites of Abri Blanchard and Abri Castanet, approximately 150 m southeast of the Abri de la Souquette. Despite its relative lack of renown, however, it is likely that, at the beginning of the 20th century, La Souquette was in fact the richest of all the Castel-Merle Aurignacian sites. In addition, the site once contained a considerable amount of Magdalenian material. An unfortunate series of excavations conducted in the early 20th century, however, removed almost all archeological material from this spectacularly rich site, with only minor vestiges of the original Aurignacian material left. Here we will attempt to reconstruct some of the previous richness by providing a review of the history of archeological investigations at La Souquette and the collections they left behind.

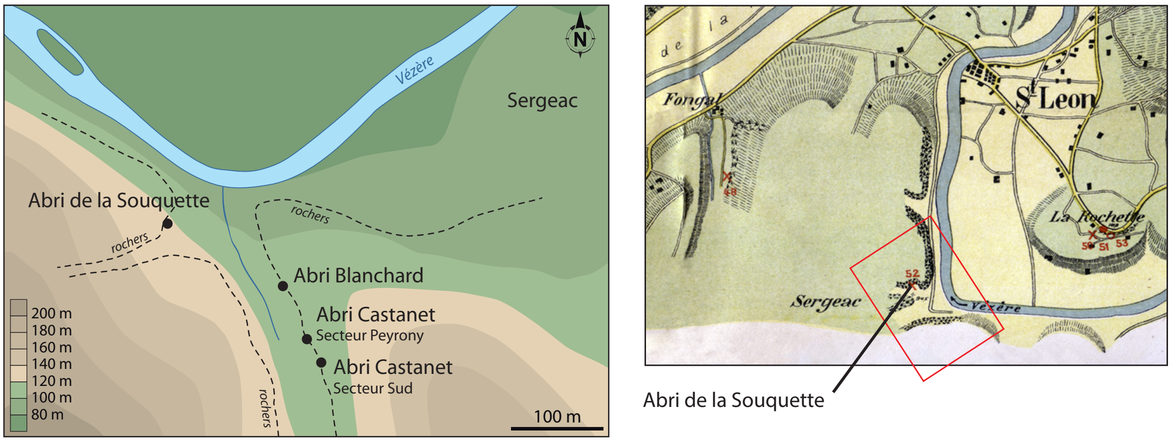

Figure 1 - Left: Localisation of the major Aurignacian sites in the Castel-Merle vallon;
right: Map of the Vézère valley in 1910 with the Castel-Merle valley highlighted (after Hauser 1911).

1 - The history of the site

By 1938, Franck Delage had already described La Souquette as "a perfect example of one of numerous prehistoric sites which have been devastated by excavation for reasons opposed to science" (Delage, 1938: 105). La Souquette had been a victim of antiquarianism and, in a period of less than 40 years, was thought to be almost completely emptied of prehistoric deposits. By the time Delage was writing, there had been no fewer than four different phases of excavation.

The 'vicinity of the site' was first excavated in 1902-1903 by the abbé Michel Antoine Landesque (1838-1905), a priest and geologist (Delage, 1938: 105). Landesque was a reasonably well-regarded figure in his time, but died in 1905 before publishing anything on the site, and so very little is known about his excavations. After his death his collections were broken up and sold all over the world, some to America, simply marked 'abbé Landesque', and thus much information was subsequently lost to science. If the death of Landesque was unfortunate for our understanding of the site, the next excavations would be even more so. The site was appropriated between 1903-1910 by a clockmaker and collector of antiquities from Issigeac named Costes, who, working with a local shopkeeper named Letellier, excavated the site. A considerable portion of the site was disturbed, no records were kept, and it appears that only worked flints were retained (Delage, 1938: 105-106). Flint artifacts which did not meet their standards, and seemingly all the bone and ivory industry, were discarded (Delage, 1938: 106).

In 1910, La Souquette was leased by Antoine Blanchard, the owner, to flint collectors, who in turn sub-leased the site to the Swiss archeologist Otto Hauser, who would excavate much of what remained at La Souquette. Local tradition holds that the goal of the excavation was the acquisition of large Aurignacian blades and of worked flints which might be sold to museums, and Hauser's workmen were reputedly paid by object recovered. No attention was paid to either spatial or stratigraphic context, and apparently no records kept (figure 2[B]). Hauser sold large amounts of material to the *Museum für Völkerkunde* in Berlin (the modern-day *Ethnologisches Museum*).

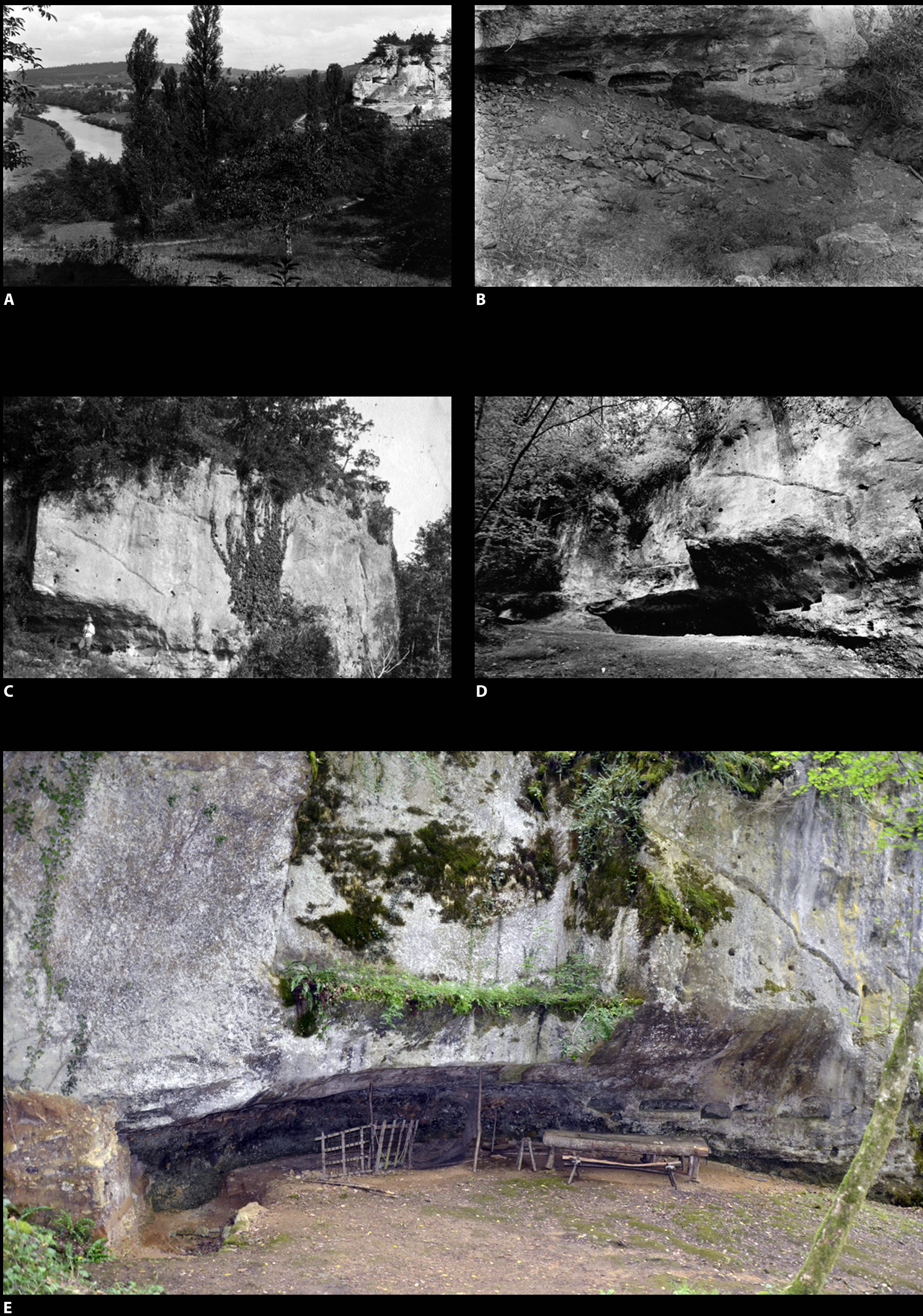

Figure 2 - The Abri de la Souquette through the ages. A: north-facing photo of the Vézère taken from La Souquette (Hauser 1911); B: disturbed deposits within La Souquette during Hauser's excavation (1911); C: northwest-facing photo of northern end of La Souquette (MacCurdy 1921); D: west-facing photo of La Souquette (Roussot 1980); E: abri de la Souquette in summer 2011, note Roussot's section at left.

2 - The Castanet Collection

The land was acquired by Marcel Castanet (after whom the Abri Castanet is named) following his return from the First World War in 1919, and he immediately began to investigate the spoil-heaps of previous excavations at La Souquette, recovering huge quantities of discarded material. Although it would come to be known as the 'Hauser spoil-heap', the deposits Castanet screened were probably derived from all previous excavations, and they were incredibly rich (figure 3). Castanet was ironically introduced to archeological excavation as a boy during Landesque's excavations at La Souquette, but had subsequently worked for Louis Didon at the Abri Blanchard, and for Didon and Denis Peyrony at the Abri Reverdit, and he understood the importance of wet-screening for recovery of small items, particularly ornaments.

Working with the well-known archeologist, Louis Pradel, Castanet recovered large quantities of flint tools, engraved blocks, *pierres anneaux*, *batons percés*, bone and antler points, *lissoirs* and almost 600 personal ornaments. Given that most of the material recovered by Castanet was of mixed provenience, much of it is difficult to categorize, although some diagnostic Aurignacian and Magdalenian types were recovered.

The 483 basket-shaped beads (including fragments) recovered may confidently be attributed to the Aurignacian (figure 4), and are accompanied by 187 unfinished bead-blanks. The vast majority are in ivory, with 64 in steatite and another 11 (and 2 blanks) in bone. The perforated fox, wolf, deer and bovid teeth and perforated mollusk shells he recovered may be assigned to either the Magdalenian or Aurignacian, although many of them do exhibit classically Aurignacian perforation techniques. Several pendants also appear 'Aurignacian' in style, such as the 5 seashell facsimiles featuring pointillist decoration, a steatite roundel measuring 3.5 cm in diameter, a calcined lignite 'barrel' measuring 2.2 cm, and oval and triangular ivory pendants. Delage furthermore attributed to the Aurignacian several fragments of *batons de commandement* and incised bones based upon technological similarity with material recovered from Aurigacian horizons at Castanet and Blanchard.

The diagnostically Aurignacian lithics recovered by Castanet include large numbers of retouched blades, along with end-scrapers on strangled blades, oblique end-scrapers, double end-scrapers, end-scrapers with burins, large burins with retouched sides, and carinate and nosed end-scrapers (Delage, 1938: 108-109). Castanet also recovered several split-based bone points, along with antler rods indicating in situ manufacture of points (Delage, 1938: 110).

The Magdalenian material comprises a diverse collection of scrapers, burins, double-burins, perforators, points, knives, a gouger and a micro-burin (Delage, 1938: 115). There is also an extensive microlithic collection, with large numbers of backed bladelets and elongated scalene triangles. Peyrony considered this type characteristic of the Magdalenian II, but Delage sees the assemblage more reflective of the Magdalenian III or IV (Delage, 1938: 117). Barrière (1952) later identified a Tardenoisian-style micro-burin among the Magdalenian IV material, which he thought significant for the origin of that industry.

Outside of the Aurignacian and Magdalenian, Delage claimed to have identified a Mousterian racloir, along with some Mousterian-like flake tools (Delage, 1938: 108), but these are hardly unknown in the Aurignacian and there is no compelling evidence for a pre-Aurignacian occupation at La Souquette. A single Solutrean laurel-leaf point fragment was also found, apparently in intact deposits in front of the rockshelter, and Delage also regarded a 3 cm long foliate point recovered from the spoil-heap as potentially Solutrean, although no other evidence for a Solutrean occupation has been recovered.

Figure 3 - A: Aurignacian blade tools from La Souquette recovered by Hauser (photo: O. Hauser); B-D: personal ornaments recovered by Marcel Castanet from the spoil-heap of previous excavations; B: perforated ivory sea-shell facsimile; C: perforated steatite pendant with radial incisions; D: perforated red deer vestigial canine (photos: R. White).

According to Delage (1938: 108), however, Marcel Castanet did discover and excavate an 80 × 30 × 30 cm block of in situ Aurignacian sediment, which revealed some stone tools and several bone or antler points. Some intact Magdalenian deposits were supposedly also found at the southern extremity of the site, while a trench dug 8-10 m in front of the rock-shelter revealed the supposed laurel-leaf point fragment, below a reworked layer that included historic pottery fragments. In fact, Delage himself may have engaged in some small-scale excavations at La Souquette, as there exists a collection bearing his name at the *Institut de Paléontologie humaine* in Paris (Roussot, 1982a: 2).

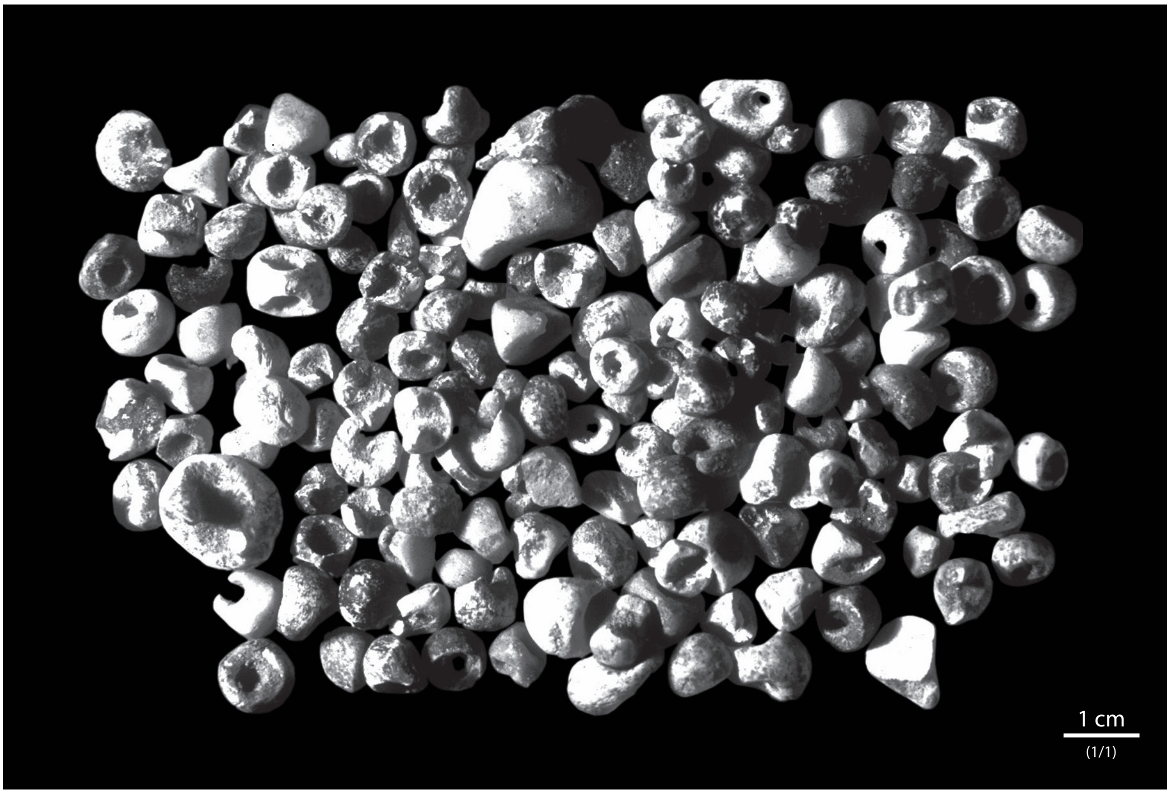

Figure 4 - A number of basket-shaped beads in ivory and steatite recovered by Marcel Castanet from previous spoil-heaps at the Abri de la Souquette (photo: R. White).

Castanet retained most of this material in the family museum in Sergeac, Dordogne, where much of it remains today. A significant amount of material, however, was sold to the Field Museum of Natural History in Chicago, USA, where one of the authors (RW) has been able to identify 307 individual accessions from the Abri de la Souquette. The majority of the material comprises various lithic materials – mainly flint tools, but also including some engraved limestone or sandstone blocks. 62 accessions of bone or antler, 13 teeth, 3 ivory fragments, two shells, an echinoderm fossil, two fragments of manganese dioxide and a piece of red ochre were also identified. Of course, like the material that remained in France, this is not a representative sample of the original archeological record from La Souquette, as archeologists and museums of the period were mainly concerned with acquiring objects thought to be "beautiful" or "typical" of a certain period or region. Castanet applied these same standards, discarding for example, virtually all debitage, cores and river cobbles, as well as most of the fauna.

3 - The Roussot Excavations

By the middle of the 20th century, the Abri de la Souquette was considered something of a lost cause (Sonneville-Bordes, 1960: 105-106). A small number of specialists were aware that it had once contained substantial Aurignacian and Magdalenian deposits, and Castanet's collections were examined with interest by the likes of Franck Delage and Denis Peyrony: the site itself, however, was considered essentially devoid of further scientific value. In 1980, however, René Castanet, son of Marcel and owner of the site, requested an investigation of the remaining deposits at La Souquette in order to display a stratigraphic section on public visits to the site (Roussot, 1982a: 5). The site was thought to retain little of archeological significance, but test excavations were nevertheless conducted in 1980 by one of the authors (AR), then curator of prehistory at the *Musée d'Aquitaine* in Bordeaux. Excavations concentrated on a small area at the southern extremity of the rockshelter, which were believed to be the area least disturbed by previous excavations (figure 5). To general surprise, substantial intact deposits were encountered and excavations continued for an additional two years, over a total of approximately 10 m².

Eleven discrete horizons were identified, one of which (Layer 11) contained Aurignacian material lying directly atop bedrock. These apparently intact Aurignacian horizons were overlain by medieval material, and a medieval silo also truncated the Aurignacian layers and cut into the bedrock towards the back of the rockshelter. Although it was clear that the site had once contained significant Magdalenian deposits, no trace of these was recovered. While it remains possible that these deposits may simply not have extended into this corner of the rockshelter, a considerable amount of reworked lithic material was recovered from the overlying historic layers, and we suspect that the Magdalenian deposits were reworked during the historic occupation of the site (see below). It is unfortunate that no Magdalenian deposits were recovered from these excavations as they provide us with the only stratigraphic profile at La Souquette (figure 6).

The excavation was conducted along a meter-square grid, and artifacts recovered in situ had their co-ordinates recorded, while sediments were dry-screened through 2mm screens. The provenience was recorded for over 850 objects recovered from layer 11, allowing the recent digitization of the excavation archive and projection of materials recovered (figure 7). Unfortunately, the relatively small window of excavation at La Souquette makes generalized assertions about site activities difficult, but these new data nonetheless hint at the potential utility of digitizing old excavation archives.

A large quantity of Aurignacian lithic material was recovered, with 921 flint artifacts and 6 pieces of quartz recovered, 400 of which had their exact provenience recorded. Typological classifications of the lithic tools are listed in table 1, and are dominated by retouched blades, with a significant number of end-scrapers of various types (figure 8). In addition, there were three carinate end-scrapers, and one carinate end-scraper rough-out, often interpreted today as bladelet cores, rather than formal tools in and of themselves. Two conventional bladelet cores were also recovered, but no blade cores.

Aurignacian and retouched blades can be found right throughout the Aurignacian, however they are most commonly associated with the Aurignacian I, generally referred to today as the Early Aurignacian (Bon, 2002). The same is true of the exclusive use of carinate end-scrapers for bladelet production, as opposed to carinate burins or burins busqués. Given the additional presence – albeit out of context – of a split-based bone point fragment, and the mass of similar material in the Castanet collections, it seems beyond doubt that the La Souquette Aurignacian belongs to this facies. Interestingly, the relative frequencies of the lithic tools at La Souquette closely parallels the rest of the Castel-Merle Aurignacian sites, with significant numbers of

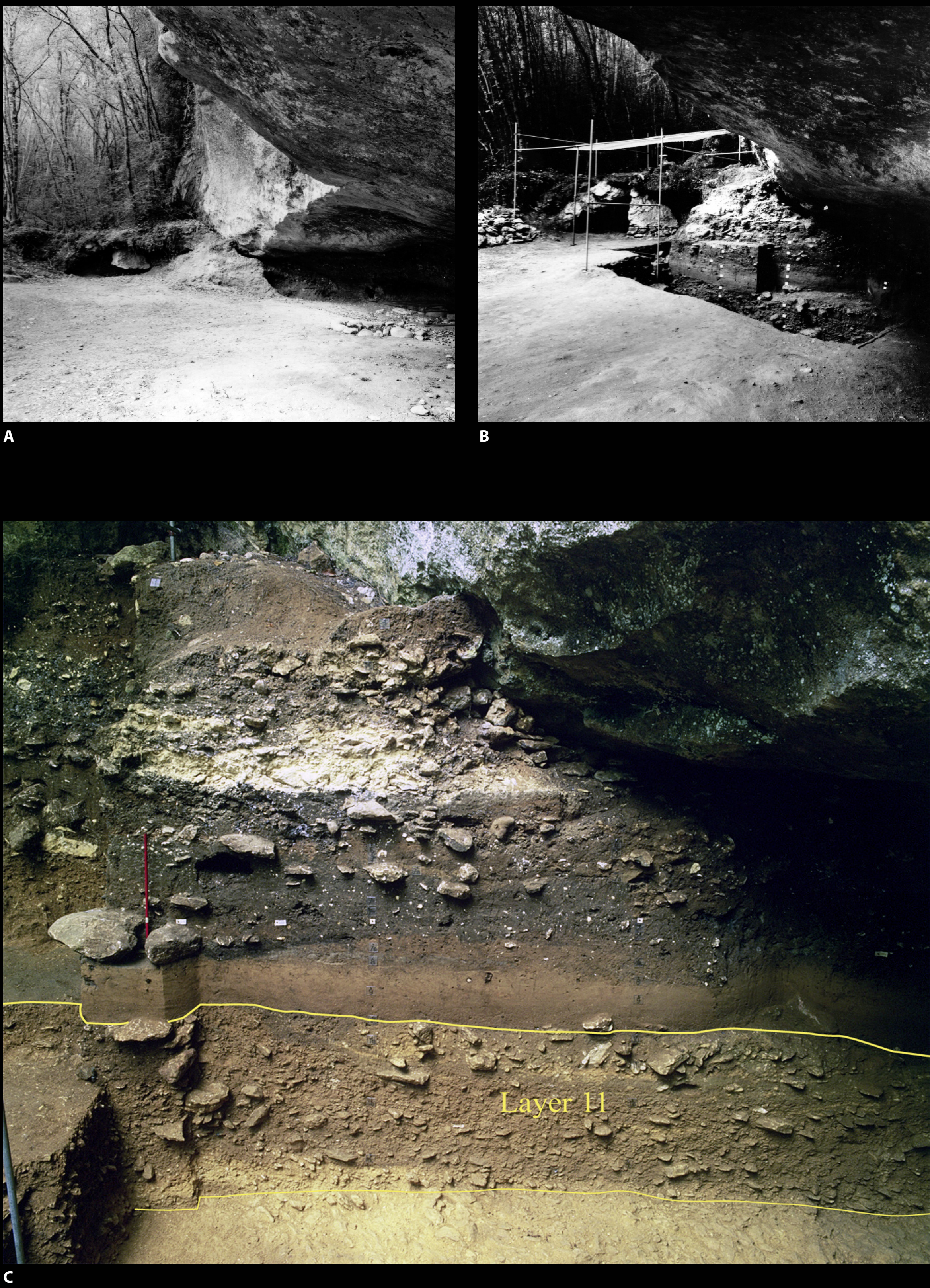

Figure 5 - Excavations conducted at the Abri de la Souquette 1980-1982. A: the site before excavation, photo facing southwest towards intact deposits; B: insertion of test trench into southwestern end of rockshelter; C: cleaned section with Layer 11 highlighted (photos: A Roussot).

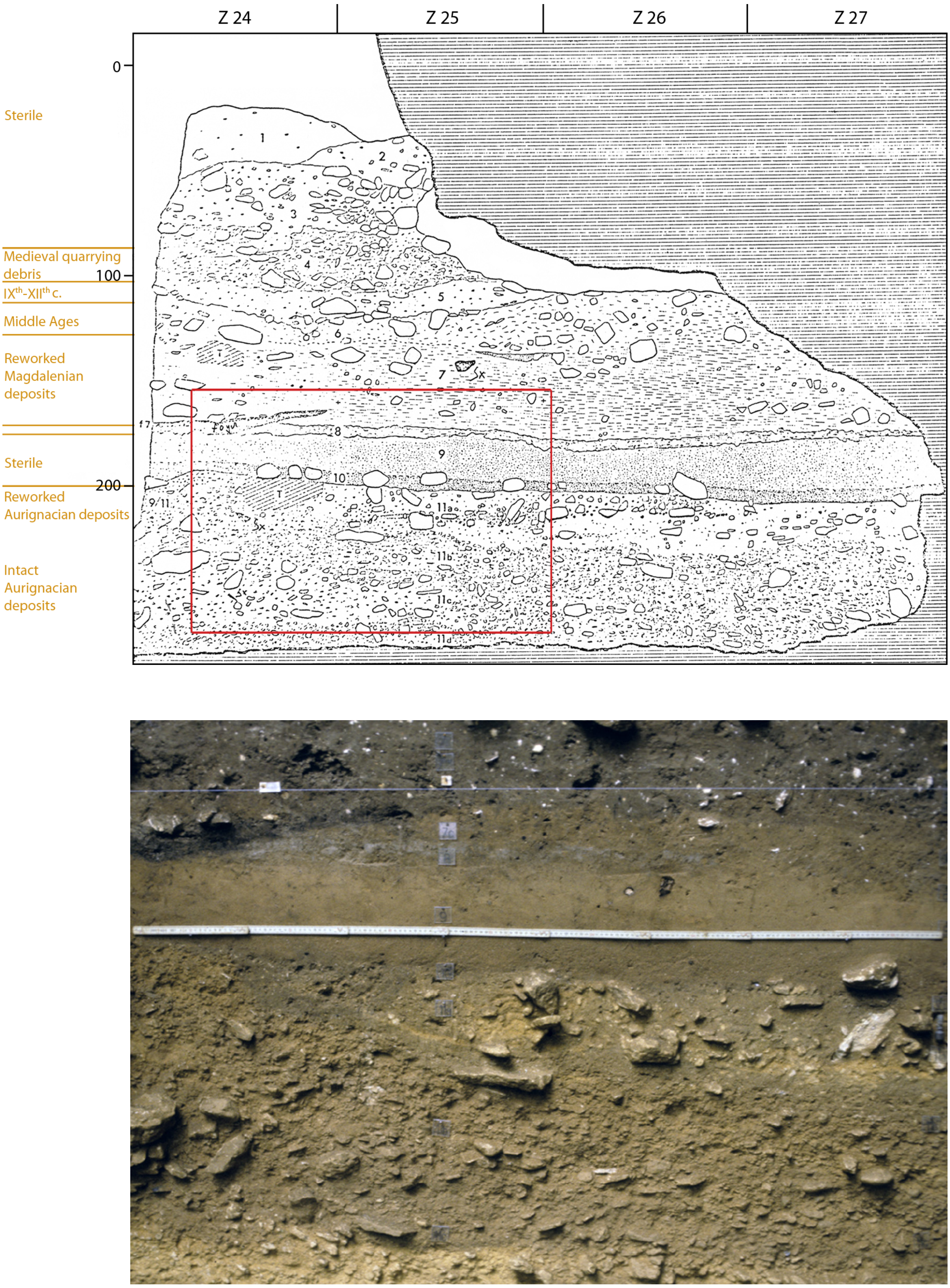

Figure 6 - Southwest-facing stratigraphic profile of deposits excavated at Abri de la Souquette in 1982. Highlighted area is shown inset, and shows Layer 11, and the intact overlying Layers 8, 9 and 10. Grid squares = 1 m.

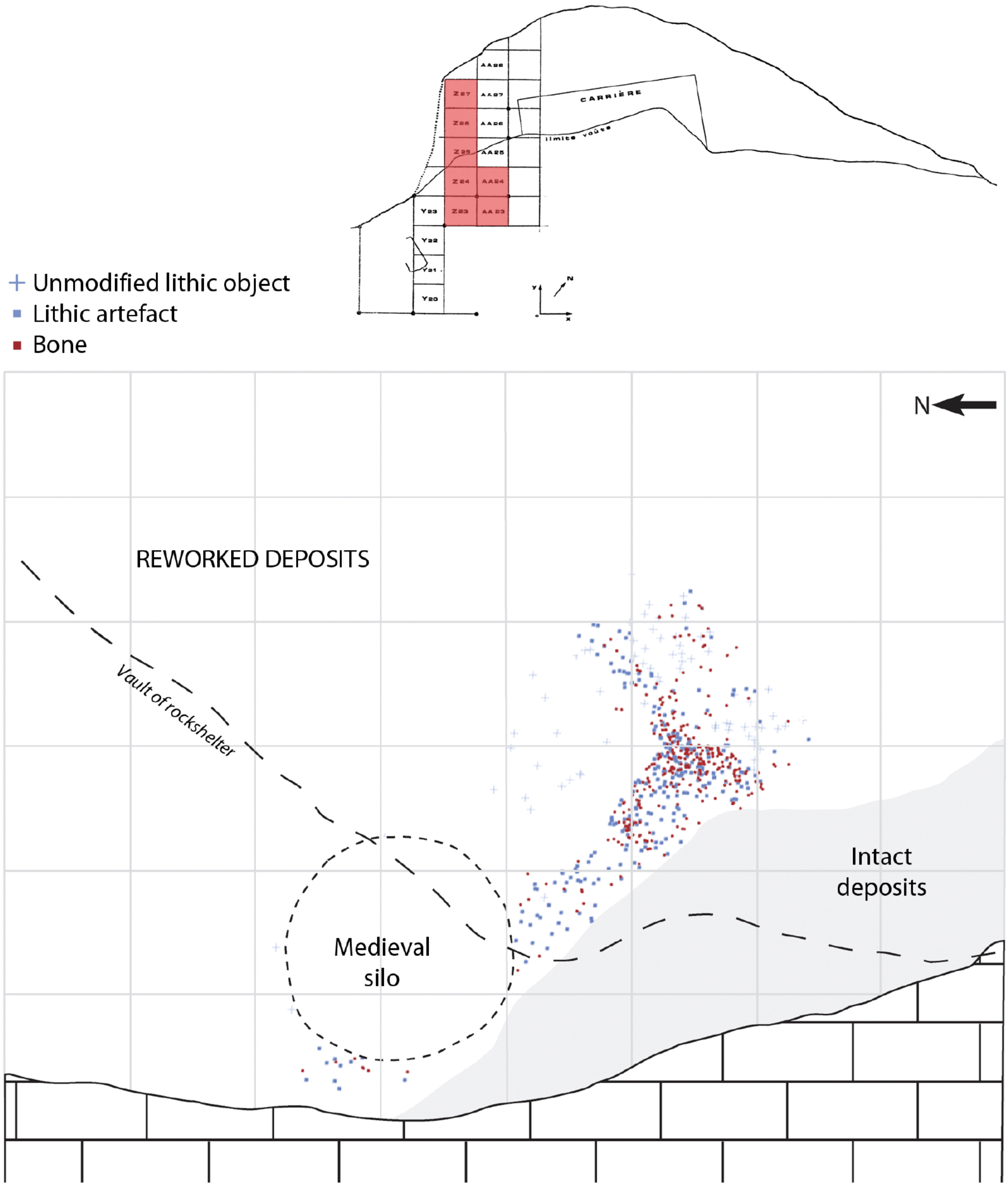

Figure 7 - Top: Meter-square grid installed at the Abri de la Souquette for object provenience, area of excavation highlighted in red; Bottom: reconstructed projection of material recovered from Abri de la Souquette. Objects re-projected using Abri Castanet/Abri Blanchard grid to enable integration with other Castel-Merle Aurignacian sites. Grid squares = 1 m.

Retouched blade	14	End-scraper	6
Aurignacian blade	1	End-scraper on retouched blade	3
Bec	1	End-scraper on Aurignacian blade	2
Burin	2	Double end-scraper on Aurignacian blade	1
Double burin	1	End-scraper with double burin	1
Carinate end-scraper	3	Side-scraper	2
Carinate rough-out	1	Notched piece	2
Denticulate	2	**Total**	**42**

Table 1 - Sonneville-Bordes (1960) typological classifications of tools found in Layer 11.

Figure 8 - A selection of formal lithic tools recovered from Aurignacian deposits at the Abri de la Souquette. A: double burin; B: side-scraper; C: end-scraper on retouched blade; D: end-scraper on Aurignacian blade; E-G: carinate end-scrapers; H: double end-scraper on Aurignacian blade.

retouched blades, a moderate amount of end-scrapers, and a paucity of burins (figure 9). This seems to imply similar activity patterns across the valley, or perhaps indicates a local variant of the Aurignacian complex.

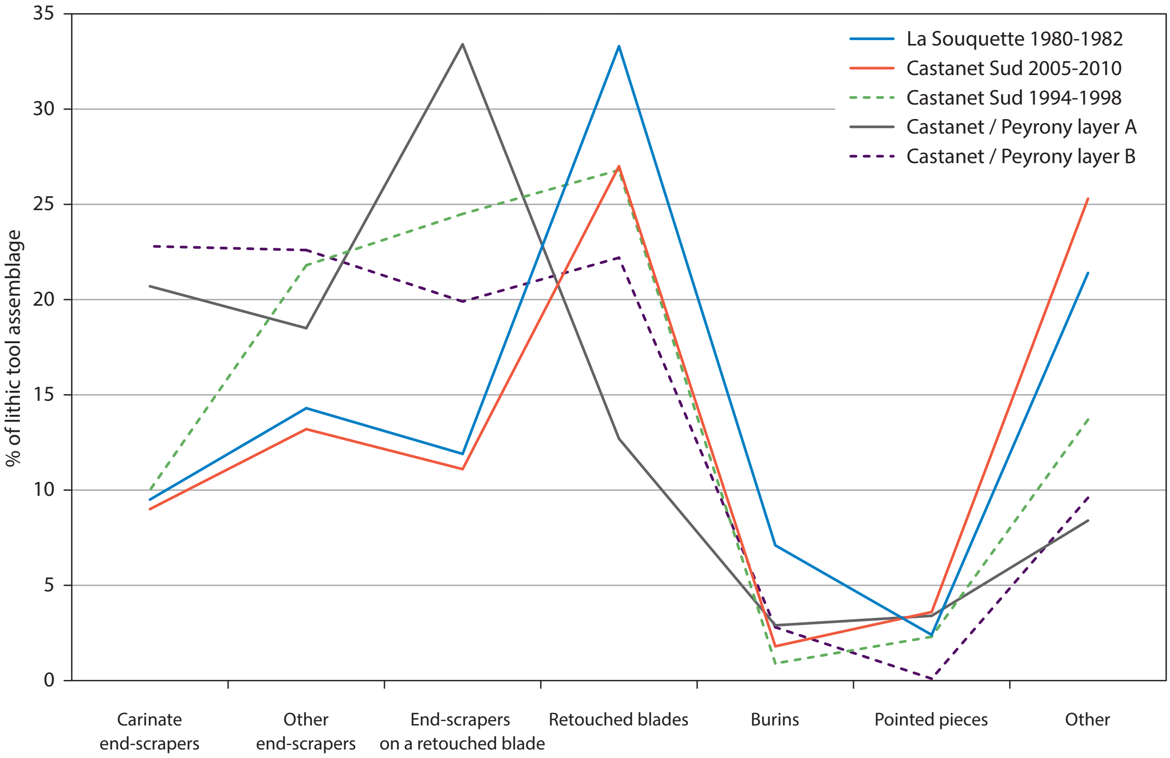

Figure 9 - Relative frequencies of lithic tool type groups across Castel-Merle Aurignacian assemblages.

Faunal identifications are listed in table 2, and are dominated by reindeer. In addition to the taxa listed above, 641 unidentifiable bone fragments, and an additional 455 burnt fragments of 1cm or less were also recovered from layer 11. The osseous industry from layer 11 included a burnt fragment of a bone or antler point, a fragment of what is described as a baton, and several incised, splintered and percussed bone pieces.

Context	Taxon	NISP
Layer 11 (Aurignacian)	Rangifer	18
	Equus	7
	Vulpes	1
	Sus (intrusive)	1
Presumed Paleolithic	Rangifer	177
	Bos / Bison	1
	Rupicapra	2
	Equus	2
	Lepus	3
	Vulpes	2

Context	Taxon	NISP
Historic	Sus	2
	Ovicapra	1
	Lagomorph	6
	Talpa	3
	Avian	3

Table 2 - Faunal identifications as determined by F. Delpech in 1980s (Roussot, 1982a).

No ornaments were recovered from layer 11, although a perforated red deer canine and a piece of incised ivory were recovered from the backfill of previous excavations (Roussot, 1982a: 14). 142 small fragments of red ochre, weighing 314 g, were recovered, along with two chunks of manganese dioxide and one of yellow ochre. A 30 cm long block of limestone featuring multiple non-figurative engraved lines was also recovered from Layer 11, and may possibly have collapsed from the vault. It may be compared with a similar, although figurative, block recovered by Castanet (figure 10).

Figure 10 - Top: figurative engraved block recovered in spoil-heap at Abri de la Souquette by Marcel Castanet(photo: R. White); bottom: engraved block recovered from Aurignacian deposits in 1981 (photo: R. Bourrillon).

4 - Historic Occupation of the Abri de la Souquette

As mentioned above, significant occupation of the site occurred during historic times. As it seems likely that the absence of Late Upper Paleolithic deposits in the south-western end of La Souquette is due to historic reworking of the rockshelter sediments, it is important to understand these occupations. However, while the prehistoric artifacts from sites like La Souquette were preserved, the overlaying historic layers were not only removed, but also often ignored. Fortunately, the 1980-1982 excavations allow us to understand a little about the site's historic occupations, and how this likely affected the Paleolithic deposits.

Several structural features, including "banquettes", post-holes, and roof gutters, were cut into the rockshelter in historic times, and a silo was excavated into the bedrock towards the southern end of the site. Additionally, much of the cliff above the shelter was cut back vertically in quarrying operations, which removed a 5.5m wide, 5m high, 1m deep section of limestone (figure 2[D, E]). This had the effect of weakening the vault of the rockshelter, some of which has since collapsed.

The historic finds from Roussot's excavations include 29 bone fragments from modern fauna, 17 pieces of metal, 123 pieces of ceramic, a spindle whorl, and part of a grinding stone. These finds were scattered across the surface as well as through stratigraphic layers 1 to 9/11. Most of the metal was badly corroded iron, although one piece of bronze was also excavated. The corrosion made it difficult in most cases to determine the iron's original functions, however, some nails were recovered and in other cases evidence that the pieces had at least been worked was preserved.

The chronology of the historical presence at the site may be determined by the pottery remains, which comprise a homogenous mixture of communal earthenwares of grey, white, and reddish colors. Several large pieces, made of an orangish paste, were refitted and dated to the Carolingian period. In contrast, two glazed fragments from Layer 1 were attributed to the mid and late 14th century, respectively (F. Hautefeuille, pers. comm.). These two fragments derive from the uppermost deposits in the sequence, and likely provide a *terminus ante quem* for the site's usage.

As noted above, in addition to historic artifacts, the 1980s excavations also uncovered a silo; a previously unknown structure inserted into the floor of the southwest corner of the rockshelter (figure 11). This feature truncated Layers 10-11, and extended 20 cm into the bedrock. With a diameter of 1.4 m, the total holding capacity of the silo was approximately 1.54 m^3, and historic remains were found in Layer X, the 'fill' deposit of this feature.

Silos are a ubiquitous structure in the western medieval world, especially amongst rural populations, and are most simply defined as in-ground pits for grain storage (Conte, 1995: 190). In this capacity, they have served not only medieval populations, but are known as early as Neolithic times (Sigaut, 1979). The artifacts and stratigraphy at La Souquette suggest that the silo here is of an early medieval origin, and was no longer in use by the 14th century. The isolated nature of the silo, as well as the communal nature of the pottery and other artifacts recovered, suggest that La Souquette likely accommodated a small or part-time occupation, either as the home of a family unit or as part of a larger complex that included sites in the immediate area. Regardless of site function, it is important to note that although only a single silo was found at La Souquette, it is not an isolated find; rather, it represents one stage in a large scale agricultural and alimentary process of production, process, and distribution that reflects a vibrant but poorly understood social organization.

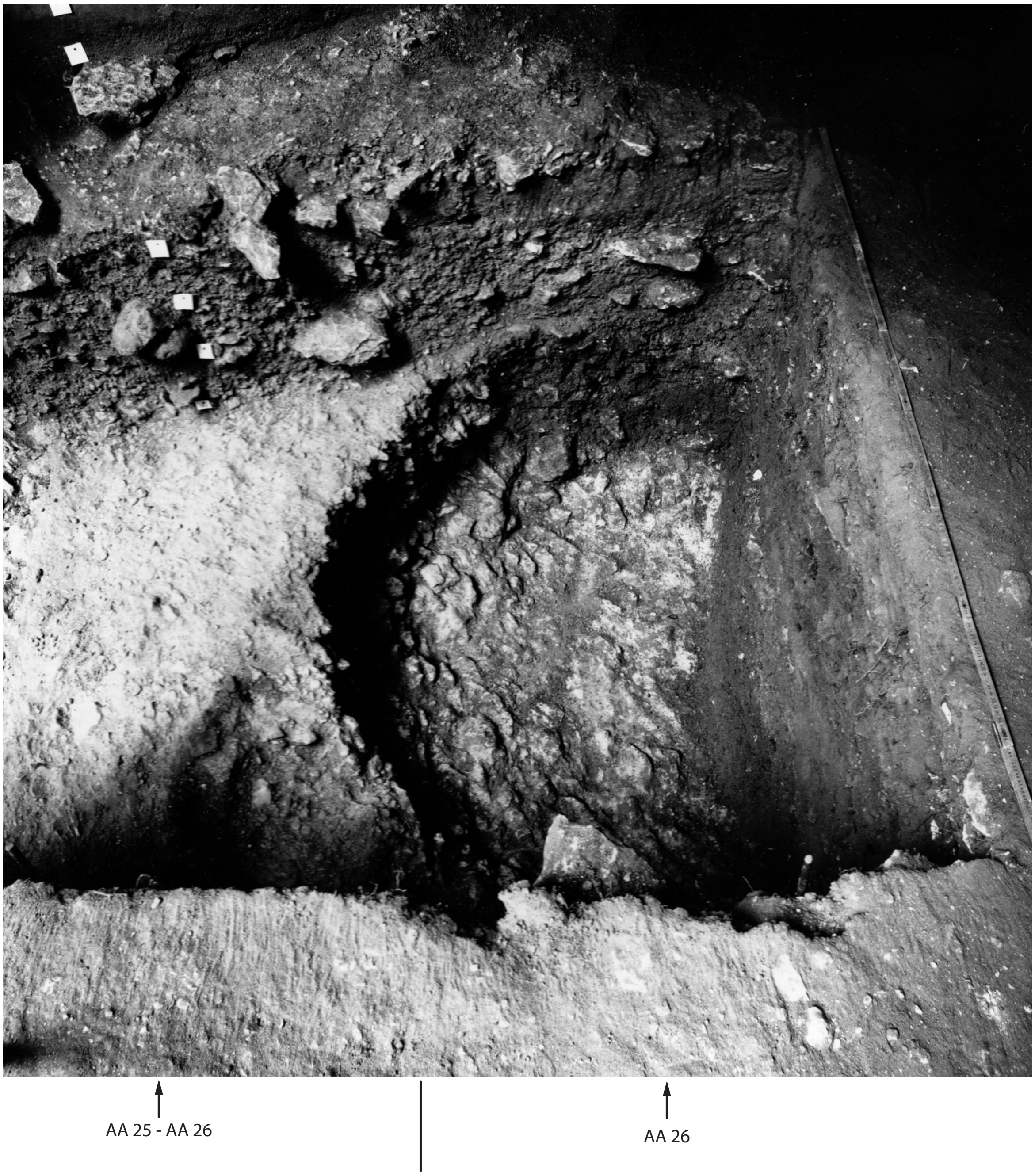

Figure 11 - Excavation of the silo in 1980-1982, showing truncation of Paleolithic layers and bedrock.

Historic occupations undoubtedly had a great impact on Paleolithic sites, and understanding the cultural activity and context of any prehistoric site must account for all the effects of later populations upon these assemblages. The Abri de la Souquette's long history of occupation may in fact provide fresh insights into surrounding prehistoric site assemblages, and alerts us to underestimated processes of disturbance. Despite the preoccupation of this paper with prehistoric material, however, it is also important to recognize our responsibility to address, study and preserve later archeological material which we ourselves encounter in our research pursuits.

5 - Radiocarbon dating: contextualizing the Abri de la Souquette

Given its current condition, it is difficult to see what can be done to attempt to fit the Abri de la Souquette back together. One possibility is to try to relate it back to its context, and derive inferences from the framework of knowledge we have assembled over the years. The potential relationship of the La Souquette to the Abris Blanchard and Castanet, for instance, may tell us more about the Aurignacian than any one site taken in isolation. The first step in understanding any potential association, however, is to demonstrate a chronological relationship.

Absolute dating of the Abri de la Souquette began in 2000, when eight pieces from the Roussot and Castanet collections were sent by one of the authors (RW) to the CNRS AMS radiocarbon laboratory in Gif-sur-Yvette, two of which returned successful radiocarbon dates (table 3). Further radiocarbon age estimates were acquired in 2015 using ultrafiltration at the Oxford Radiocarbon Accelerator Unit, and are provided in table 3.

Reference	Sample No.	Material	Age BP	Calibrated BP*
GifA 09456	SQT 11b, 17	Bone	33 710 ± 1000	38130 ± 1210
GifA 10054	SQT 11b, 2	Ivory	18 790 ± 140	22680 ± 160
OxA-X-2627-47	SQT 11, Z23 240	Bone	32 400 ± 550	36 460 ± 740
OxA-32198	SQT 11, Z23 201	Bone	32 400 ± 500	36 430 ± 690
OxA-32198	SQT 11, Z23 68	Bone	32 150 ± 450	36 090 ± 580

* Calibrated using OxCal 4.2, IntCal13 calibration curve (Bronk Ramsey, 2009)

Table 3 - Radiocarbon age estimates on two objects from Layer 11 of the Abri de la Souquette.

The date of 18 790 ± 140 BP (GifA 10054) is clearly incompatible with the object provenience, but it is almost certain that this may be attributed to contamination by a consolidant applied to the material in the field, rather than infiltration between archeological layers (H. Valladas pers. comm.). The rest of the dates, however, are perfectly coherent with the ultrafiltered dating sequence from the Abri Castanet, which runs from 33 650 ± 650 BP through to 32 310 ± 190 BP for the Secteur Sud, and 32 900 ± 230 BP through to 31 960 ± 230 BP for the Secteur Nord (White, Higham, 2008). This is highly suggestive that the Aurignacian occupations at the Abri Castanet and Abri de la Souquette were roughly contemporaneous, and should be analyzed as such.

In addition to refining our understanding of the chronology of the Castel-Merle Aurignacian, these new dates have important implications for our understanding of the relationship between these sites, which ongoing work will attempt to further. While future excavations of the scant remaining deposits may add to our understanding of this site, the loss of most of the site means comparisons of spatial patterning or activity patterns are unlikely to be adequately realized. What can be compared is the remaining material itself – partial sample though it may be – and future techno¬logical analyses of the material collected from La Souquette with that subsequently from Castanet and Blanchard will help us better situate the Aurignacian of the Abri de la Souquette in its local cultural and chronological context.

Conclusions

What should we do, as archeologists, with an old mess like that left at the Abri de la Souquette? Do we write off these old sites as essentially devoid of or greatly diminished in scientific value? Can technological advances, as well as new theoretical paradigms, glean new meaning from old data? It is certainly true that scarce archeological resources are sometimes better spent on a site with greater integrity, especially in a time of ever more constrained budgets. However, it can sometimes be those key sites that we consider to be 'pristine' which benefit most from such contextualization; we may never know exactly what activities were undertaken at La Souquette, for instance, but we may be able to say something about the cultural relationship between the groups occupying that site and those at Castanet. Though once a 'supersite' in its own right, the importance of La Souquette may end up being limited to the contribution it can make to our understanding of the geographic placement of Aurignacian habitations on the broader landscape of the Vézère Valley in particular, and the northern Aquitaine in general. We hope that the review presented here has suggested that, despite its troubled history, there is still much to be learned from the Abri de la Souquette.

Acknowledgements

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EARLY AURIGNACIAN GRAPHIC ARTS IN THE VÉZÈRE VALLEY:

In Search of an Identity?

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EARLY AURIGNACIAN GRAPHIC ARTS IN THE VÉZÈRE VALLEY:

In Search of an Identity?

Raphaëlle BOURRILLON, Randall WHITE

Abstract

Since 2007, programmed excavations directed by R. White in the Aurignacian sites of Blanchard and Castanet have resulted in renewed studies of graphic representations and have led to a new approach to some of the earliest parietal art from a cultural, chronological and environmental perspective. The analysis of the formal and technical artistic characteristics within each archeological context as part of all the known representations on limestone blocks in rock shelter habitation sites in the northern Aquitaine reveals a form of cultural territory.

Although certain graphic, as well as socio-economic choices, seem to be used partly as identity markers, convergences with other European regions can also be observed. These graphic representations thus seem to express both the need to mark out territory and at the same time, to convey a sense of belonging to a wider cultural entity. This dichotomy undoubtedly contributes to the broad stylistic diversity present at the beginning of the Upper Paleolithic. In this paper, we seek to define the reasons for such diversity of behavior and graphic arts within the Aurignacian culture.

Keywords

Aurignacian, parietal art, portable art, living sites, Aquitaine.

Introduction

Since the 1990s, several major discoveries recognized as among the first examples of Aurignacian graphic art have been made in France (Chauvet, l'Aldène, l'Abri Castanet, Baume-Latrone; Ambert *et al.*, 2005; Azéma *et al.*, 2012; Clottes *et al.*, 2001; White *et al.*, 2012), in Germany (Hohle-Fels; Conard, 2009), in Italy (Fumane; Broglio, Gurioli, 2004), in Central Europe (Coliboaia; Clottes *et al.*, 2011) and in the northeast of the Iberian Peninsula (Altxerri B; González-Sainz *et al.*, 2013; figure 1). These discoveries expand the limited corpus of sites, renew our perspective on early Upper Paleolithic symbolic expressions (Leroi-Gourhan, 1965) and rekindle the debate surrounding their emergence.

In recent years, debates relating to the concept of "modernity" have included a heavy emphasis on symbolic productions (Bar Yosef, 2006; Bon, 2010; Conard, Bolus, 2008; D'Errico *et al.*, 2003; Henshilwood *et al.*, 2002; Higham *et al.*, 2012; Mellars, 2004; Soressi *et al.*, 2007; Szmidt *et al.*, 2010; Teyssandier *et al.*, 2010; White, 2007; Zilhão, 2007). While certain researchers consider that the emergence of traits characterizing this modernity (e.g., reasoned management of resources or production of decorative elements and figurative motifs) are related to *Homo sapiens*, others propose that some of them (particularly ornaments) are also associated with Neanderthals and affirm that the latter were not influenced by *Homo sapiens* (D'Errico, 2010; Soressi *et al.*, 2007). The emergence of ornament production and geometric motifs before the Upper Paleolithic occurs around 60 000 BP onwards in different places: in the Near East (Qafzeh; Shea, 2001), as in Europe (Bacho Kiro, Ferrassie, Quina, etc.; D'Errico *et al.*, 2003; Verna *et al.*, 2012; Zilhão *et al.*, 2000[1]). Only a very small portion of these objects are attributed to Neanderthals and the vast majority of them are ascribed to *Homo sapiens*.

Figure 1 - Inventory of Aurignacian sites in Europe and examples of graphic representations attributed to this period (Map: F. Tessier, modified and adapted by R. Bourrillon; photos and plan: Castanet and Blanchard (unpublished), R. Bourrillon; Chauvet, C. Fritz; Fumane, R. Broglio; Hohle-Fels, H. Jensen; Coliboaia, A. Posmosanu).

On the other hand, the advent of figurative art in Europe is, for the time being, an exclusive characteristic of *Homo sapiens* and is attributed to the Aurignacian.[2] This occurs "relatively" late (*ca.* 35 000 BP) in relation to the territorial expansion of *Homo sapiens*. It is characterized by a certain unity as regards the types of figures depicted and, at the same time, by marked stylistic and technical diversity (Broglio *et al.*, 2009; Conard, 2009; Petrognani, 2013; Sauvet *et al.*, 2007; Tosello, Fritz, 2005; White *et al.*, 2012). Diverse hypotheses have been advanced to account for the origin and the expansion[3] of the Aurignacian. Debates are often heated and data are still too sparse to fully comprehend even the broad outlines of this culture (Baffier, 2010; Conard *et al.*, 2008; Rigaud, 2001; Slimak *et al.*, 2006; Teyssandier *et al.*, 2010).

Before identifying or determining the emergence and cultural origins of these figurative productions, it is essential to reconsider the very definition of Aurignacian culture and traditions. In addition to pursuing new analyses of the styles and techniques underlying this Aurignacian art, the challenge today is to understand these vehicles of meaning and tradition in their social,

1. Other productions of ornaments and geometric incisions are documented in South Africa between 100 000 and 60 000 BP (sites of Blombos, Klasies River, Diepkloof) and are, on the other hand, all attributed to *Homo sapiens*. On account of these discoveries, some researchers consider that the emergence of human modernity must be sought before this chronological period and in South Africa (D'Errico *et al.*, 2012a and b; Mackay, Welz, 2008; Texier *et al.*, 2010).
2. An anthropomorphic pendant was discovered in the site of Isturitz (Pyrénées Atlantiques) in a layer dated to 37 180 ± 420 BP and would thus belong to the Proto-Aurignacian (Szmidt *et al.*, 2010, White and Normand, this volume).
3. Intrusive, gradualist, diffusionnist, multi-faceted innovations (Brun-Ricalens *et al.*, 2007; Kozlowski, 2010; Tartar, 2012; Teyssandier, 2007; Zilhão, 2007).

economixc and religious context. Indeed, many ethnographic and anthropological studies point out that symbolic factors play a fundamental role in the organization of societies and are much more than just esthetic expressions (Carpenter, 1973; Godelier, 2007; Whallon, 2006; etc.): “the activities of individuals are largely determined by their social environment, but reciprocally, their activities influence the society in which they live […]” (Boas, 1927 [2003]: 285).

Due to the presence of different cultures before or during the early Upper Paleolithic (Proto-Aurignacian, Chatelperronian), as well as living sites revealing the whole spectrum of daily activities, rock shelter living sites in the Vézère region are central to defining Aurignacian graphic characteristics and figurative practices and to identifying their structural role in the organization of Aurignacian culture (Bourrillon, White, 2014; Delluc, Delluc, 1991; White *et al.*, 2012; Mensan *et al.*, 2012).

1 - From block to block: a long history

In the Dordogne, the Aurignacian “culture” has been identified at many sites, particularly in rock shelters; most of which are now partially or totally collapsed. These sites were excavated from the first half of the 19th century onwards but remain poorly known. Out of the 45[4] Aurignacian rock shelters in the region, 13[5] have yielded fragments of ceilings or semi-portable blocks with bicolored or black figures, engraved or pecked animal or vulvar outlines, as well as cup marks and rings. The remaining 32 rock shelters are not devoid of symbolic activities, as shown by the incisions or decorative elements on osseous objects (e.g., abri Cro-Magnon, Roc de Combe, etc).

The first engraved block was discovered by O. Hauser at the site of Fongal, on May 1 1909, embedded in the occupation layers (figure 2) of the site. Several kilometers away in 1910, in the Castel-Merle Valley, Marcel Castanet unearthed the most important collection of blocks and decorated vault fragments in the famous Aurignacian rock shelters of Blanchard and Castanet (Bourrillon, White, 2014; Delluc, Delluc, 1991); other examples were identified at La Ferrassie by D. Peyrony and L. Capitan in 1912 (Capitan, Peyrony, 1921) and additional discoveries were made at nearby sites in the 1920s (table 1 and figure 3).

The fact that most of these discoveries are from pre-modern excavations raises problems for understanding their archeological contexts. Between 1995 and 1998, then between 2005 and 2013, a French-American team[6] resumed research in the Castanet and Blanchard rock shelters (Castel-Merle valley). Using innovative recovery methods and modern excavation technologies, these sites have now yielded a precise and well-dated archeological context (by ^{14}C-AMS[7]), not only for the decorated blocks and fragments but also for all the artefacts, providing evidence of daily activities (Bourrillon *et al.*, in press; Castel, 2011; Chiotti, Cretin, 2011; Mensan *et al.*, 2012; Tartar, 2012; White *et al.*, 2012). Apart from the several thousand provenienced artefacts (lithic and bone industry, fauna, decorative elements, etc.), it is clear that these two shelters hold a major quantitative position with respect to the inventory of Aurignacian decorated blocks and fragments in the Dordogne region (cf. figure 3). The analysis of the archives of M. Castanet and the

4. Cf. Michel, 2010.
5. Belcayre, Blanchard, Castanet, le Cellier, la Ferrassie, Fongal, La Souquette (cf. O’Hara *et al.*, this volume), Laussel, Pataud and Poisson. And sites for which the blocks have disappeared: la Rochette, Lartet, Pasquet.
6. Excavations led by R. White and J. Pèlegrin from 1995 to 1998, then by R. White and R. Mensan between 2001 and 2013.
7. For abri Castanet, the latest ^{14}C-AMS dates place the early Aurignacian occupation of the site in a relatively short period, between 36 940 – 36 510 calBP (68.2% prob.; White *et al.*, 2012).

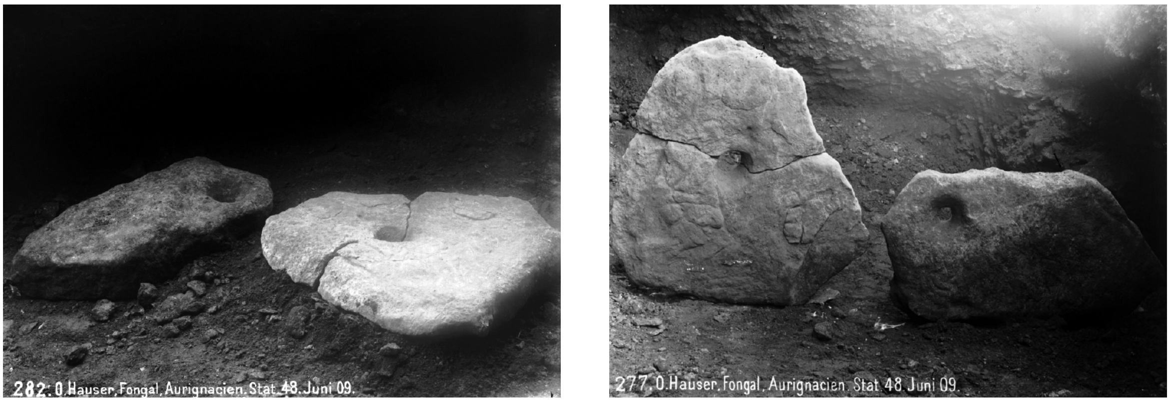


Figure 2 - Decorated blocks discovered in the site of Fongal (archives O. Hauser ; assembled by R. White). On the first photo, the blocks still seem to be *in situ*.

Year	Site	Number of blocks (in 2013)
1909	Fongal	4
1910-1912	Blanchard	38
1911-1912	Laussel	6
1912	La Ferrassie	29
1911-1912 et 1924-1925	Castanet	36
1921	La Souquette	2
1923	Abri du Renne - Belcayre	1
1927	Abri Cellier	7
1963	Abri Pataud	2

Table 1 - Inventory of blocks and fragments from decorated ceilings in Dordogne since the beginning of the last century.

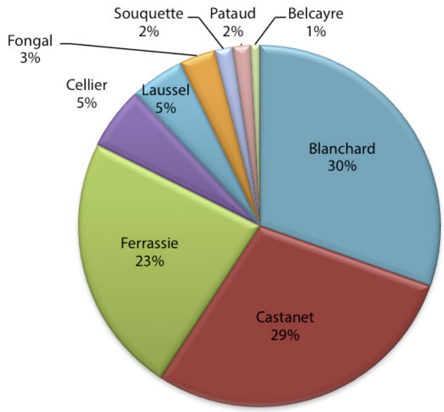


Figure 3 - Percentage of decorated blocks and fragments in rock shelters, site by site, for the whole Aurignacian corpus from the Dordogne (n = 125).

major discovery of new decorated blocks (White *et al.*, 2012; Bourrillon *et al.*, in press), stimulated us to undertake an important re-study of the old collections of decorated blocks in order to better grasp their role in the structure of Aurignacian life. This study involved: 1. Analysis of field archives; 2. High resolution photographs and photogrammetry of the decorated surfaces; 3. Rhodoid sketch of the anthropogenic drawings; 4. X-ray fluorescence analysis to detect colored surfaces; 5. Replicative experiments; 6. Reconstruction of the graphic operational sequence; 7. Restitution of this operational sequence within the context subsistence and economic activities at the sites concerned; 8. ^{14}C-AMS dates (of the levels in which the blocks were discovered); 9. Analysis of the spatial position of the blocks at the site.

The results of this research provide new perspectives on the earlier data for Aurignacian sites in Dordogne with such decorated surfaces, to better grasp the importance of these productions and to establish inter and intra-regional links.

2 - Everyday symbolic acts

A - A regional graphic and technical identity

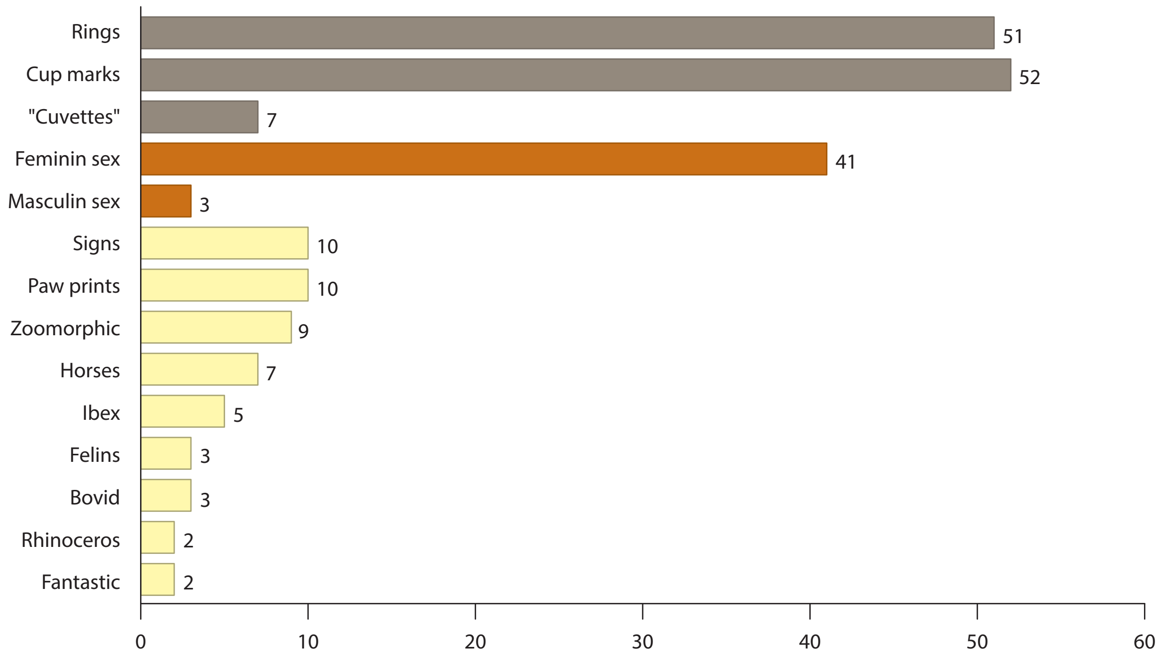
The recent analyses of these "human-altered" limestone surfaces have updated our understanding of the subjects depicted and the techniques used. This revision brings to light regionally distinctive features as well as strong inter-regional similarities. Contrary to common belief, while rings (anneaux) and female genitals (vulva) predominate the sample, animal subjects are present and are part of the general repertoire of subjects in early Upper Paleolithic art (Petrognani, 2014; Tosello, Fritz, 2005; figure 4) in SW France.

While all subjects are not present at all sites, there are clear stylistic similarities, particularly the female genitals isolated from the rest of the body (Bourrillon *et al.*, 2012). Their generally rounded shape, their outline sometimes split into two and "engraved" lines constructed of sequential punctuations are territorial and chronological markers. The animal figures, while often incomplete, show several common elements. They are systematically depicted from a side view, either representing the whole body or just the forequarters; or even metonymically through the depiction of paw prints (felid?; figures 4-5). The horns and limbs (with spherical extremities for horses and pointed extremities for bovids) are parallel to each other and internal detail (eye, hair, groin, etc.) is exceedingly rare. Another example of marked intra-regional characteristics can be seen in the three ibex fore-quarters identified at Cellier and Blanchard. They are represented solely by the external outline of the head with (parallel) horns and only one of them shows the beginning of the back line (figures 5[e] et 5[i]). In terms of subjects represented, while the mammoth is one of the key subjects in European Aurignacian art, it is absent from the Vézère sample. At Castanet, Blanchard and La Ferrassie, the combination of feline representations and paw prints is a shared theme.

The techniques used by the Vézère Aurignacians are typical of the region and show considerable know-how (figures 4-5). Vigorous pecking (regularized or not) remains the main line-construction technique although there are also bicolored figures (red and black; figure 5[b]). Black is used for the contour; red is used to fill in the figures or to coat the surface.

Detailed analysis of the markings combined with intensive experimentation[8] enabled us to identify a relatively simple graphic operational sequence: 1. Preparation of the surface (removal of the flaky surface and/or weathering rind); 2. Preparatory line often composed of individual, aligned punctuations; 3. Engraving per se; 4. regularization of the line or addition of pigments (Bourrillon *et al.*, in press). The identification of the tools used remains complex for several reasons. Our assessment of the percussion marks is altered by post-depositional alteration of the Coniacian limestone bearing the paintings and engravings. Moreover, due the relative softness of the limestone (6 on the Mohs scale), the graphics were made rather quickly. Softness of the material worked and rapid execution of the images means that the tools used only bear subtle traces, making it difficult to identify them within the associated archeological assemblage. In spite of these drawbacks, our observations and comparisons of the archeological and experimental material reveal that, for the figures engraved by pecking, the tools used were only slightly modified for use, or even unmodified (e.g., pointed quartz pebble, non-transformed antler, etc.), and that

8. Experiments conducted in collaboration with É. Tartar (UMR 7041, Paris), F. Le Mené (independent researcher, Montpellier), C. Cretin (CNP, UMR 5199, Bordeaux), L. Chiotti (MNHN, Paris) and A. Morala (MNP, Eyzies), as part of the research program "Aurignacian Genius", directed by R. White and F. Bon and funded by the Partner University Fund.



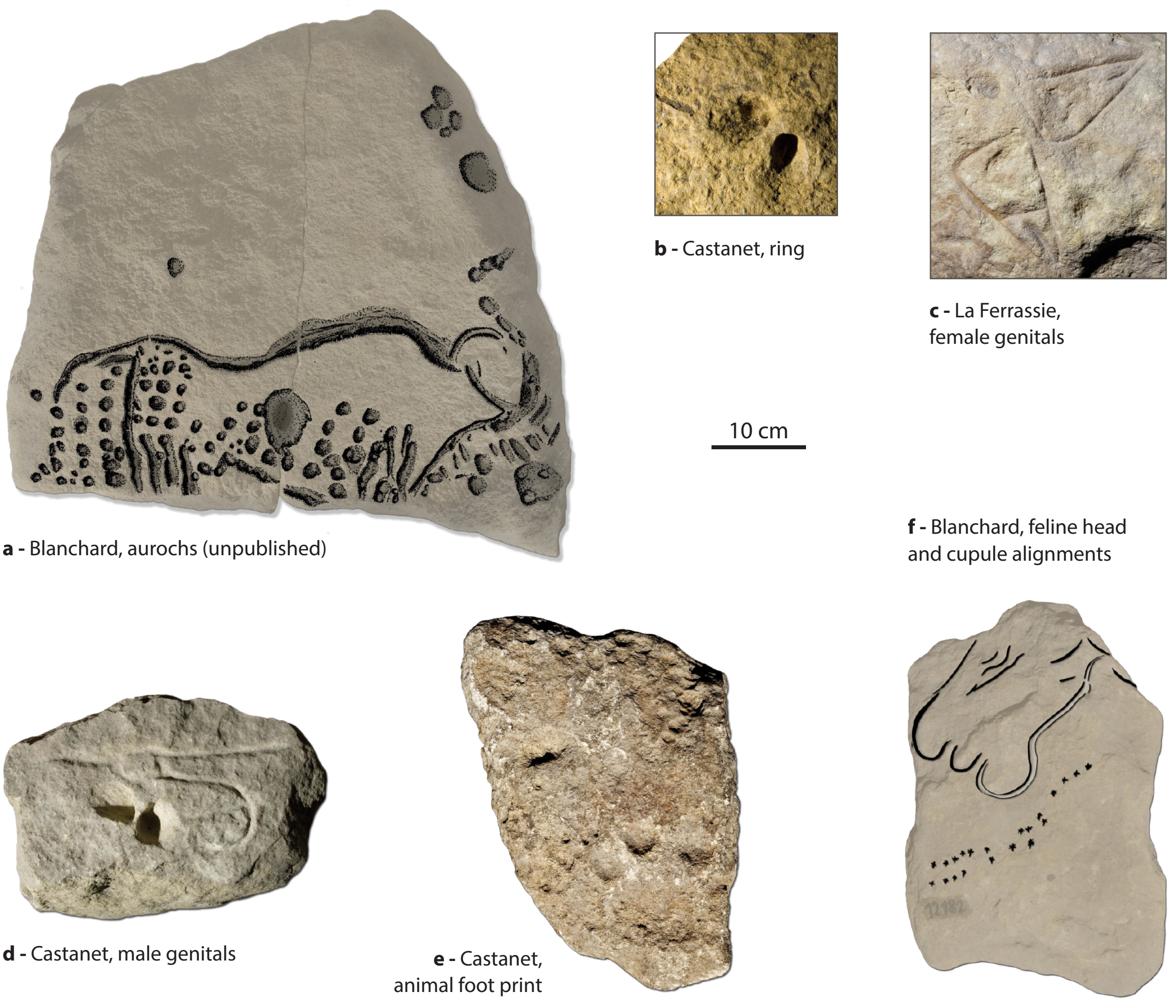
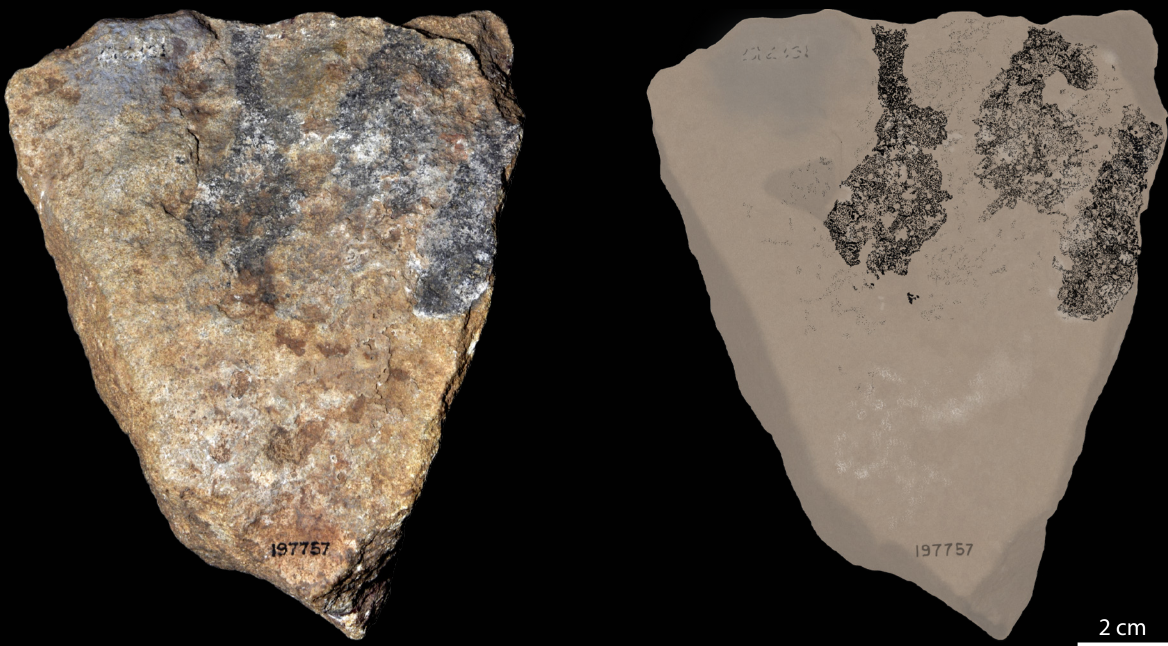


Figure 4 - Subjects depicted on the decorated blocks and fragments from Aurignacian sites in the Dordogne region: Belcayre, Blanchard, Castanet, Cellier, Ferrassie, Fongal, Laussel, Pataud, Souquette (unpublished, figure identified by G. Tosello, R. Bourrillon and R. White in the process of being published ; photos, sketches and plans R. Bourrillon).

a - Abri Belcayre, caprid

b - Abri Blanchard, horse



c - Abri Blanchard, horse limbs (unpublished)

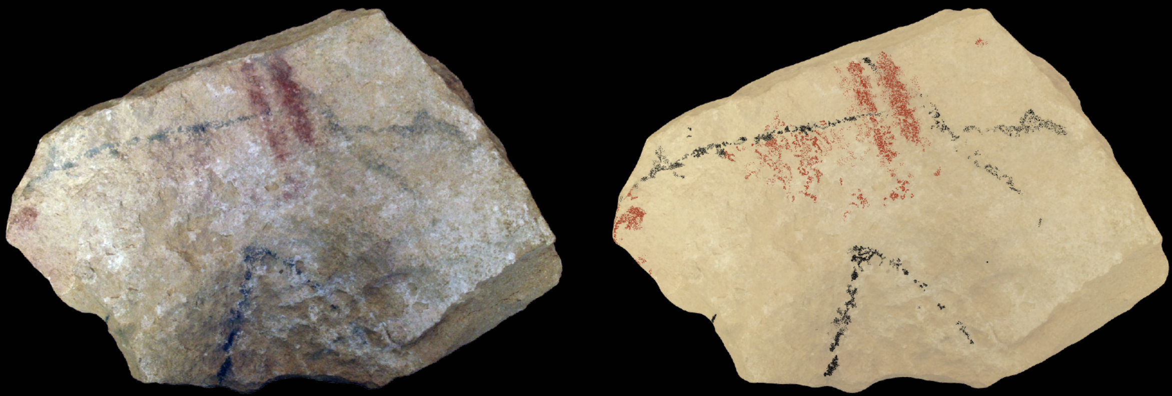
Figure 5.1 - Examples of animal depictions identified in Aurignacian sites in the Dordogne (plans, drawings and photos: R. Bourrillon).

d - Abri Blanchard, zoomorph and horse limbs

e - Abri Blanchard, ibex

f - Abri Blanchard, vestiges of a zoomorphic figure

Figure 5.2 - Examples of animal depictions identified in Aurignacian sites in the Dordogne (plans, drawings and photos: R. Bourrillon).



g - Abri Castanet, zoomorph

10 cm

h - Abri de la Ferrassie (only the engravings are shown on the plan;
a red post-engraving mark is visible on the photo), possible feline head

5 cm

i - Abri Cellier, ibex

10 cm

Figure 5.3 - Examples of animal depictions identified in Aurignacian sites in the Dordogne
(plans, drawings and photos: R. Bourrillon).

bone materials were used as much as lithics (figure 6). Indeed, the variability of the observed markings suggests that a number of these “tools” were simply selected from knapping waste (e.g., exhausted core used as a pick).

Surface preparation

Direct thrusting percussion punctiform Perpendicular and oblique gesture	Hammering Pointed quartz cobble

Preparatory outline

Linear “rubbing” Oblique gesture	Incision Unretouched flake

Engraved outline (with or without smoothing of the pecked preparatory outline)

Before smoothing

Indirect percussion punctiform Perpendicular and oblique gesture	Pecking Soft hammer (boxwood) Pointed quartz cobble Or a pick formed on the broad edge of a core Or an unworked cervid antler tine

Smoothing of the outline

Linear “rubbing” Or indirect percussion punctiform Oblique gesture	Scraping Soft hammer (boxwood) River cobble with rough surface Or an unworked cervid antler tine

Figure 6 - Procedures, techniques and tools used for the experimental engraving of a pecked out and regularized line.

B - A specific context

We have seen that the sites concerned by this study are thus rock shelters formed in Coniacian limestone. Before they collapsed, they provided potential occupation surfaces of wide-ranging dimensions (e.g., Laussel 126 × 15 m, Blanchard 20.75 × 6.50 m). At the sites of Blanchard and Castanet in particular, Aurignacian groups, perched on rocky terraces, situated their camps directly on the rocky substratum into which they hollowed out hearths. The whole range of activities imaginable for a living site has been identified in all these shelters (apart from at Belcayre for which data are lacking; Delage, 1949; Delluc, Delluc, 1991). Blanchard, Castanet, Pataud and La Ferrassie have yielded immense quantities of artefacts (Bourrillon, White, 2014; Delporte *et al.*, 1984; Peyrony, 1935; White *et al.*, 2012), suggesting that they were major occupation places or even aggregation sites for Aurignacian groups (Conkey, 1990). This assemblage richness combined with the presence of graphic representations on blocks or vault fragments, identified in or between the Aurignacian layers (Bourrillon *et al.*, in press; Delluc, Delluc, 1971; White *et al.*, 2012; cf. table 2), supports the notion of a numerous recurring occupations or a single intensive occupation, over a short span of time as appears to be the case at Castanet, according to the latest ^{14}C-AMS dates (White *et al.*, 2012).

Sites	Stratigraphic context	Excavation	Main bibliographic references
Belcayre	Between two layers, both attributed to the Early Aurignacian	Pre-modern	Delage, 1949; Delluc, 1991
Blanchard	Within and between Early Aurignacian layers as well as in the backdirt	Pre-modern and recent	Bourrillon *et al.*, in press; Delluc, 1978; Didon, 1911
Castanet	Within and above the Early Aurignacian layer as well as in the backdirt	Pre-modern and recent	Chiotti *et al.*, 2011; Delluc, 1978 ; Peyrony, 1935; White *et al.*, 2012
Cellier	Within and above the Early Aurignacian layer as well as in the backdirt	Pre-modern	Delluc, 1978; Nesbitt, 1928; Peyrony, 1946; White, 1992
Ferrassie	Within the Early and Later Aurignacian layers	Pre-modern and recent	Capitan *et al.*, 1912 and 1921; Delporte *et al.*, 1984; Delluc, 1978
Fongal	Within the Early Aurignacian layer	Pre-modern	Delluc, 1978; Peyrony, 1941
Laussel	Within the Early Aurignacian layers?	Pre-modern	Delluc, 1978; Lalanne, 1912; Roussot, 1984
Pataud	Within the Early and Later Aurignacian layers	Pre-modern and recent	Chiotti *et al.*, 2003; Delluc, 1991; Movius, 1966
Souquette	Within the Early Aurignacian layer	Pre-modern and recent	Delage, 1938; Roussot, 1982

Tableau 2 - Stratigraphic attribution of the decorated surfaces discovered in Aurignacian rock shelter sites in the Dordogne region.

3 - Discussion

A - A common base overlain by regional diversity

During the course of the early Aurignacian, portable and parietal figurative art employing different media, developed in sites in the Swabian Jura, in Central Europe, in NE Italy, SW France and NW Iberia. Between 35 and 32 000 BP, this new form of art displayed strong inter-regional similarities in subject-matter with, in descending order, the depiction of horse, cervid, mammoth, bison, ibex, feline, rhinoceros, and much more occasionally the bear and human figures. Other types of graphic motifs, such as alignments or clusters of punctuations, are also part of broader Aurignacian practices (Bourrillon *et al.*, in press). Some of these "subjects" are better represented in certain regions (e.g., female vulva in SW France; figure 7), or sometimes even absent (e.g., cervids in the Swabian Jura), but they make up the corpus of subjects known to and represented by Aurignacian groups across Europe. Formal similarities can be added to this common background, such as rounded horses' hooves (Tosello, Fritz, 2005), the double "S" contour of feline heads from Abri Blanchard and Chauvet Cave (Bourrillon *et al.*, in press) or the distinctive rhinoceros ears from the caves of Latrone, Chauvet or Aldène (Azema *et al.*, 2012; Clottes *et al.*, 2001; Vialou, 1979; figure 8).

On the other hand, significant diversity against this common backdrop is observed among the different regions from the very "first" Aurignacian representations onwards. In SW France, art develops mainly in rock shelters,[9] amidst everyday tasks, with the widespread use of the pecking technique and the prevalence of female vulvar representations. In Northern Iberia, SE France and Central Europe, this art develops in caves separated from living areas, and is constituted of more-or-less finely made engravings,. Finally, figurative art in the Swabian Jura is characterized by smooth-outlined sculpture in the round and bas-relief with figurines discovered in shallow cave living site contexts.

What factors can account for such formal and technical diversity during the course of the Aurignacian in Europe?

9. The graphic style of certain parietal engravings and paintings in Dordogne seems to link them to the Aurignacian period, in particular in the caves of Bernous or Cavaille (currently being studied by S. Petrognani and E. Robert).

a - Abri Cellier

10 cm

b - Abri Blanchard

c - Abri Castanet

Figure 7 - Examples of female genital depictions in Aurignacian sites in the Dordogne (photos a and b: R. Bourrillon; photo c: P. Jugie).

Figure 8 - Stylistic similarities in the representation of rhinoceros ears in Chauvet Cave (Ardèche) and la Baume-Latrone Cave (Gard) (photos: J. Clottes and M. Azéma).

B - Searching for an identity?

We know today that as early as the Proto-Aurignacian, then during the Aurignacian, human groups had relatively vast ranges or at least extended zones of between-group contact. The presence of raw materials from distant sources in the Vézère rock shelters provides evidence of this (e.g., ornaments in talc from the Pyrenees and shells of Mediterranean and Atlantic origin; White, 2007; Taborin, 1993). This new form of long-distance procurement stems from (or is responsible for) what F. Bon calls "a profound redefinition of social relations" at the beginning of the Upper Paleolithic (Bon, 2010: 141) and therefore the internal organization of groups. Based on ethnographic studies (e.g., Whallon, 2006), groups of hunter-gatherers are organized on two different levels: a local group made up of 20 to 50 individuals and another with a maximum of about 700 people. Social traditions and access to other resources are perpetuated through regular reunions or aggregations. It is also important to note that during these reunions, exchanges between groups are as much symbolic, ceremonial and ritual as they are economic. This aspect is also emphasized by M. Godelier (2010), who considers that groups are ruled as much by political-religious concerns as by economic ones. This organization into local and maximum groups leads to the circulation of technical know-how and symbolic traditions from "one person to another" over vast territories. It could partly explain the existence of the common Aurignacian art base noted above. This would have had utility for the cohesion of groups across large geographic spaces. On the other hand, regional graphic diversity (cf. figure 1) would be a consequence of the division of the maximal group into local groups. We could construe this as a drifting away from or regionalization of the common base and shared motifs.

Remember that these symbolic productions appear in environmentally different contexts (the Swabian Jura, Dordogne, Hérault, etc.) and in different kinds of places (rock shelters, cave entrances, in the depths of caves), which undoubtedly have different meaning potential (Poor, 2010). Choice of media appears then, to be cultural and not "practical" or "environmental" (e.g., limestone in the open air in the Dordogne, ivory in the Swabian Jura, cave walls in the Gard and Ardèche), as ivory was available in Dordogne just as cave walls were in the Swabian Jura. The various media used influence the choice of techniques, which are themselves adapted to the particular modes of representation and traditions of different regional groups.

We can also imagine climatic parameters as the first Aurignacian phases are marked by climatic instability with two major deteriorations (Heinrich 4 and 3) between 40 000 and 30 000 BP (Banks *et al.*, 2013; Sanchez-Goni, 2000; Stuiver, Grootes, 2000). Bruxelles *et al.* note that the Aquitaine and the southern zones, which encompass most of the Aurignacian graphic representations in France, seem to have served as refuges during particularly severe periods (Bruxelles, Jarry, 2012). This retreat into specific zones and the observed climatic instability during the course of this period could thus be contributing factors to the emergence of regional graphic variations within a shared Aurignacian framework, due to (temporary) isolation or group displacement.

In sum, all these parameters suggest a strong tendency to forge intra- and inter-group identity during the course of the Aurignacian. This trend finds a parallel in studies of the osseous (Tartar, 2009) and lithic industry (Bon, this volume), portable art (Floss, this volume, 2007) or ornaments (Taborin, 2004; White, 2007; Wolf, Conard, this volume). The preservation of a common base underlying more regional symbolic traditions leads to a certain cohesion linking different regional grouops. This is really nothing more than the "mechanical solidarity" elaborated by E. Durkheim, whereby individuals are united by the sum of different similarities (Durkheim, 1893). However, Durkheim points out that the collective conscience dominates individuality, which is not really coherent with Aurignacian regional variability in the domain of decorated blocks or walls or for decorative objects or the bone industry (e.g., lissoirs), as shown by the plurality of geometric lines on these objects (Tartar, this volume). Could we then interpret the Aurignacian pattern as evidence for "organic solidarity" within groups on a regional scale, as defined by E. Durkheim (1893)? The appearance of specific tasks in the organization of human groups would thus develop, in this sense, a more acute individualization of the group and the individual. This in turn would promote an intrinsic regional, or even local, variability.

4 - By way of a conclusion

The emergence of figurative art at around 35 000 BP is one of the characteristics of Aurignacian "genius". But above and beyond this innovation, this cultural period is deeply marked by the rapid diffusion of this art throughout Europe and by the maintenance of a common basis underlying marked regional variation. With the Aurignacian, symbolic practices seem to play a preponderant role in the organization of societies, as shown in particular by certain rock shelters in the Vézère Valley, where decorated surfaces on the shelter ceiling and floor occur in the same place as daily activities (Mensan *et al.*, 2012). Such practices are not separated from daily life and are visible to the whole community and to other groups. This observation is also valid for the portable ivory sculptures worn or transported, in the Swabian Jura, in particular. In other cases, such as Chauvet, representational images are found in isolation deep in caves, and must undoubtedly have a different place and significance in the lives of the Aurignacians concerned.

In conclusion, it is our position that these symbolic practices play a cohesive role among dispersed groups through shared techniques, beliefs and contexts. At the same time, these same symbolic practices permit expressions of identity at regional, local and even individual levels.

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EARLY AND ARCHAIC AURIGNACIAN PERSONAL ORNAMENTS FROM ISTURITZ CAVE:

Technological and Regional Perspectives

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EARLY AND ARCHAIC AURIGNACIAN PERSONAL ORNAMENTS FROM ISTURITZ CAVE:

Technological and Regional Perspectives

Randall WHITE, Christian NORMAND

Abstract

Recent excavations at Isturitz Cave by Christian Normand have yielded a rich assemblage of Aurignacian personal ornaments in chronostratigraphic context. Here, we present the first study of this corpus, focusing on the techniques used for perforating teeth; the chronological variation in the selection of animal teeth (and one human tooth); the raw materials used for the beads and pendants (amber, ivory, talc, bone); data concerning local personal ornament production (or not); the exploitation of amber and its provenance; and the existence of abundant personal ornaments (pendant-anthropomorphic sculpture and shells) in the Archaic Aurignacian levels.
The stratigraphic sequence from Isturitz allows us to demonstrate the chronological evolution of personal ornaments during the course of the Aurignacian in Aquitaine, as well their intra-regional variability. We conclude that this chronological and intra-regional variation considerably complicates the recent hypothesis of regionalized personal ornaments, representing ethnic entities that last for more than ten thousand years.

Keywords

Isturitz Cave, Personal ornaments, Early Aurignacian, Archaic Aurignacian.

Introduction and basic data

Today, there is a consensus that for modern humans, material systems of personal ornaments serve as a way of constructing diverse personal and social identities (White, 1999; Sanders, 2002; Yentsch, 1995). They do so mainly by evoking the history, the values and the beliefs of the group through deep metaphoric links between the chosen raw materials and created forms, on one hand, and a diversity of conventional social identities on the other. It is thus legitimate to imagine that the invention of the first material systems of personal ornaments reflects the first, internally differentiated human societies.[1]

Our own research into Aurignacian personal ornaments aims to understand not only the formal qualities of the finished objects, but also to bring to light the processes (technological, esthetic, symbolic) contributing to the construction of these meaning-laden forms. Regional systems of ornaments cannot be understood without evaluating the choice of raw materials, fabrication-

1. Here, we emphasize this notion of personal ornament “systems”. For us, rare examples of perforated objects more than 40 000 years old, isolated in time and in space, can indicate the technological and esthetic capacity of these distant ancestors, but their ornamental activities appear to be sporadic, and seemingly never coalesce into organized regional entities.

suspension-presentation procedures, as well as their archeological and chronostratigraphic context (Bar-Yosef Mayer, 2005; Stiner, 2013; Vanhaeren *et al.*, 2013; Cristiani *et al.*, 2014). Which, admittedly, is asking for a lot...

In order to understand systems of personal ornaments, it is essential to work on the broadest possible range of samples from reliable stratigraphic and cultural contexts. Yet, in many cases, data derived from early excavations do not fulfil these two criteria.

On one hand, recovering small objects was not one of the excavation aims for many sites. In particular, the use of dry sieving with a mesh ≥ 5 mm, still in use in certain Aquitaine sites until the 1980s, undoubtedly deprived us of many personal ornaments. Recent excavations where sieving with ≈1.5 mm mesh results in almost exhaustive recovery, enable us to assess the extent of the deficit of small elements at over 90% for early excavations. In the specific case of personal ornaments, absence of awareness and lack of interest in this type of artifact had even more dramatic consequences.[2] Not surprisingly, personal ornaments, fragments and fabrication waste are minimally represented or even absent from collections resulting from early excavations.

Similarly, stratigraphic and spatial contexts are missing or imprecise for many or most personal ornaments. Either the different Aurignacian techno-complexes were not differentiated, or cultural identification is erroneous or needs to be reevaluated. As a consequence, arguments and hypotheses are often based on heterogeneous samples spanning several millennia. In this context, the identification and interpretation of systems of personal ornaments lose all their meaning and the recently published sweeping overviews of Aurignacian personal ornaments are unconvincing being founded on unreliable empirical data (Vanhaeren, 2002; Vanhaeren, D'Errico, 2006).

For these different reasons, it is clear that most of the data derived from early excavations cannot be used to reply to current questions. It is thus essential to focus on data from recent excavations (or at times early excavations) that paid careful attention to these issues.

From this point of view, the recent excavations from the Aurignacian sites of Brassempouy (Landes), Castanet (Dordogne) and Isturitz (Atlantic-Pyrenees) provide data able to contribute to our knowledge of Upper Paleolithic society and systems of personal ornaments. The meticulous recovery of objects linked to personal ornaments was integrated into excavation and recovery procedures. Excavators were taught how to recognize ornaments and fabrication waste and all sediments were wet-sieved (mesh = 1.5 mm).[3] Sieve residues were sorted several times in order to retrieve the smallest fabrication waste (ivory shavings, talc dust).

One of the most important contributions of the programmed excavations at Isturitz Cave was the discovery of more than 200 perforated objects (or worked in other ways in order to be suspended) as well as a number of waste products linked to their fabrication (cf. table 2). It is no exaggeration to say that these abundant (Archaic and Early) Aurignacian personal ornament objects from a modern excavation[4] transform our scientific knowledge of the symbolic aspects of the first modern humans in Western Europe.

Isturitz Cave is located in the western Pyrenees, at the center of a zone of circulation and contact between Aquitaine and the Cantabrian coast and was excavated during the first half of the 20th century. Those excavations yielded a remarkable archeological complex covering the Middle

2. It is probable that the small ornamental assemblages from recent Aurignacian excavations, such as Abri Pataud, Le Flageolet I, La Ferrassie, only represent a small proportion of the ornaments and fabrication waste present in these sites, this deficit being due to the absence of rigorous recuperation methods, notably wet-sieving.
3. In fact, the absence of ornaments in Europe or elsewhere cannot be taken seriously for sites where fine-mesh wet sieving was not undertaken.
4. Quite a significant number of these objects come from the Saint-Périer spoil and the reworked deposits left in place by the latter.

Paleolithic and almost all of the Upper Paleolithic. New research in the Saint-Martin gallery brought to light important Aurignacian occupations attributed to the Archaic and Early phases of this technocomplex. In this article, we will present an overview of the main data relating to the personal ornaments, for which Isturitz is a key site.

We will only present here general preliminary observations and the most remarkable objects as the complete data will be published in a subsequent monograph (see also White, 2001a, 2002a, 2003, 2007a, 2007b). As one of us (R. W.) is responsible for the analysis of the personal ornaments from other Aurignacian sites in the process of being excavated in Aquitaine (White, 2007a, 2007b) and elsewhere (White, 2002b), it will be interesting to carry out comparisons between the type and technology of the personal ornaments from Isturitz and other sites in Aquitaine.

1 - Isturitz Cave, Normand excavations, stratigraphic overview

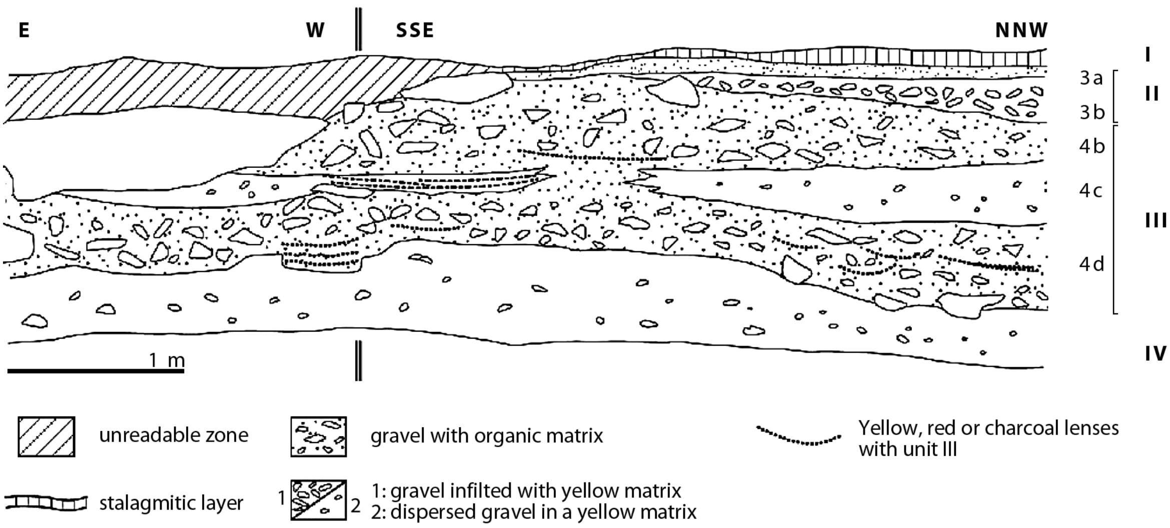
The location of the recent excavations in the Saint-Martin gallery is illustrated in the table 1. This zone is divided into two sectors separated by a large block: the "fouille principale" sector (main excavation) and the "coupe" sector (section). The archeostratigraphy of these two sectors was recorded separately and the stratigraphic correspondence between the sections is probable, but has not yet been demonstrated with certainty.

The Aurignacian sequence from the excavated zone in the Saint-Martin gallery is made up of three main complexes (table 1):

An **upper complex**: This complex was divided into three subcomplexes in the "Main Excavation" sector (C 3a, C 3b summit and C 3b base) and two in the "Section" sector (C 3I and C 3II). C 3a, C 3b summit and C 3I contain sparse diagnostic material. A fragment of a backed piece and a Noailles type burin discovered in C 3a suggest an attribution of all or part of the material to the Gravettian. The top of C 3b and C 3I are undoubtedly part of a relatively recent Aurignacian phase, which could explain the two dates obtained for C 3b summit (Beta 136048: 28 290 ± 240 BP and Beta 136049: 29 400 ± 370; Barandiaran *et al.*, 2000). However, these dates were made on unburnt bone fragments that may have been subject to leaching and are thus not totally reliable. A considerable quantity of the material from C 3b base and C 3II, which is more abundant, presents characteristics of the Early Aurignacian, in particular the presence of several Aurignacian blades and bladelet production from carinated cores. An attribution to this phase of the Aurignacian thus seems likely.

A **middle complex**: We differentiated two main subcomplexes in the "main excavation" sector (C 4b and C 4c) and one in the "section" sector (C 4I), which are further subdivided. C 4b and C 4I yielded very rich series, with for example a lithic toolkit containing over a thousand pieces. The study of these pieces points to an attribution to an early phase of the Aurignacian with several differences in relation to the material from Brassempouy some 60 km distant, for example (Bon, 2006). At Brassempouy, bladelets are almost exclusively derived from carinated cores, whereas at Isturitz, this method is predominant but coexists alongside two others: a débitage following on from blade débitage and a separate débitage on the edge of flakes, usually associated with the archaic Aurignacian. The sedimentary integrity of these assemblages is good (Texier, Lenoble, 2005) and it is probable that a real anthropogenic association exists between these methods. How can we interpret these observations? At the present time, we think that they reflect territorial differences, especially as the dates corresponding to these subcomplexes are similar to those from Brassempouy (C. Szmidt, oral inf.). As for the base of this middle complex, layer C 4c4 could evidence a link between the Archaic and Early Aurignacian. Six dates were recently obtained, with an average age of 37 180 ± 420 BP (Szmidt *et al.*, 2010).

Site	Layer	Square	Number	Weighted ^{14}C age in years BP (# targets)	Laboratory number
Isturitz	C 4c4	W132	1074	37 000 ± 1600 (3)	AA69179
		W133	725	37 300 ± 1800 (2)	AA69180
		W133	736	36 800 ± 860 (7)	AA69181
		W133	637	37 580 ± 780 (10)	AA69183
		W132	1003	40 200 ± 3600 (1)	AA69184
		W132	327	36 990 ± 720 (8)	AA69185
				mean: 37 180 ± 420 (31)	



Recent excavations		
Lithostratigraphy (Texier 1997)	Archeostratigraphy (Normand 2002)	
I	C 1	
	C 2	
II	not present	
	not present?	
	C 3a	
	C 3b sommet et C 3I/II	Late Early Aurignacian
III	C 3b base	
	C 4b1/2 and C 4I	Early Aurignacian
	C 4c and C 4II	Intermediate between Archaic and Early Aurignacian
	C 4d and C 4III	Archaic Aurignacian
IV	C 5	
V	C 6	

Table 1 - Normand excavations, dates and Aurignacian archeostratigraphy linking both sectors (after Texier, Lenoble, 2005).

Stratigraphic unit	Nature	Number
3b base and summit	vestigial canine, red deer	3
	tooth, lion	1
	tooth, wolf	1
	tooth, undetermined species	1
	tooth, undetermined ungulate	1
	tooth, bovid	2
	tooth, human	1
4a	tooth, horse	1
	tooth, fox	2
	tooth, undetermined mammal	1
4b	tooth, fox	8
	tooth, hyena	1
	tooth, bovid	25
	vestigial canine, red deer	5
	tooth, undetermined mammal	4
	tooth, undetermined species	1
	bead, basket-shaped	3
	bead, flattened	1
	bead, globular	1
	bead, cylindrical	1
	bead, with double incisions	6
4c	pendant, amber	2
	tooth, bovid	1
4d	pendant, calcite	1
	sheels, pierced	15
4I	bead, basket-shaped	6
	bead, bone, cylindrical	1
	bead, tabular	1
	tooth, bovid	1
4Ia	bead, basket-shaped	3
	tooth, fox	1
4Ib	bead, basket-shaped	1
	tooth, fox	2
	tooth, bovid	2
	tooth, undetermined mammal	1
	vertebra, fish	1
4Ic	bead, basket-shaped	6
	tooth, wolf	1
4Id	bead, basket-shaped	1

Table 2 - List of the personal ornaments by stratigraphic unit when the exact provenience is known (excavations 1996 to 2005).

A **lower complex**: it includes the C4d complexes in the "main excavation" sector and C 4III in the "section" sector, which correspond to very dense human occupations with abundant remains. The only published dates are from burnt bone fragments discovered in a test pit in 1998: 36 550 ± 610 BP (Gif 98238) and 34 630 ± 560 BP (Gif 98237) (Turq *et al.*, 1999). However, subsequent excavations lead us to rule out these dates as the sampled zone turned out to be disturbed. The currently available typo-technological data for C 4d and C 4III clearly link these series to the Archaic Aurignacian, already observed in several sites relatively close to Isturitz, such as Gatzarria (Laplace, 1966; Sáenz de Buruaga, 1991), Labeko Koba (Arrizabalaga, Altuna, 2000) or Cueva Morín (e. g. Maíllo Fernández, 2003).

2 - Aims of this presentation

With continued work at the site and more in-depth stratigraphic knowledge, it is now possible to demonstrate a certain number of technical, material, chronostratigraphic, spatial and even regional tendencies.[5] We present here a first study of this corpus, with particular focus on the techniques used for perforating teeth; the chronological variation in the selection of mammal teeth (including one human tooth); the raw materials used for beads and pendants (amber, ivory, talc, bone); the data concerning local versus external personal ornament production; the exploitation and provenience of the amber used; and the existence of numerous personal ornaments (pendant-anthropomorphic sculpture and shells) in the levels dated to the archaic Aurignacian.

A - Shaping and perforation techniques at Isturitz

Working mammal teeth to make holes for suspension is a relatively complicated and elaborate procedure at Isturitz (figures 1-3). A single tooth (fox) was worked by basal grooving (or "rainu-rage), but two perforated bovid teeth also bear grooves on at least one outer edge of the tooth. This observation shows once again that basal grooving is not limited to the Châterperronian (White, 2001).

Practically all of the bovid teeth and the vestigial deer canines underwent complicated and intensive alteration, made up of several preparation stages. The root of the tooth was first thinned by fine abrasion, removing large surfaces of the cement layer. Then, on each side of the root, the zone to be perforated was prepared by rather crude scraping. In some cases, the exact perforation location was deepened by scraping, through the application of a pressure tool, or by pecking.

In most cases, once this preparation was finished, semi-rotation was used for perforation, which is rather rare technique in other Aurignacian sites in Aquitaine (White, 1989a, 1989b, 1992, 1993a, 1993b, 1997). Often the lips characteristic of a change in direction of the semi-rotational movement are visible on the internal edges of the hole.

It is legitimate to wonder if this perforation and preparation technique is particularly adapted to the morphology of bovid teeth or if it is a more widely used technique at Isturitz. The micro-scopic observation of teeth from other taxa, allowed us to observe the generalized application of this operational chain across different species and tooth morphologies.

5. In order to do so, we ruled out the objects recovered in the Saint-Périer spoil and the reworked deposits left in place by the latter.

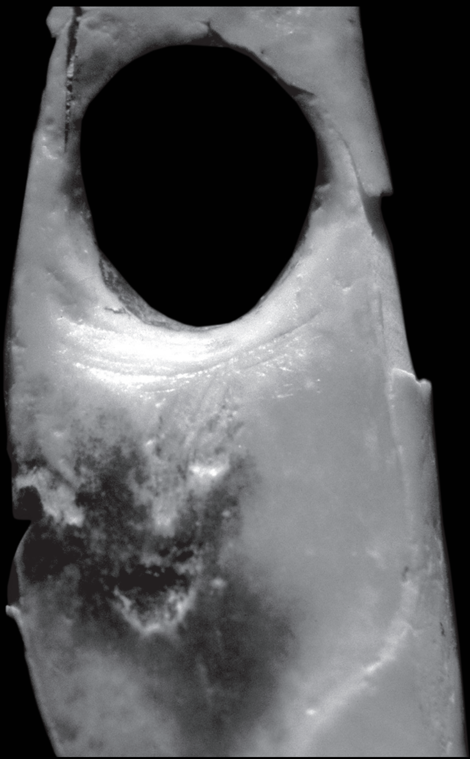


Figure 1 - Bovid tooth, first thinned by fine abrasion, then scraped, and then perforated by semi-rotation. Note a first preparation in the middle at the bottom (repeated on the other side of the tooth) of the perforation, subsequently abandoned (6.4 ×).

Figure 2 - a: Totally worked vestigial deer canine (or facsimile), with bifacial semi-rotational perforation (6.4x) and b: very worn bovid incisor, perforated by bifacial semi-rotation (layer 4b).

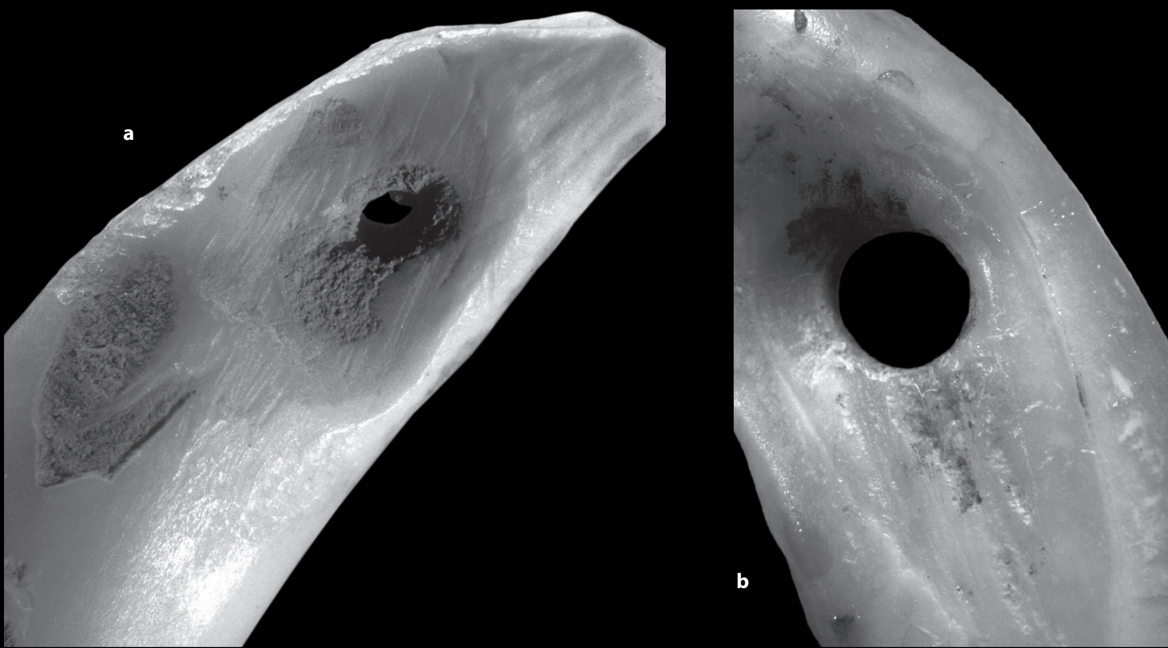


Figure 3 - a: fox canine thinned by fine abrasion, then prepared by bifacial scraping to open a perforation. Note the heavy working of the lateral edge of the root (6.4 ×). b: fox canine thinned by very deep carving, followed by scraping and bifacial semi-rotational perforation (6 ×).

The bovid teeth are generally heavily worn. In a number of cases, the animals were very old, in others, the teeth appear to have been subject to strong artificial modification by abrasion. In these cases, the enamel surface was intensively reduced by rubbing and the proximal extremity of the root and the lateral edges of the tooth were also transformed by abrasion. In these cases, the teeth display the same characteristics as the blanks used for making cylindrical beads. Indeed, there are two cylindrical ivory beads with very similar shapes to those of the worked bovid teeth.

B - Does the choice of mammal teeth used for personal ornaments remain stable during the course of the Aurignacian?

As we have seen, most of the personal ornaments from the recent excavations at Isturitz are made up of perforated mammal teeth. Figure 4 shows the distribution of these teeth by taxon[6] and by stratigraphic unit. Bovid teeth are predominant, but the situation is somewhat more complicated and more interesting, as the proportions of bovid teeth display marked chronological variations. They are more frequent in the lower stratigraphic units (especially C 4b) attributed to the Early Aurignacian.

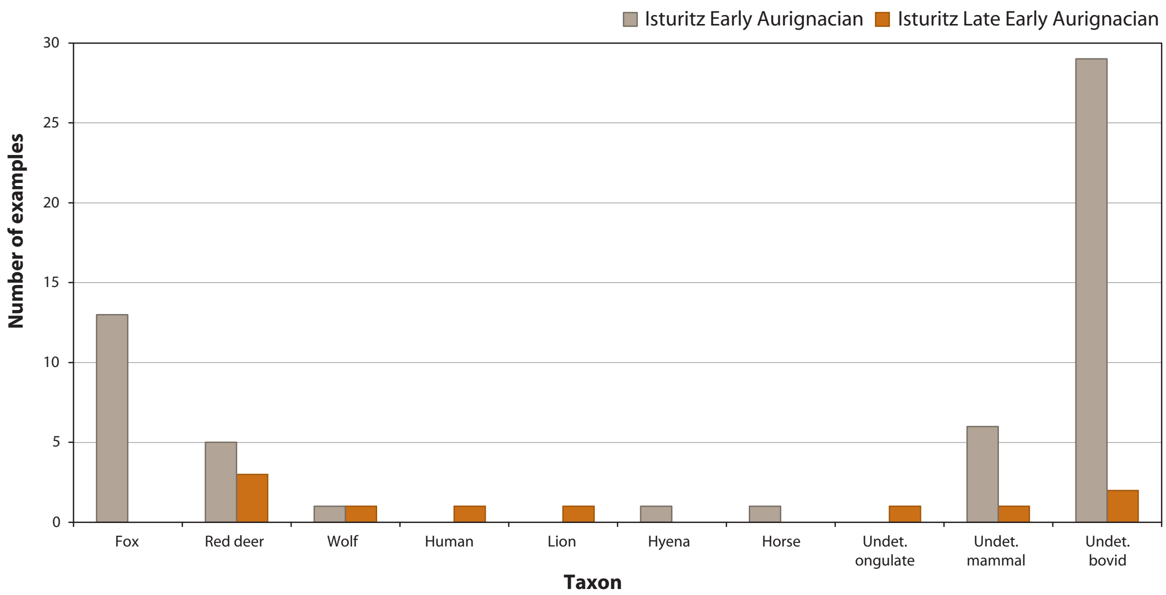


Figure 4 - Worked teeth, frequency of species in the early Aurignacian layers (layers 4Ia, b, c and d then 4a, 4b [4b, 4b1 and 2], 4c1, 4c2, 4c3) and the recent early Aurignacian layers (layers 3 a, b-base and b-summit).

Indeed, mammal species in personal ornaments display fascinating chronological variability. Over the past few years, we have observed important differences in "ornamental" species between Brassempouy (galérie des Hyènes) and Isturitz, which are only about 60 km apart. One of us (R.W.) advanced several hypotheses to explain these differences, which consist in a dominance of bovid teeth at Isturitz and their total absence from Aurignacian personal ornaments at Brassempouy. This variability is either random, which does not appear to be very plausible given the sample sizes; or it points to the existence of a border between two regional groups, marked by teeth from particular species; or it is linked to hitherto non-identified chronological shifts in the choice of ornamental species, within the Aurignacian in Aquitaine.

6. Identifications until the end of the 2002 season by S. Costamagno.

Figures 5 and 6 illustrate the consequences of a methodology with no control over the chronostratigraphic context, combining Aurignacian complexes spread out over several millennia. Taken as a whole, the personal ornaments from Isturitz display strong differences with those from the levels from complex 2 at Brassempouy, from a more restricted chronological context. However, when the ornaments from level 3 at Isturitz (recent Early Aurignacian) are separated from those from levels 4a to c and 4Ia to c (Early Aurignacian), a dramatic shift in the relative frequencies of the selected species is observable.

This change in behavior, from a dominance of bovid teeth to a dominance of other species (fox, deer, human), bears no relation to possible environmental changes. At Isturitz, bovids are as abundant in the recent Early Aurignacian fauna as in the Early Aurignacian.

At Castanet (Castel, 1998) and Brassempouy (Letourneux, 2003), as well as Isturitz (Costamagno in Normand *et al.*, 2006), the remains of reindeer, horse and bovids, taken collectively, dominate the fauna. It is thus surprising to observe the total absence of worked teeth from these taxa in the early Aurignacian at Brassempouy and Castanet. The consumed animals and the "worn" animals appear to be mutually exclusive.

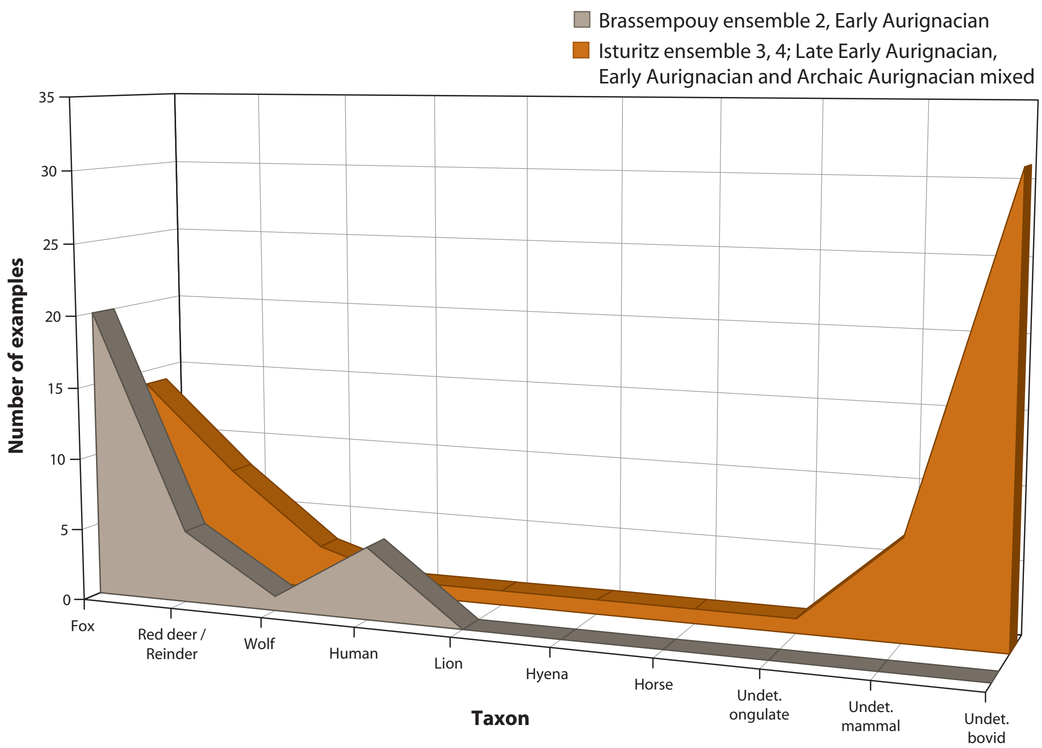


Figure 5 - Inter-site comparison of mammal teeth used for making personal ornaments by species; between Brassempouy and Isturitz (with no stratigraphic distinction for Isturitz).

The example of Isturitz (figure 6) shows the repercussions that sample construction may have on interpretations. Grouping objects without taking into consideration their exact stratigraphic origin is likely to lead to biased or totally erroneous interpretations.

At the scale of the entire Aurignacian, which lasts for several millennia, and given the resolution level of radiometric dates, it is very difficult to interpret inter-site differences (figure 7) related to the choice of species, as these can reflect regional differentiation as well as chronological evolution. The conclusions of Vanhaeren and d'Errico (2006) in favor of the stable and structured regional variation (of Aurignacian personal ornaments) across Europe are thus invalidated.

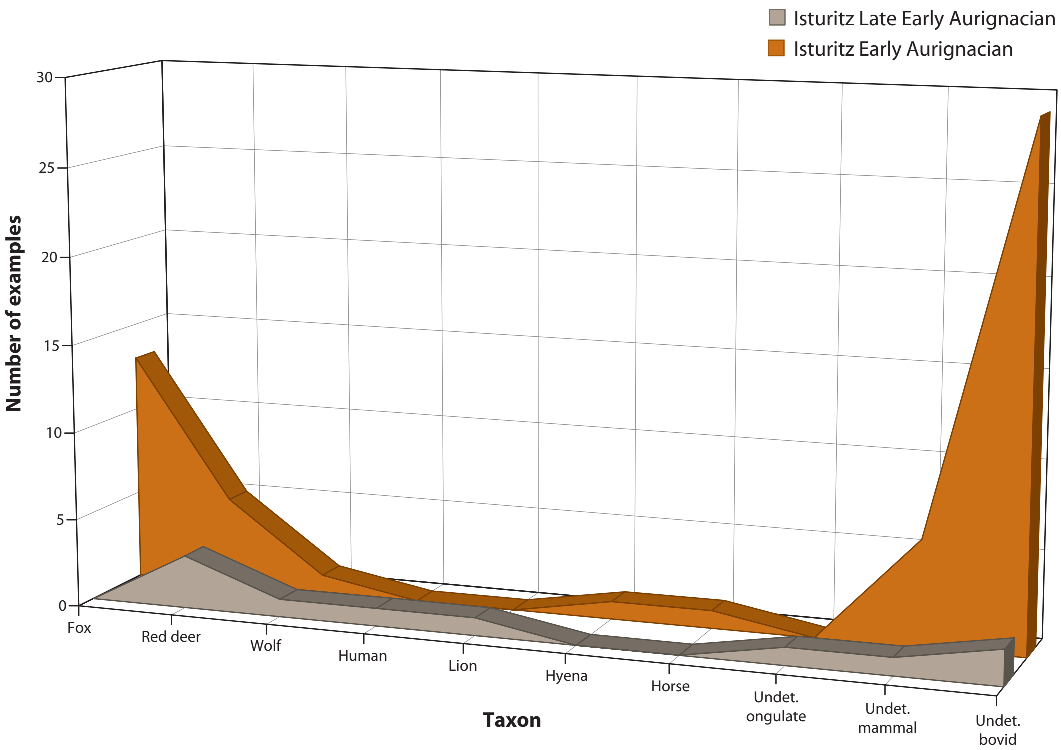


Figure 6 - Differences in mammal teeth used for making personal ornaments by species, between the Early Aurignacian (layers 4la, b, c and d then 4a, 4b [4b, 4b1 and 2], 4c1, 4c2, 4c3) and the recent Early Aurignacian (layers 3 a, b-base and b-summit) at Isturitz.

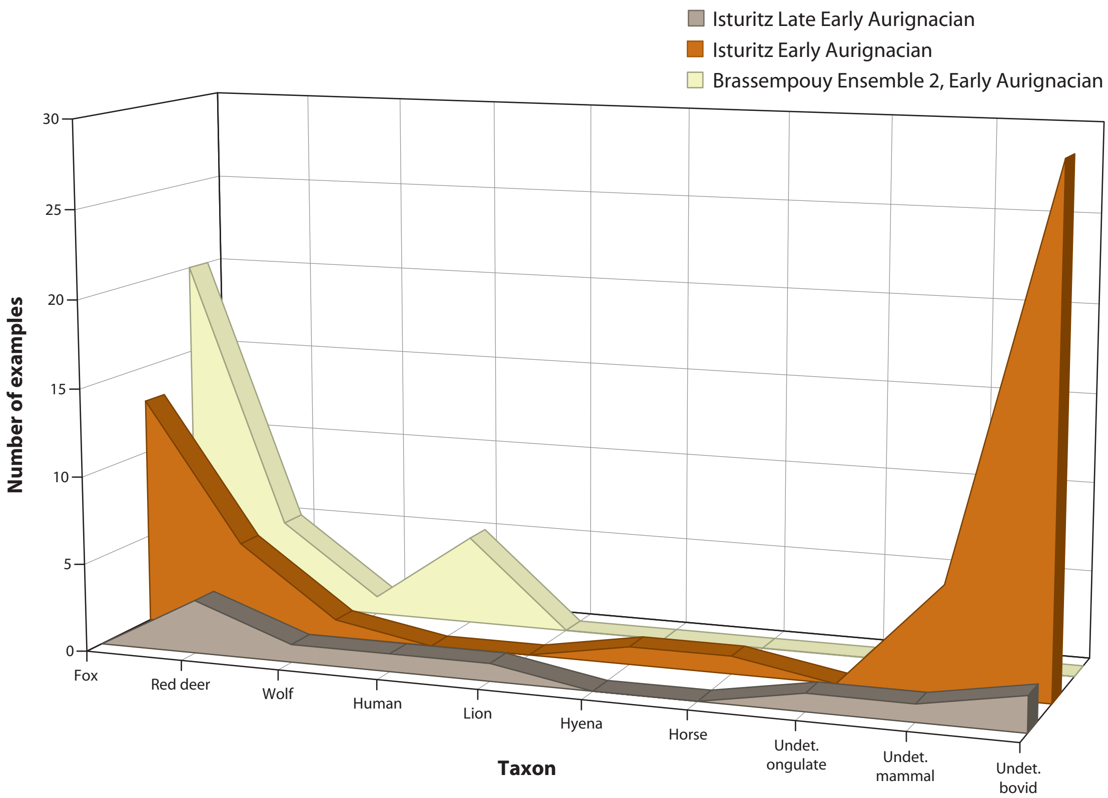


Figure 7 - Differences in mammal teeth used for making personal ornaments by species, between the Early Aurignacian (layers 4la, b, c and d puis 4a, 4b [4b, 4b1 and 2], 4c1, 4c2, 4c3) and the recent Early Aurignacian (layers 3 a, b-base and b-summit) at Isturitz and the Early Aurignacian (complex 2) from Brassempouy.

On a much smaller scale, the observation of fluctuations in the frequency and proportions of worked teeth by species in an Early Aurignacian sequence, as at Brassempouy (White, 2007a), confirms the necessity of detailed site by site analyses in order to record and understand the observed variations.

At Isturitz, this variability also has a non-negligible spatial aspect. The "section" sector only yielded eight worked mammal teeth (half of them in 4Ib), including just three bovid teeth. In sum, for now, the "section" sector yields a higher proportion of beads in relation to worked teeth (figure 8). However, it is clear that the excavation of a small surface runs the risk of yielding non-representative samples.

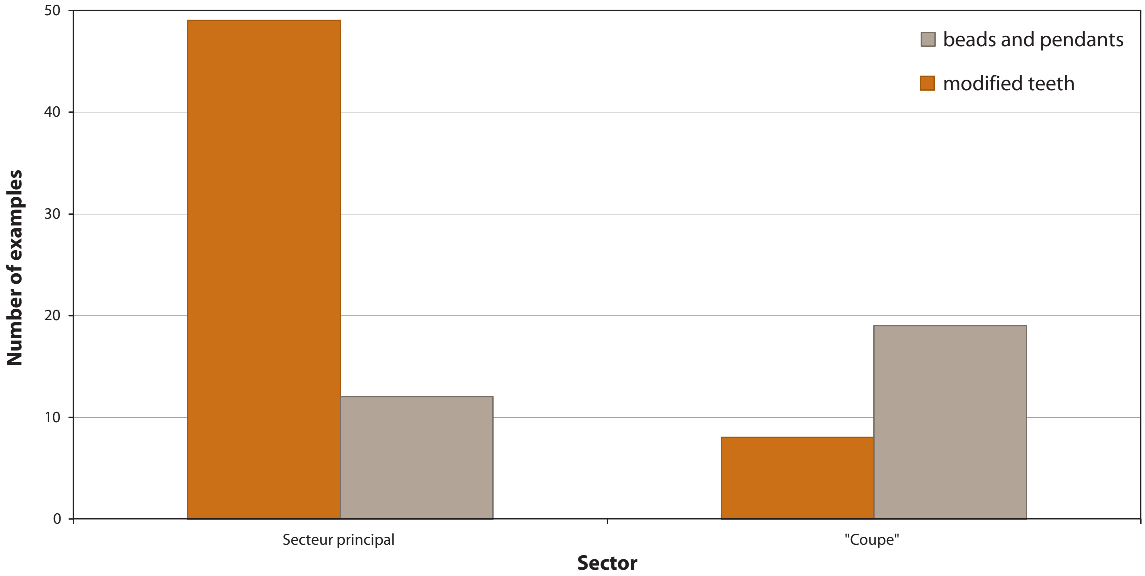


Figure 8 - Complex 4. Bead / worked tooth ratio in both sectors of the excavations.

C - The perforated human tooth

The only perforated human tooth (lower left M2 or 3) is intact (figure 9). It is part of a growing number of such ornamental objects in the French Aurignacian (Henry-Gambier *et al.*, 2004). It bears clear bifacial semi-rotational perforation (figure 9), made with a rather blunt tool, as is the case for certain bovid teeth from Isturitz. The rotation marks are not very visible (figure 10), given the very worn and glossed surface of the piece. For now, it is impossible to know whether this results from use-wear caused by refining the hole by fine abrasion or by wearing the object for a long period of time.

It is important to underline that human teeth worked for suspension are limited to four sites attributed to the early Aurignacian in the Aquitaine Basin: La Combe; Brassempouy; Isturitz and Tarté (White *et al.*, 2003; Henry-Gambier, White, 2006; Henry-Gambier *et al.*, 2004).[7] Some of these teeth bear scraping marks, apparently to remove flesh, showing that they were taken from corpses. The Charente Aurignacian sites of Rois and Fontechevade both contained a mandible with cut marks (Gambier, 2000), which may possibly be linked to tooth extraction procedures for transformation into personal ornaments.

7. Note that the specimen from Tarté comes from the backdirt of a site also containing Gravettian occupations.

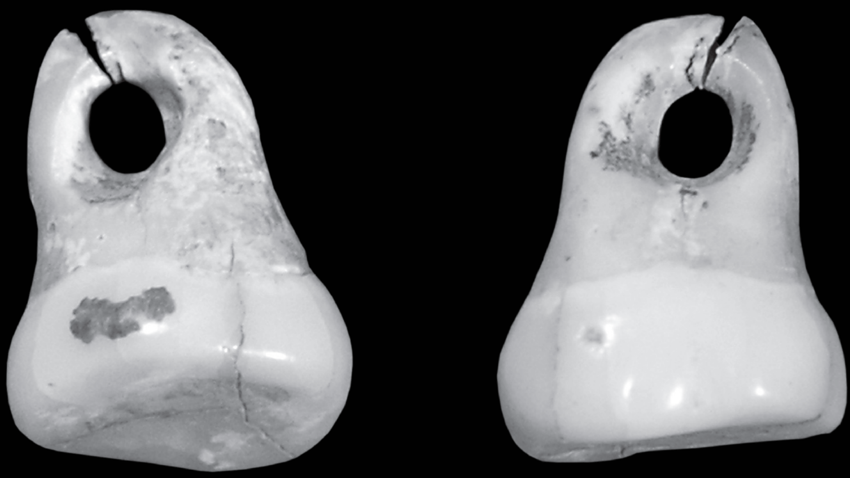


Figure 9 - Isturitz 2001, C 3b base. The perforated human tooth.

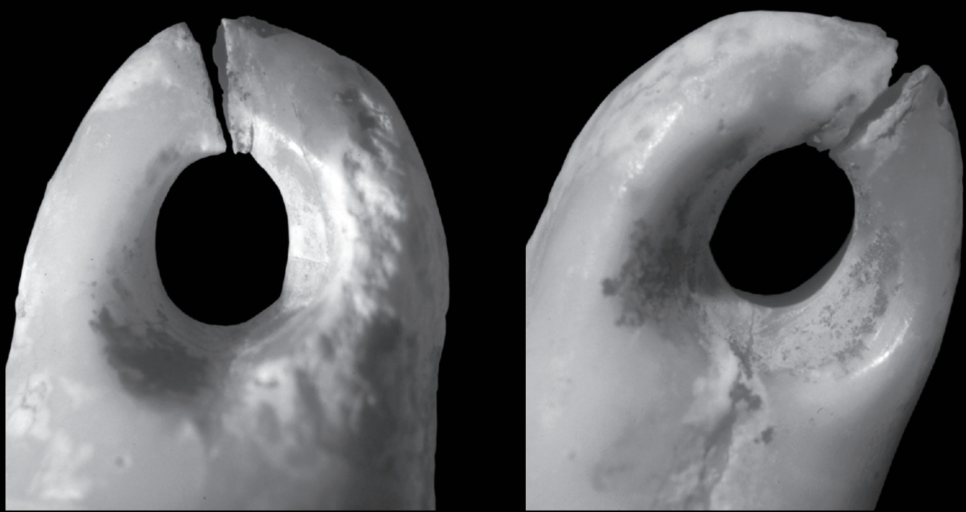


Figure 10 - Both sides of the perforation of the human tooth. The tooth was perforated by semi-rotation, but the rotation rings are not very visible due to marked use (6.4 ×).

D - Raw materials used for making beads

The Aurignacian beads and pendants from complex 2 at Brassempouy are made in ivory, chlorite, talc, calcite, bone, hematite and lignite. Roughly the same raw materials were used at Castanet and Isturitz, with several subtle but significant differences. For example, the proportions of beads in ivory compared to the beads in soft stone (figures 11-13) are very different at Brassempouy and Castanet (as well as for the other Aurignacian sites of Castel-Merle – La Souquette and Blanchard). We could conclude that the geographic location of Brassempouy, situated nearer Pyrenean talc outcrops, would explain the higher percentages of beads in this material. This would be a classic example of focusing on a certain raw material in relation to the distance from its geological origin.

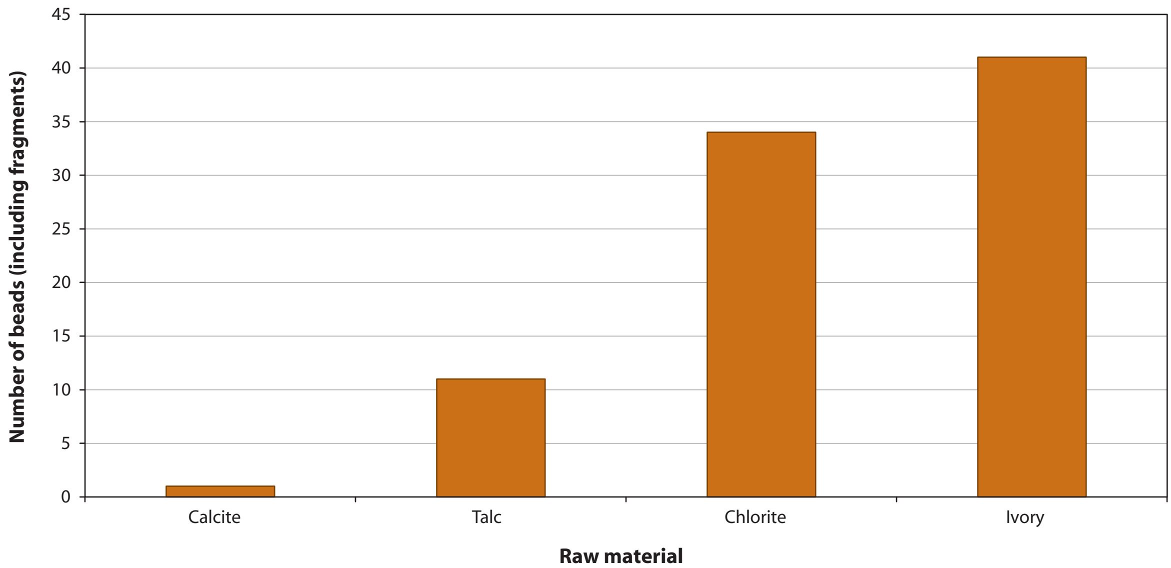


Figure 11 - Proportions of basket-shaped beads by raw material, complex 2, Brassempouy.

Nonetheless, there is a surprising aspect in the choice of raw materials for basket-shaped beads at Isturitz. Unlike Brassempouy (figure 11), where approximately half of the basket-shaped beads are in soft stone, at Isturitz most of these beads are in ivory or bone. The quantitative data for Isturitz are thus similar to the proportions observed in the Périgord sites (figures 12-13). This is even more surprising, given that Isturitz is located near Pyrenean talc outcrops.[8] Could this be explained by links with Aurignacian populations further north? Were the basket-shaped beads from Isturitz brought to the site from the north as finished products? Or is this merely the result of a non-representative sample due to the small excavated surface? Once again, we are faced with variability that cannot be explained by a simple regional model. It will be interesting to see how this question progresses over the coming excavation seasons.

8. This said, uncertainty remains as to the availability of talc in the western part of the Pyrenees. Prospections and bibliographic research by one of us (C.N.) did not lead to the discovery of talc in this part of the Pyrenees, in the same form as it was used to make these beads.

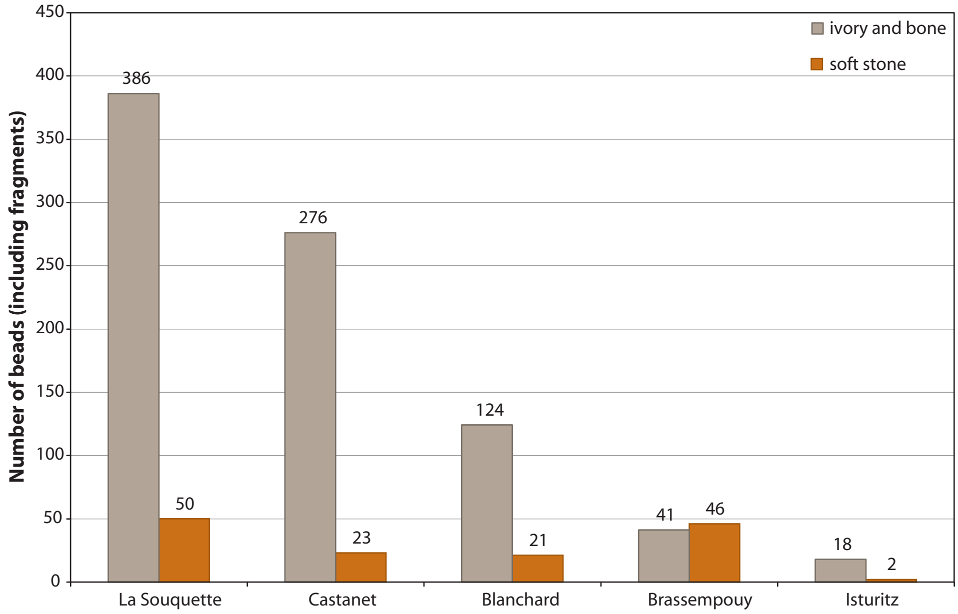


Figure 12 - Comparison of the proportions of ivory and soft stone beads from the sites in the Vézère Valley (Dordogne), Brassempouy (Landes) and Isturitz (Atlantic-Pyrenees).

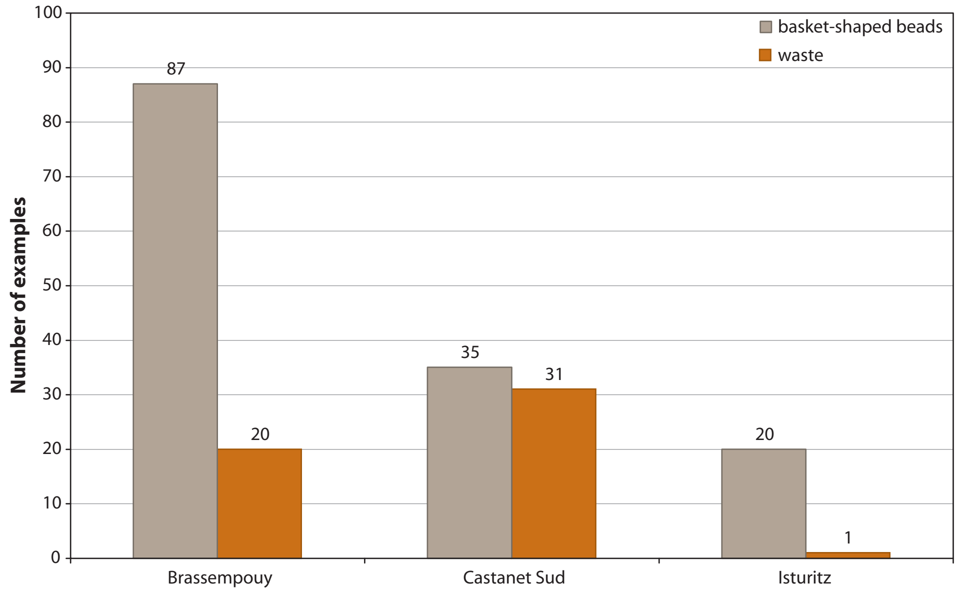


Figure 13 - The ratios between basket-shaped beads and waste (unfinished beads) for Brassempouy, the recent excavations at Castanet and Isturitz.

E - On-site production or allochthonous bead production?

Basket-shaped beads are relatively rare at Isturitz in comparison with other, recently excavated Aurignacian sites. After nearly ten years of excavation, traces of the production of these beads are practically absent. The only possible exception was a large cylindrical bead identified in 2003 (2.1 cm long), which could be a rough out of a globular or "basket-shaped" bead. The blank could be in ivory, but it is more likely that it is the root of a large tooth, the proximal end of which appears to be preserved (figure 14).

Figure 14 - Isturitz 2003, C 4I. Rough out of a bead in dentine or ivory.

A small quantity of fabrication waste, as well as several unfinished beads and unfinished perforated teeth (figure 13) provide evidence of the on-site fabrication of at least some of the beads and perforated teeth at Castanet and Brassempouy. In contrast, in spite of the presence of about twenty basket-shaped beads and fragments in levels 3 and 4a (Early Aurignacian) at Isturitz, only one unfinished bead was identified and no fabrication waste was found in the excavated sector.

The systematic recovery and quantification of fabrication waste enables us to observe a rather interesting pattern (figure 13). The new excavations at Castanet confirm the idea of intensive personal ornament production, particularly of basket-shaped beads. At this site, we find as much waste and rough outs as finished beads. Complex 2 of Brassempouy shows much more limited production activity, implying that this context is one of clothing repair and personal ornament replacement. Certain very clear use-wear marks inside the perforations also point to on-site use / loss.

Lastly, in the recently excavated sector at Isturitz, evidence of fabrication is practically absent, with one exception: the production of personal ornaments in amber, a phenomenon limited to levels 4b, 4c and 4d.

A comparison of the intensity of activities linked to bead making at Brassempouy, in the Aurignacian sites of Castel-Merle (Dordogne) and at Isturitz (Pyrénées-Atlantiques), enables us to outline a model for ornament fabrication within a regional system of seasonal movements and activities. This model remains extremely fragile, given the paucity of available data and the above mentioned spatio-temporal correlation problems between the sites. Nonetheless, it is important to underline that the skeletal-chronological data point towards a summer occupation at Brassempouy (Letourneux, 2003) and Isturitz (Rendu in Normand *et al.*, 2006) and a winter occupation at Castanet (Pike-Tay, 1998). We hope that isotopic analyses (Heckel *et al.*, 2014) will in time help to better assess this question.

F - Personal ornaments in amber (and lignite)

The recovery of much amber waste, from the first excavation season onwards, ranging from millimetric splinters (figure 15) to large pieces (figure 16) (2.9 × 2.3 cm), supports the hypothesis of on-site fabrication of personal ornaments in amber. It is important to recall that the Saint-Périer excavations (R. and S. Saint-Périer, 1952)[9] yielded an amber pendant attributed to layer SIII (figure 17). The discovery of amber pendants during the course of the 2004 excavation was thus predictable (figure 18). They represent, for now, the oldest known personal ornaments in amber.

To date, the recent excavations at Isturitz have only yielded amber objects in the main excavation sector (table 3). They are absent from the "section" sector.

Stratigraphic unit	Number of amber fragments
US 4b	11
US 4c	14*
US 4d	2
US 4I	0
US 4Ia	0
US 4Ib	0
US 4Ic	0
US 4Id	0
Total	**27**

* (including two pendants)

Table 3 - Stratigraphic and spatial distribution of the amber remains, 1996-2005.

The question immediately arises as to the origin of this amber, given that in Cantabrian Aurignacian sites, this raw material comes from local Cretaceous outcrops (Álvarez Fernández *et al.*, 2005a). The same applies to the recently found Paleolithic amber in La Garma (Peñalver *et al.*, 2007).[10] Field investigations carried out by one of us (C.N.) confirmed the presence of an outcrop at Saint-Lon-les-Mines to the south of Dax, already cited by the Saint-Périers (1952) as a possible source for the Isturitz amber. In this case, as in others, the amber is associated with lignite, which is all the more interesting as the Isturitz Aurignacian (Saint-Périer collection in the MAN, Saint-Périer spoil) contains personal ornaments in this material. Unfortunately, unlike amber, lignite waste cannot be identified during sieving, as it cannot be distinguished from other carbonized organic matter, such as burnt bone.

We contacted *The Center for Amber Studies* in Vassar College in the United States. The director of the center, Professor Curt Beck, agreed to participate in a spectral characterization project of the Isturitz amber and samples from the known outcrops in the Landes and along the French Basque coastline. Professor Beck had already undertaken this type of research in collaboration with Dominique Sacchi on the amber from the Magdalenian site of Aurensan (Beck *et al.*, 1987). Maria Rosa, a student directed by Curt Beck, carried out infrared spectrometry (Beck, 1997) and chromatography of seven samples from the Aurignacian at Isturitz (Rosa, 2007). Her results rule out a Baltic origin (Passemard, 1913; de Saint Périer, 1930). The spectrometric characteristics of the amber are consistent with a Saint-Lon-les-Mines origin (Rosa, 2007).

9. They had already found Magdalenian amber pieces at Isturitz, including a zoomorphologic sculpture (de Saint-Périer, 1930, 1935, 1936).
10. The early Aurignacian from Cueva Morín and El Pendo (Álvarez Fernández *et al.*, 2005a, 2005b), Gatzarria (Sáenz de Buruaga, 1991) and Labeko Koba (Arrizabalaga, 2000; Arrizabalaga *et al.*, 2003) also yielded pieces of amber, some of which were worked (see also Moncel *et al.*, 2012).

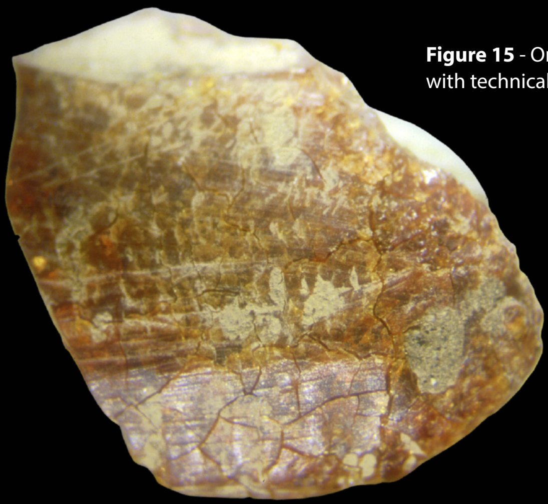


Figure 15 - One of the two (refitting) amber fragments with technical marks (l: approx. 3 mm)

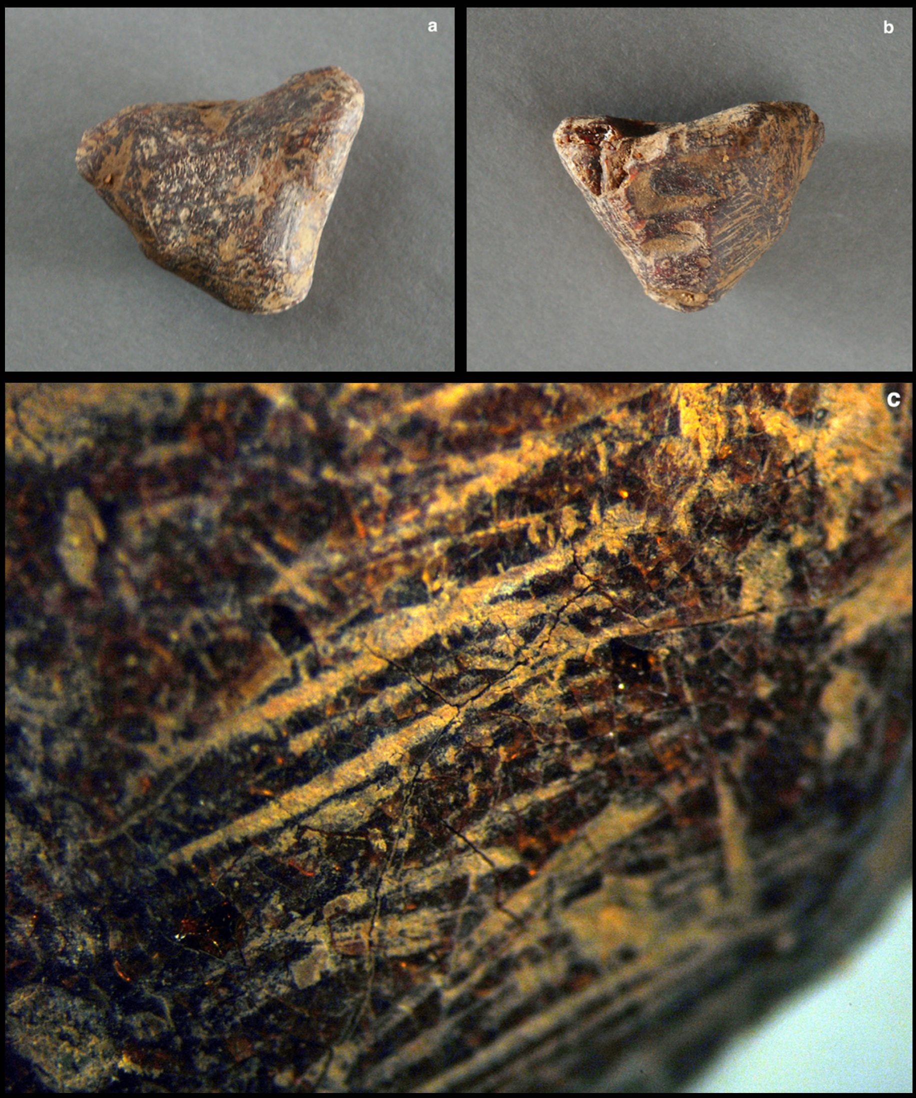


Figure 16 - Isturitz 2003, C 4c2. Large piece of amber (length = 2.9 cm) with (at the bottom at 18 ×) heavy scraping marks indicating probable on-site amber ornament fabrication.

Figure 17 - MAN 83894 884, amber pendant from layer SIII (Aurignacian), Saint-Périer excavations.

Figure 18 - Isturitz 2004, C 4c6. Amber pendant with technical marks.

G - Tubular beads

Lastly, it is important to underline the discovery in 2003 (probably in layer 4b) of a series of six beads (figure 19), made on small bird-bone tubes. These beads are about 5 mm long, with fine decoration, made by grooves running around the circumference of the tube. The ends of these beads are generally quite worn. Identical beads were found in the site of Cottés (Rigaud *et al.*, 2014), but were unfortunately discovered in the backdirt. There are also five decorated pieces and two without decorations in the early Aurignacian (layer Cbci-Cbf) of Gatzarria (Sáenz de Buruaga, 1991: 147 and 163).

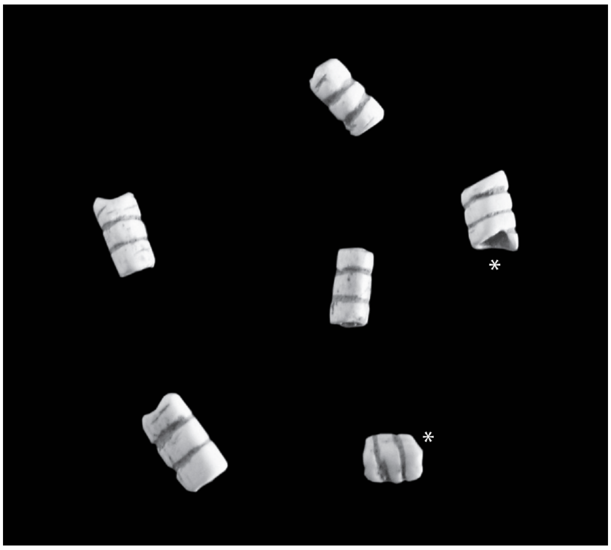


Figure 19 - Isturitz 2003, C 4b probable. Beads decorated by circum-incised grooving (average length 4 mm). The two beads marked by an asterisk refit.

H - A major discovery: personal ornaments from layer 4d (Archaic Aurignacian)

During the course of the 2004 and 2005 seasons, layer 4d (Archaic Aurignacian) yielded an important series of ornamental objects including fifteen perforated shells (*Littorina obtusata*) and a pendant in soft stone which can be interpreted as a zoomorphic or anthropomorphic figure (figures 20-22). This pendant is made by bifacial semi-rotation and is 5.25 cm long with many technical traces, mainly on sides I and IV (figure 21).

Although several interpretations are probable, we are struck by the potentially female characteristics of this ornament. In a Gravettian context, we would easily accept the interpretation of a feminine figure. Yet, this piece comes from a context attributed to the Archaic Aurignacian, and if we opt for this interpretation, it is one of the oldest anthropomorphic representations in the European Paleolithic.

Apart from the interest of these ornamental objects as artefacts, they also play an important role in the current debate on the nature of the Middle to Upper Paleolithic transition. Recently, certain authors (Zilhão and d'Errico, 1999, 2003) denied that art and ornaments were present from the beginning of the Aurignacian in Europe. According to these authors, the so-called absence of symbolic objects leaves the door open to the possibility of a separate invention of ornaments by Châtelperronians-Neanderthals and Aurignacians-modern humans. For these authors, this absence precludes the idea of a "symbolic revolution" at the beginning of the Aurignacian. For us, their position cannot be defended given the symbolic archaic Aurignacian objects in layer 4d, dated by ^{14}C well beyond 37 000 BP and thus among the oldest objects of this kind in Europe.

Figure 20 - Isturitz 2004, C 4d1. Four sides of the pendant in soft stone (talc or calcite) with an anthropomorphic or zoomorphic form from layer 4d1 (photo: R. White).

Figure 21 - Isturitz 2004, C 4d1. Pendant in calcite or talc. a: Technical marks on side IV; b: groove in the continuity of the perforation on side I; c and d: details of the perforation, sides I and III; e and f: black marks (dendrites?) on side I (photo: R. White).

Figure 22 - Isturitz 2004, C 4d1.
Pendant in calcite or talc *in situ* (photo: C. Normand).

Conclusion

Over the past few years, the origin of personal ornaments has been acknowledged as one of the fundamental events in the evolution of humanity. Due to the abundance, originality and reliable context of the Aurignacian personal ornaments from Isturitz, they play an important role in discussions on the origin of modern humans and the Middle to Upper Paleolithic transition (Hublin *et al.*, 2012; Peresani *et al.*, 2011, 2013).

On a more modest, but no less important scale, the personal ornaments from Isturitz are beginning to provide precious details concerning the chronological, geographic and even spatial variability within the Aquitaine Aurignacian. The stratigraphic sequence at Isturitz enables us to demonstrate the chronological evolution of personal ornaments during the course of the Aurignacian in Aquitaine, as well as its intra-regional variability. We emphasize that this chronological and intra-regional variability considerably complicates the hypothesis of regionalized personal ornaments, marking ethnic entities that last for more than 10 000 years.

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THE AURIGNACIAN IN SOUTHERN BURGUNDY

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THE AURIGNACIAN IN SOUTHERN BURGUNDY

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Abstract

Since the second half of the 19th century, Southern Burgundy has constituted one of the most important regions of Early Upper Paleolithic research in France, but with a remarkable discontinuity in research after the 1950s and considerable emphasis on the site of Solutré. Beginning in the middle of the 1990s, a research team from Tübingen University directed by H. Floss has been investigating this area, building on a tradition of research started by A. Arcelin and H. Breuil and carried on by J. Combier and H. Delporte. In spite of the long history of research in this region, it is clear that more detailed information in the form of absolute dates, chronostratigraphic studies, and technological reassessments of the Aurignacian industries is required. The Tübingen research team and researchers from several French institutions are filling gaps in current knowledge through ongoing excavation, survey, and collections analysis as part of a Projet Collectif de Recherche *on the Early Upper Paleolithic in the region. The present article summarizes the existing information available on the Early Aurignacian of Southern Burgundy as concretely as possible. Of particular significance are the sites of Solutré and Grotte de la Verpillière in Germolles. Some new open-air sites have also been recently discovered, e.g. at Germolles-en-Roche, Uchizy and Charnay-lès-Mâcon. This article provides an overview of our initial insights into the technological characteristics of the lithic and osseous industries.*

Keywords

Southern Burgundy, Grotte de la Verpillière, Aurignacian, lithic and osseous industry, ivory.

Introduction

While there are many Early Upper Paleolithic sites known in Central Eastern France, our knowledge of the emergence and character of the Aurignacian in the region remains incomplete. Southern Burgundy is situated between two regions (Dordogne and the Swabian Jura) known for assemblages that fit neatly into the classic "Early Aurignacian", or *Aurignacien ancien*, but the region has until recently suffered from a lack of high-resolution data. Protoaurignacian industries are increasingly being recognized in areas north of the Rhône valley, for example at the Grotte du Renne (Arcy-sur-Cure) and Trou de la Mère Clochette (Szmidt *et al.*, 2010), and some elements (e.g. bladelet cores) in the assemblages of our recent excavations have technological affinities with this phase of the Aurignacian. Regarding the osseous industry, the split-based points traditionally associated with the Early Aurignacian have also been recently associated with assemblages in which bladelet production sequences are more typical of the Protoaurignacian (Szmidt *et al.*, 2010).

Until recently, the only site yielding chrono-stratigraphical information about the Aurignacian in Southern Burgundy was Solutré. For several years, our investigations at Grotte de la Verpillière I near Chalon-sur-Saône have been yielding materials that enhance the database of the Aurignacian record in this region of France. In combination with newly-discovered open-air sites, this research provides techno-typological evidence that the Aurignacian occupation of Southern Burgundy was denser than has thus far been recognized (figure 1).

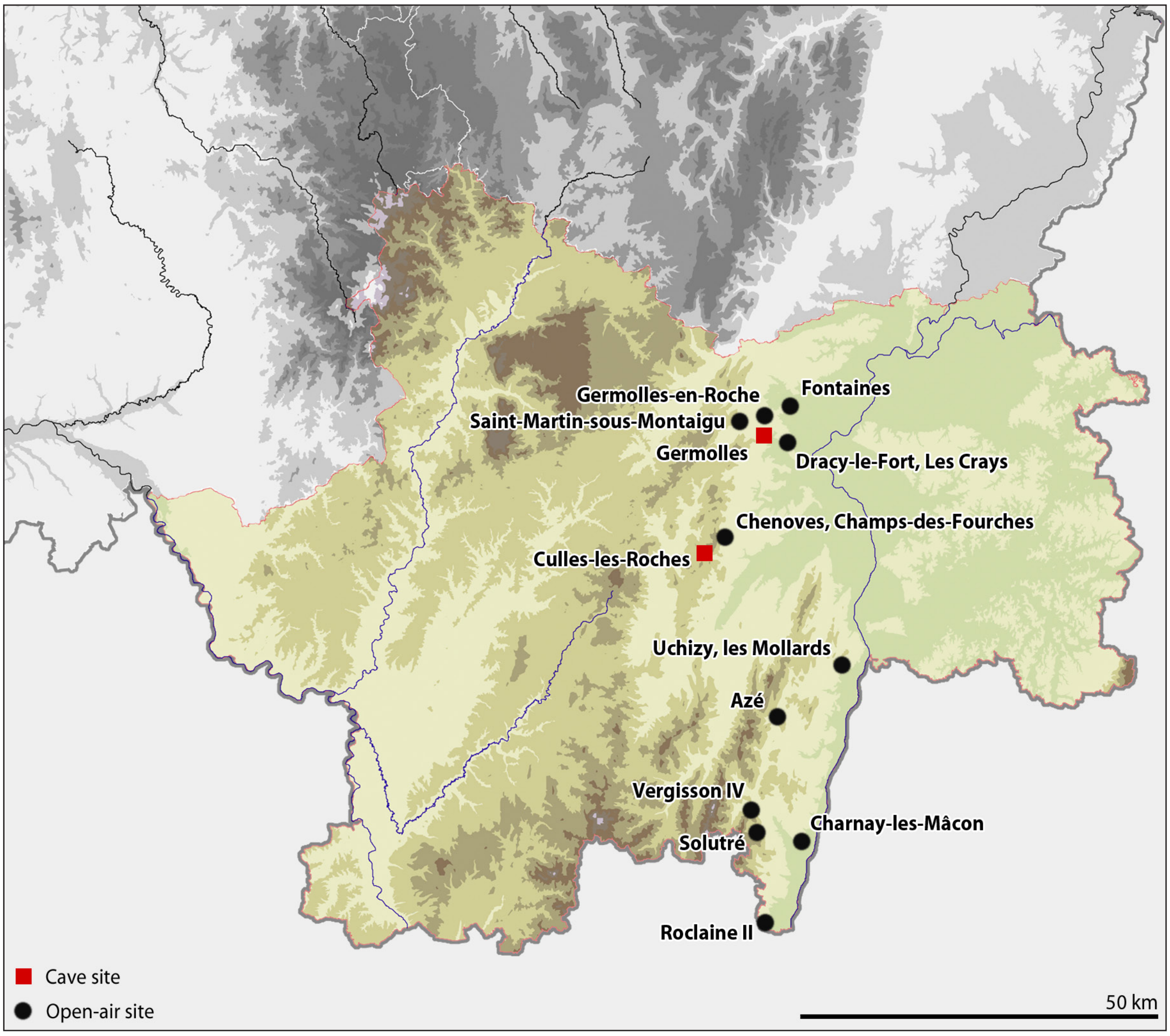

Figure 1 - Aurignacian sites in Southern Burgundy (Saône-et-Loire) (base map SRA Bourgogne and NASA).

1 - Solutré

At Solutré, the first excavators of the late 19th and early 20th centuries (eg. A. Arcelin and Abbé Ducrost) identified industries in the stratigraphic unit labeled "foyers de l'âge du cheval" that were later assigned to the Aurignacian (Combier, 1955). At the beginning of the 20th century, during the famous "*bataille Aurignacienne*", Solutré held a key role in solidifying the chronological position of the Aurignacian between the Mousterian and the Solutrean (Breuil, 1907). Later (in 1923), the Aurignacian was also discovered in trench G of the site, stratigraphically inferior to the "*magma de cheval*". Following J. Combier (Combier, 1955; Combier, Montet-White, 2002) the Aurignacian of Solutré is a classical Early Aurignacian with carinated pieces and split-based points. More recently, the Aurignacian was observed in the "*cailloutis rouge de base*" in sectors L13 and M12 of the site (Combier, Montet-White, 2002). Layer 6 of this complex was dated to 34 010 ± 610 (Ly-9245) and 33 970 ± 360 BP (SRLA-058). Layer 3, identified as Recent or Evolved Aurignacian (*Aurignacien recent*), was dated to 29 020 ± 170 BP (table 1). Recent excavations by N. Connet in the nearby sectors N11/12 yielded Aurignacian deposits with ornaments, rich bone and lithic industries, and dense faunal remains (figure 2; Connet *et al.*, 2005).

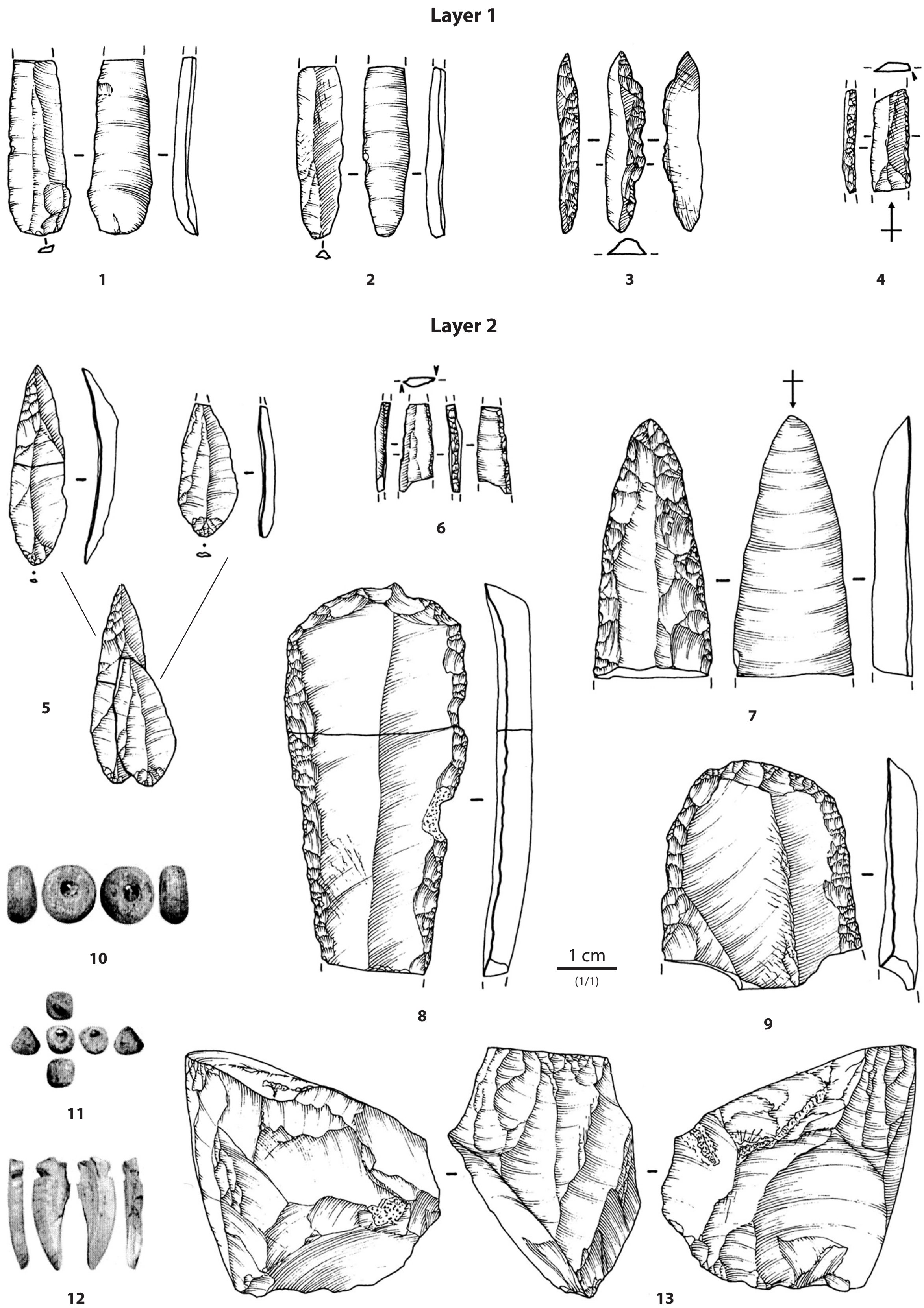

Figure 2 - The Aurignacian of Solutré: examples of the lithic industry and elements of personal decoration from layers 1 and 2 (from Connet *et al.*, 2005), 1-4: bladelets, partially retouched from layer 1; 5: two refit bladelets produced on carinated pieces; 6: Dufour bladelet; 7: Aurignacian blade; 8-9: end-scrapers; 10: disc-shaped bead made of ivory; 11: basket-shaped bead made of ivory; 12: notched marmot incisor; 13: bladelet core (Floss *et al.*, 2013: figure 5, edited).

2 - Germolles, Grotte de La Verpillière I

The second significant Aurignacian assemblage in Southern Burgundy is Grotte de la Verpillière I at Germolles (Côte chalonnaise; figure 1). This former rockshelter (figure 3), which appears as a cave today due to a massive late-glacial or postglacial roof-collapse, is situated on the banks of the Orbize river (a small tributary of the Saône) and was discovered in the 1860s. The history of research at the site is extensive and complicated (Dutkiewicz, 2011; Floss *et al.*, 2013). In concert with the new excavations, a review of records and assemblages from the old excavations in the late 19th century up to the sondages by J. Combier in the 1950s is ongoing. The Grotte de la Verpillière I at Germolles was first published by C. Méray in 1868 (Méray, 1869). In 1911, H. Breuil analyzed the artifacts from the site, drawing in part on the Aurignacian of the Grotte de Verpillière I in his definition of the Aurignacian (Breuil, 1911). Among the objects from the site that Breuil identified as typical of the Aurignacian are: "*une lame appointée massive à profonde coche bien retouchée au milieu du tranchant droit*", "*une lame large, terminée par un fort museau en ogive, très bien retouchée*", "*des grattoirs carénés typiques les uns trapus et courts, les autres s'allongeant en forme de bec*", and "*des grattoirs sur lames ordinairement fortes, très retouchés, parfois sur lames plus légères, parfois doubles*". Breuil also describes a plentiful bone industry, including *lissoirs*, incised rib fragments, pierced bovid teeth, numerous *poinçons* fashioned on flakes of bone, and what he identifies as "*une veritable pointe d'Aurignac aplatie*" (Breuil, 1911).

In the lithic industries from these old excavations we observe the presence of numerous text-book examples of carinated pieces with a high domed front (figure 4[1-6]). Unfortunately, no further information about the stratigraphic context of these finds is given. New excavations have confirmed the presence of such artifacts, and water-screening of the sediments has added a new class of artifact to the collections: bladelets of various type (figure 4[10-17]), including *lamelles torses*. A pyramidal bladelet core (figure 4[9]) with crossed negatives on the reduction face from the recent excavations, as well as numerous others from the old excavations (figure 5), might indicate the presence of "Protoaurignacoid" elements – though such interpretations must proceed with caution pending additional evidence and stratigraphic clarification.

Even if such finds from the recent excavations derive from unstratified or reworked sediments, which filled most of the primary chamber at Verpillière I's cave and have been removed in order to expose areas with preserved, unexcavated sediments, their close spatial arrangement may suggest formerly substantial sedimentary and archeological deposits from the Aurignacian. Some Gravettian artifacts are known from the recent excavations, they derive from small deposits inside and in front of the cave. No such deposits are indicated in the records from earlier excavations.

We also present here a series of radiocarbon dates made on elements typical of the Aurignacian bone industry of the area and on worked bones. These materials derive from the old excavations and from unstratified material from Grotte de la Verpillière I. These dates (table 1), range between around 32 000 and 30 000 BP (uncal.) and appear rather young in the light of the typical Early Aurignacian lithic and osseous industry, though J. Combier (1955) placed the Germolles Aurignacian typologically in a more recent context than that of Solutré. The dates presented here were established in the last years, and we look forward to adding absolute dates from several of the recently-discovered intact units very soon. A dating program that includes ^{14}C and ESR methods is under way and will deliver results soon after the 2014 field campaign.

J. Combier undertook a sondage in the southern part of Verpillière I in 1959 (figure 3), during which he documented a stratigraphic sequence containing Mousterian, Chatelperronian and Aurignacian levels partly separated by sterile deposits (figure 6). Comparable stratigraphic sequences have been observed during the recent excavations (figure 7), although the geological conditions vary slightly between different zones of the cave.

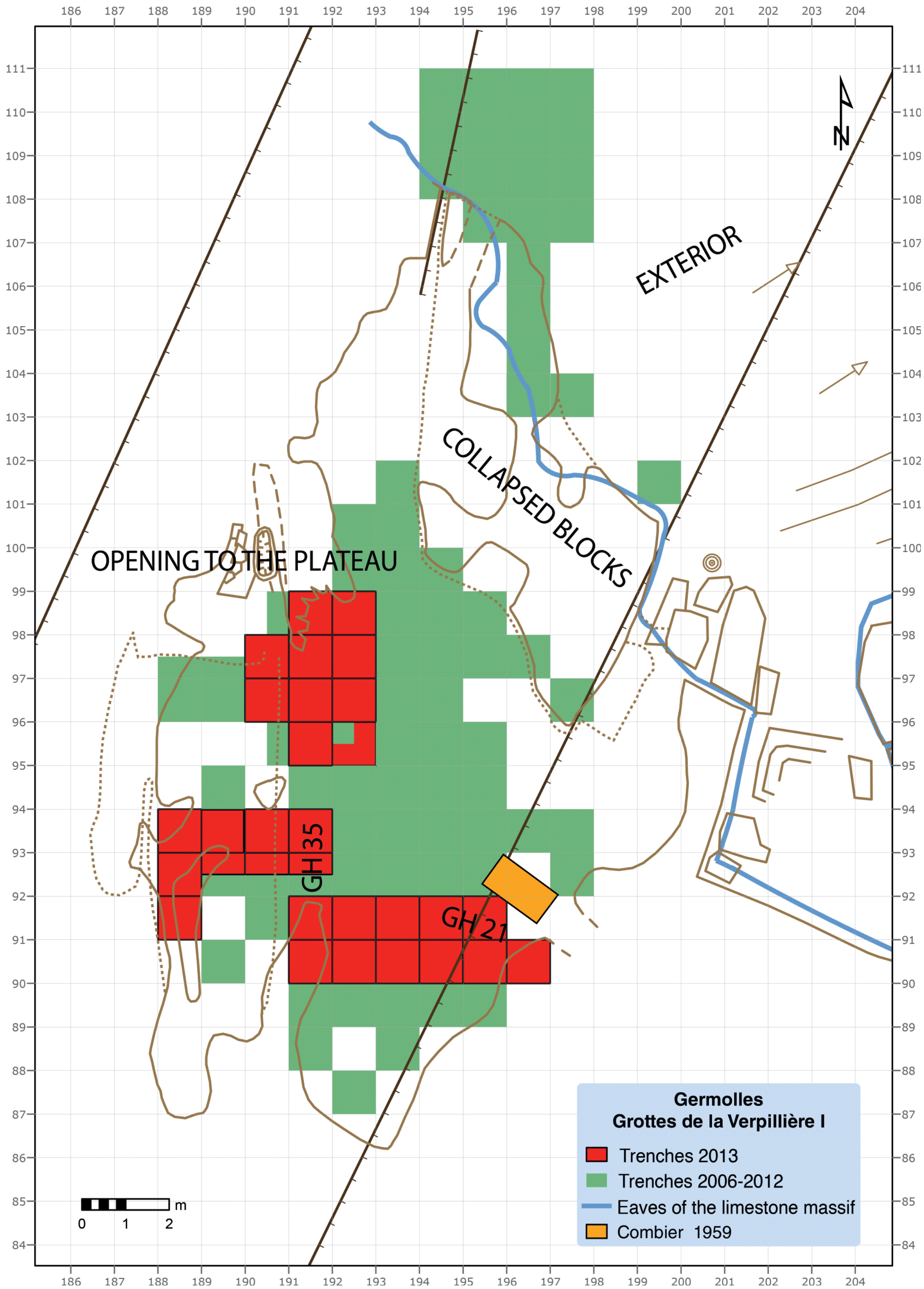

Figure 3 - Germolles, Grotte de la Verpillière I: excavation plan showing the zones excavated by the Tübingen University team since 2006 and by Jean Combier in 1959.

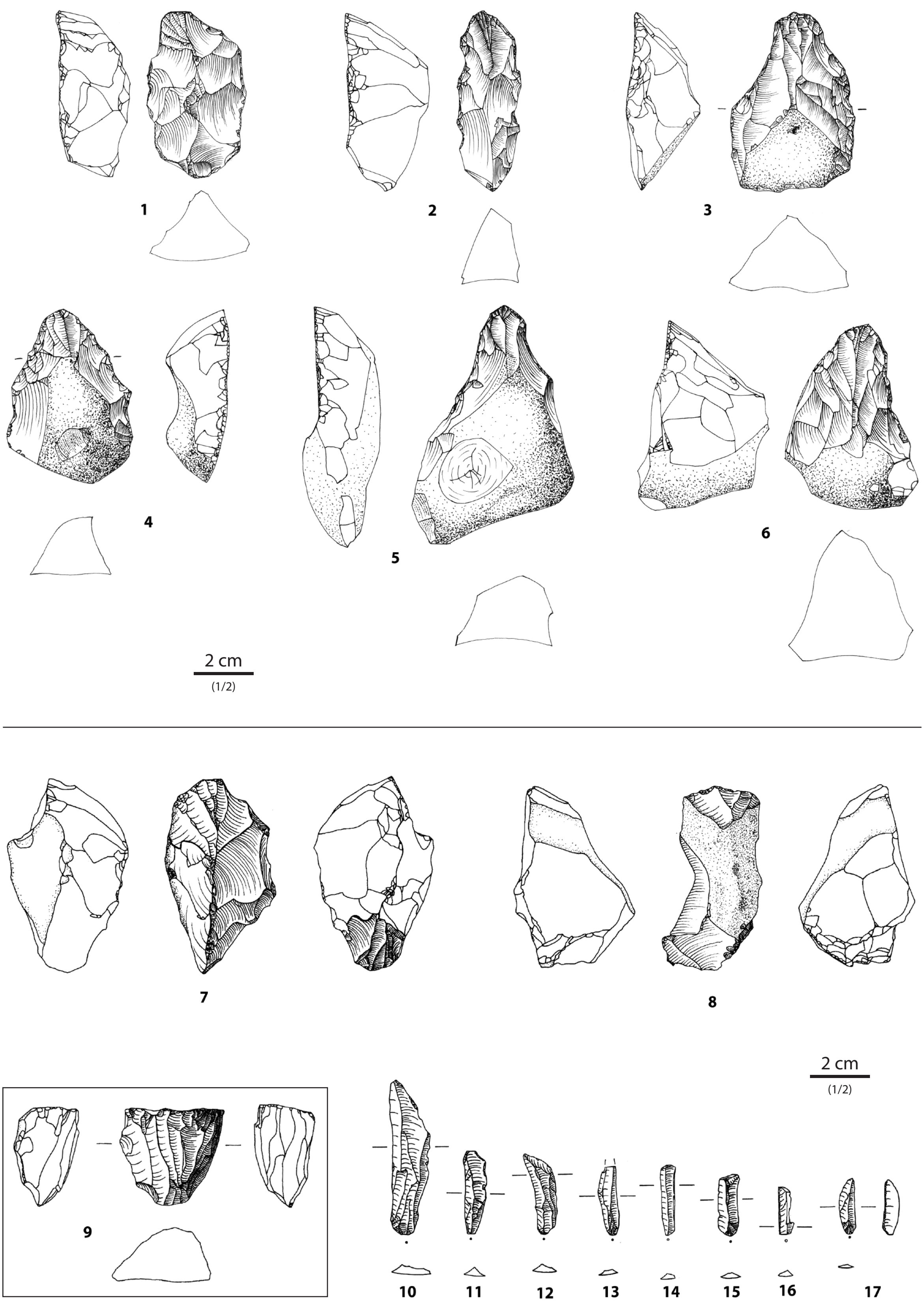

Figure 4 - Germolles Aurignacian lithic industry from Verpillière I cave. Above, old excavations, 1-6: carinated pieces. Below, recent excavations (Tübingen University), 7: double carinated piece; 8: carinated piece; 10-17: diverse bladelets, partially retouched. In frame (9), Protoaurigacian (?) bladelet core (Floss *et al.*, 2013: figure 6).

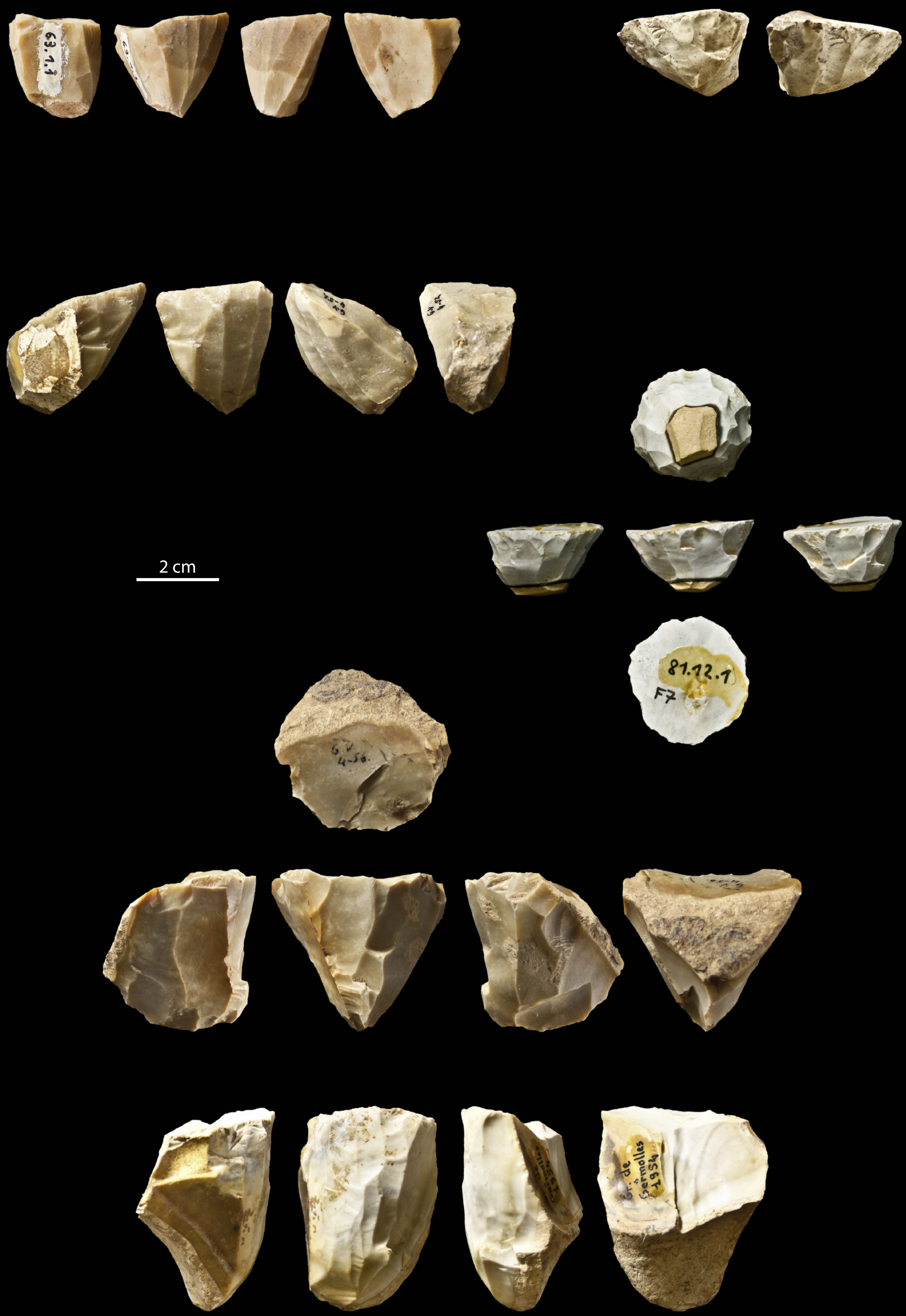

Figure 5a - Germolles, Grotte de la Verpillière I. Pyramidal cores from the early excavations with probable affiliations to the Protoaurignacian. Stratigraphic attribution is unknown (photos: E. Dutkiewicz, editing: K. Herkert).

Figure 5b - Germolles, Grotte de la Verpillière I. Pyramidal cores from the early excavations with probable affiliations to the Protoaurignacian. Stratigraphic attribution is unknown (photos: E. Dutkiewicz, editing: K. Herkert).

Site name	Lab No.	Datation (non cal.)
Germolles, Grotte de la Verpillière I	GrA-49115	30 090 + 190/-180 BP
Germolles, Grotte de la Verpillière I	GrA-49120	30 290 + 190/-170 BP
Germolles, Grotte de la Verpillière I	GrA-49127	30 660 + 200 (-180 BP)
Germolles, Grotte de la Verpillière I	GrA-49121	31 490 + 200/-190 BP
Germolles, Grotte de la Verpillière I	GrA-49122	31 660 + 120/-190 BP
Germolles, Grotte de la Verpillière I	GrA-49118	32 130 + 210/-200 BP
Solutré	CAMS-36628	29 020 ± 170 BP
Solutré	SRLA-058(CAMS)	33 970 ± 360 BP
Solutré	Ly-9245	34 010 ± 610 BP

Table 1 - Non-calibrated ^{14}C – datings from Germolles, Grotte de la Verpillière I and Solutré.

Despite the highly complex stratigraphy produced by geological processes – like standing water in the southern part of the cave and solifluction in the western-central part due to an influx of sediments and water through a large opening in the roof (figure 3) – and a complex excavation history, excavations over the last seven years have exposed several zones of intact deposits (figure 8) typologically attributed to the late Middle to the early Upper Paleolithic. These zones are considered representative of the original stratigraphic conditions in the various areas of the cave, as they were before the early excavations. Through ongoing excavations, solid correlations between different parts of the cave bearing intact sediments are being made and will soon be improved by final excavation work and accompanying analyses (figure 7). Regular micromorphological sampling and analysis have been used to distinguish remaining intact deposits from disturbed deposits and will also be finalized after the 2014 field campaign. Very promising intact deposits related typologically to Aurignacian occupation are GH (geological horizon) 21 (in the south-eastern zone of the cave) and 35 (in the western zone). GH 21, discovered in 2012, contains a small lithic assemblage with a typical Aurignacian retouched blade (figure 9[20]) and several bladelets. This sedimentary unit totaled a quarter of a cubic-meter and was delimited by the activities of J. Combier to the east and an erosional channel to the northwest. The total number of artifacts from GH 21 is 14, among them 5 lithic artifacts; the remaining faunal elements have provided little information of consequence.

GH 35 is exposed over just one and a half square meters with a total volume of almost one cubic meter. Preliminary results of micromorphological analysis strongly suggest that this unit remains intact. Slight influences of bio- and cryoturbation are not excluded, and a weak effect of floating water may not be excluded, but should not have led to critical turbation of the unit. GH 35 contains 204 single finds, including several pieces of charcoal and burnt bones as well as 72 lithic artifacts in a variable spectrum of raw materials. Beyond the local Cretaceous flint, there is a clearly non-local light-colored flint, tertiary chert, and quartzite. Several pieces bear traces of heating. The assemblage (figure 9) is characterized by a strong presence of blades and bladelets. Debitage took place on-site, and the blades are regular in shape. One of the bladelets originates from a carinated core. There are ten retouched pieces; among these are four laterally retouched blades and an atypical endscraper (figure 9[19]). This piece bears black residue that could indicate evidence of hafting. In the inventory, we also note the presence of burin spalls and wastes from splintered pieces.

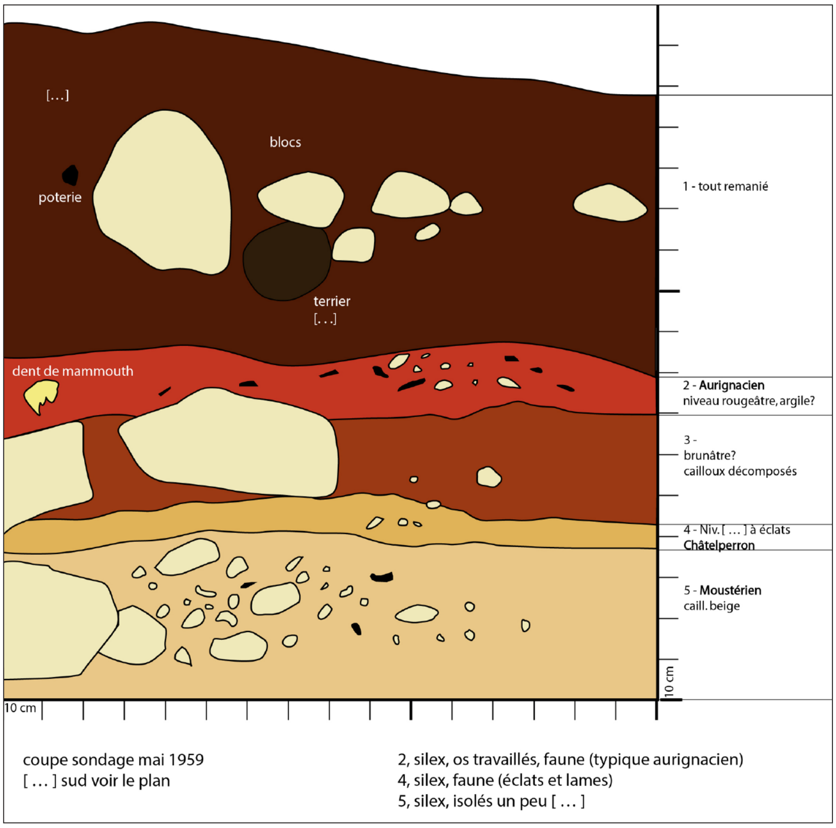

Figure 6 - Profile from Combier's 1959 sondages in the Grotte de la Verpillière I. Through archival and field research, the layers depicted were located in 2009 and appear to continue intact (drawing: Dutkiewicz 2011, after J. Combier).

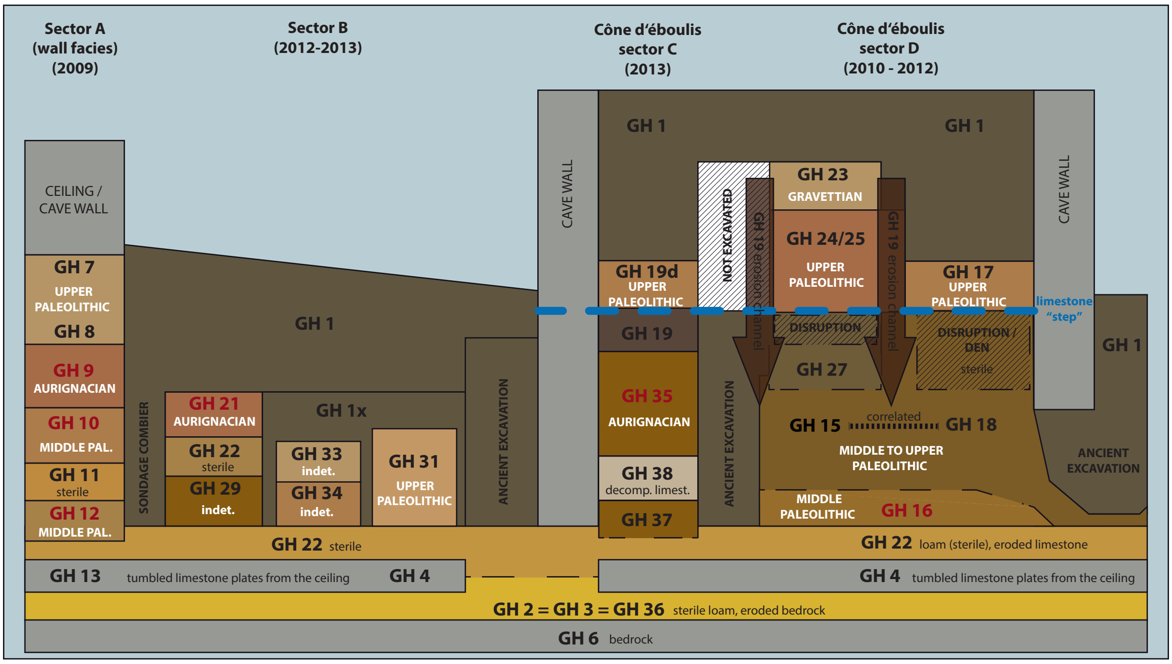

Figure 7 - Diagrammatic stratigraphy from the Verpillière I at Germolles in sectors A-D. Units with chronostratigraphically significant industries are noted in red. Further consolidation and correlation of intact layers is in progress through ongoing excavation.

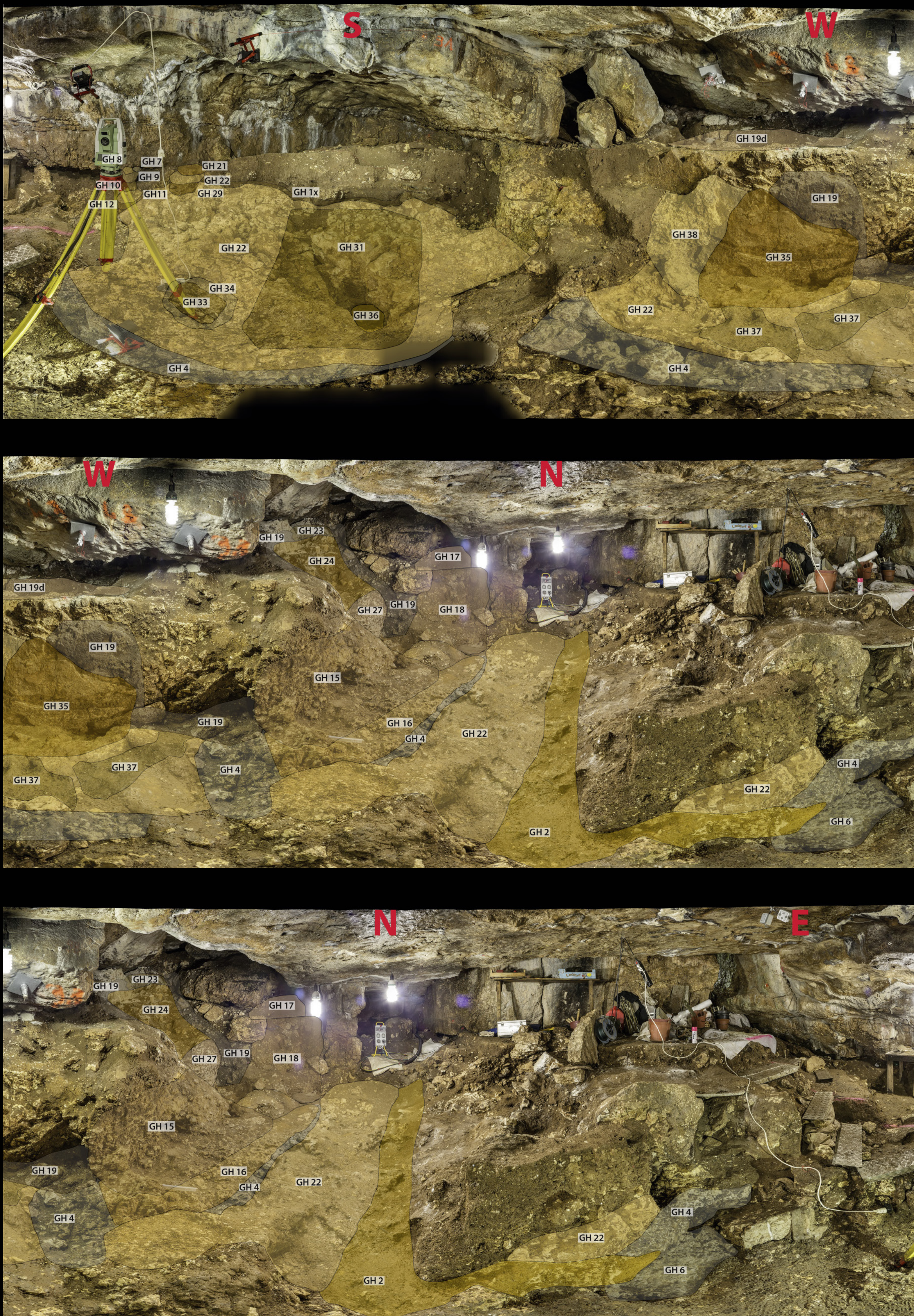

Figure 8 - 360° panorama of the interior of the Grotte de Verpillière I, Germolles (2014). The positions of the different sedimentary units discovered during the Tübingen excavations are indicated in various colors. Numerous ancient excavations since the 1860s have complicated the stratigraphic situation dramatically.

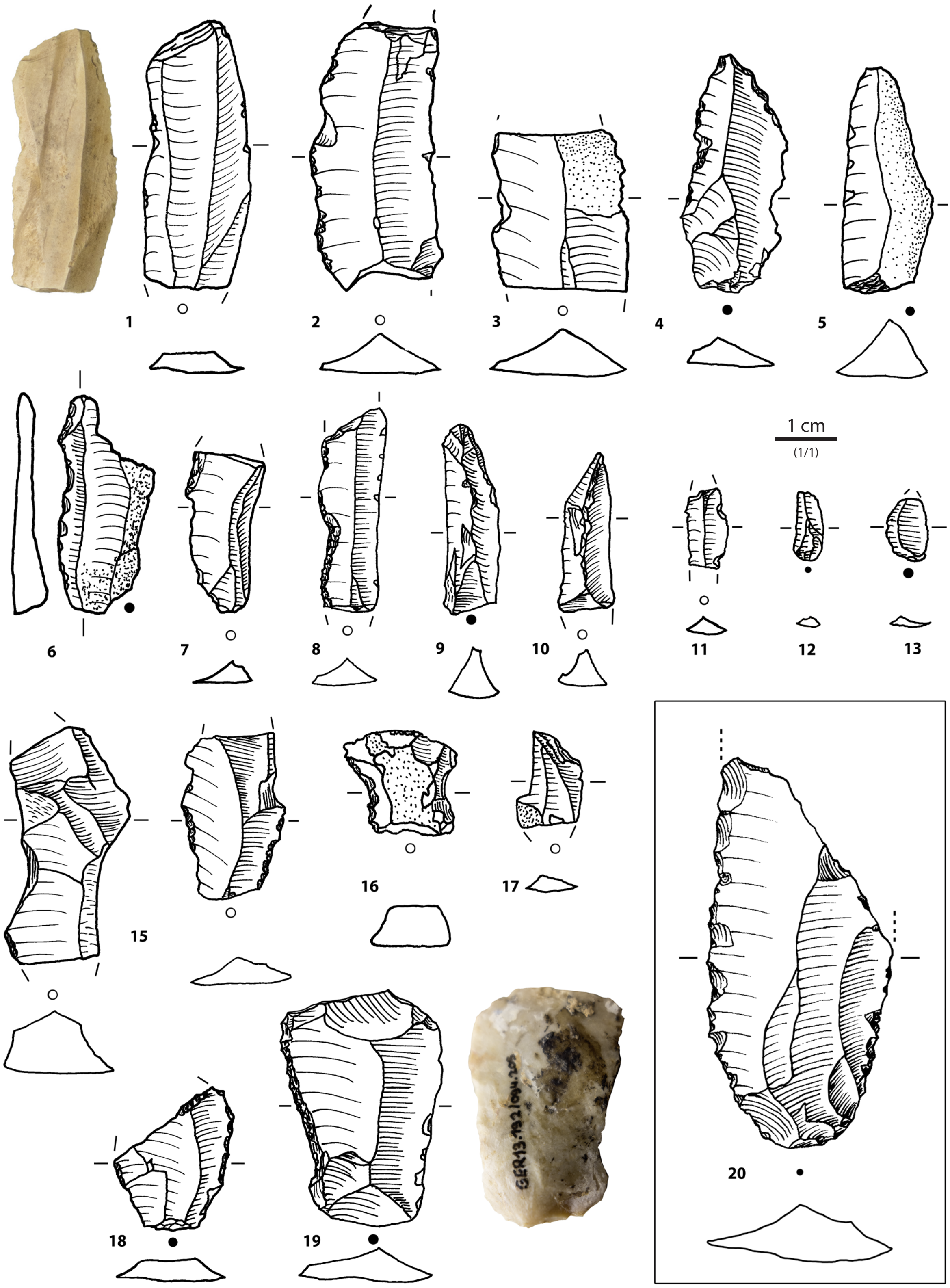

Figure 9 - Lithic industry from GH 35 (1-19) and GH 21 (20, in frame): 1: blade made from lacustrine tertiary silex. 2, 7, 8: retouched blades. 3-5, 14-15, 17-18: blades. 6: retouched flake. 8, 16: laterally retouched blades. 9-10: Chutes de burin. 11-13: bladelets, 11: twisted bladelet, probably from carinated piece.19: atypical endscraper, the ventral face showing black residues possible related to hafting (photo). In frame, 20: Aurignacian blade from GH21.

Osseous Industry and Ornaments in Southern Burgundy

The Grotte de la Verpillière I has yielded a rich assemblage of osseous tools (figure 10) and ornaments (figure 11). Table 2 provides a typological overview of the 79 osseous artifacts currently available for study. This assemblage includes artifacts from the recent excavations (since 2006) and some pieces from earlier excavations in the collections of the Musée Denon in Chalon-sur-Saône. Future analyses will incorporate additional material from the Denon collection and any new relevant finds from ongoing excavation at the site. The stratigraphic provenience of these pieces is uncertain, as they derive from disturbed deposits during the new excavation or from previous excavations with poor documentation of provenience.

The assemblage of artifacts in reindeer antler is composed of projectile-point fragments, an intermediate tool "*sur baguette*", a cylindrical center-perforated bead, and diverse byproducts of antler tool manufacture, including a blank and rough-out for point production, a tongued piece (*pièce à languette*), and ten antler bases (both shed and unshed) bearing signs of debitage. The bone artifacts fall into the following categories: lissoirs (smoothing tools), awls, chisels, and retouchers. Ivory exploitation is evidenced by a point fragment, a lissoir, a fragment of a probable incised ring, three flakes diagnostic of debitage by percussion and four fragments bearing undiagnostic tool traces. Eight perforated animal teeth have been recovered during the recent excavations (six fox canines, one vestigial canine of red deer, and one bovid incisor).

Many features of the osseous industry have a strong affinity with known techniques and artifacts from the Aurignacian. The antler waste products and byproducts demonstrate evidence of the splitting-and wedging reduction procedure (Liolios, 1999, 2003; Tejero *et al.*, 2012). This approach to antler is extremely common in the Aurignacian, and largely (but not completely) replaced in the Gravettian by the groove-and-splinter method of reduction (Goutas, 2009). Similarly, the presence of ivory flakes produced by knapping provides evidence of an approach to ivory reduction that is also characteristic of Aurignacian (Heckel, Wolf, 2014). Unfortunately,

	Antler	Bone	Ivory	Teeth
Finished objects				
Points	8		1	
Wedges	1	3		
Lissoirs		13	1	
Awls		6		
Retouchers		10		
Rectangular bead	1			
Pierced fox canine				6
Pierced red deer canine				1
Pierced bovid incisor				1
Ring			1	
Other ind. objects		4		
Waste products				
Point rough-out	1			
Raw blanks (*baguettes*)	3			
Tongued piece	1			
Shed and unshed antler bases with signs of working	10			
Flakes or fragments with signs of working			7	
TOTAL	**25**	**36**	**10**	**8**

Table 2 - Inventory of osseous industry and ornaments studied from Verpillière I.

Figure 10 - Selected elements of the osseous industry at Verpillière I: a broken antler point (1), a fragment of a lissoir (2), and antler production blank (3), an antler tongued piece (4), an ivory lissoir (5), and an awl made on a long bone diaphysis (6).

none of the points have retained their bases, and cannot be conclusively assigned to a specific type. However, the overall morphometric characteristics of these points are highly similar to those known for split-based points. Incidentally, the collection includes a tongued piece (figure 6[4]), an artifact type that has been conclusively demonstrated to be the byproduct of the manufacture of split-based points typical of the Early Aurignacian phases (Tartar, White, 2013).

Two ornamental artifacts are more ambiguous. One is a highly polished, regularly incised ivory ring fragment (figure 10[5]). Were this part of a circular ring, the complete object would have been approximately 10 cm in diameter. It has few equivalent in the French Aurignacian. It should be noted, however, that a fragment of an ivory ring polished on all sides but not incised was recovered from the Protoaurignacian layers at Isturitz (Soulier *et al.*, 2014; Heckel, personal observation). Decorative osseous artifacts with regular, parallel incisions along the sides are also not inconsistent with known Aurignacian artifacts (Laplace *et al.*, 2006; Tartar, 2009). Much more elaborately shaped and incised pieces are known in the Aurignacian of the Swabian Jura (cf. Floss, this volume). The other ornamental artifact from the site is a cylindrical bead made of antler, perforated in the center (figure 10[4]). Ivory beads similar in form have been recovered at Hohle Fels Cave in the Swabian Jura. It can also be noted, though, that this piece has formal correlates in the French Gravettian assemblages of Abri Pataud, le Blot, and les Peyrugues (Allard *et al.*, 1997; Bricker, 1995; Chauvière, Fontana, 2005). A chronological attribution of this artifact based on typology remains uncertain at this point.

The rest of the osseous artifacts are entirely compatible with known Aurignacian osseous assemblages. Even so, they do not present techno-typological features specific enough to permit exclusive assignment to this technocomplex. Aside from the bone retouchers, which are known as early as the Lower Paleolithic, the artifacts can be attributed to the Upper Paleolithic in general (*e.g.* awls, perforated teeth, figure 11[1-3], etc.).

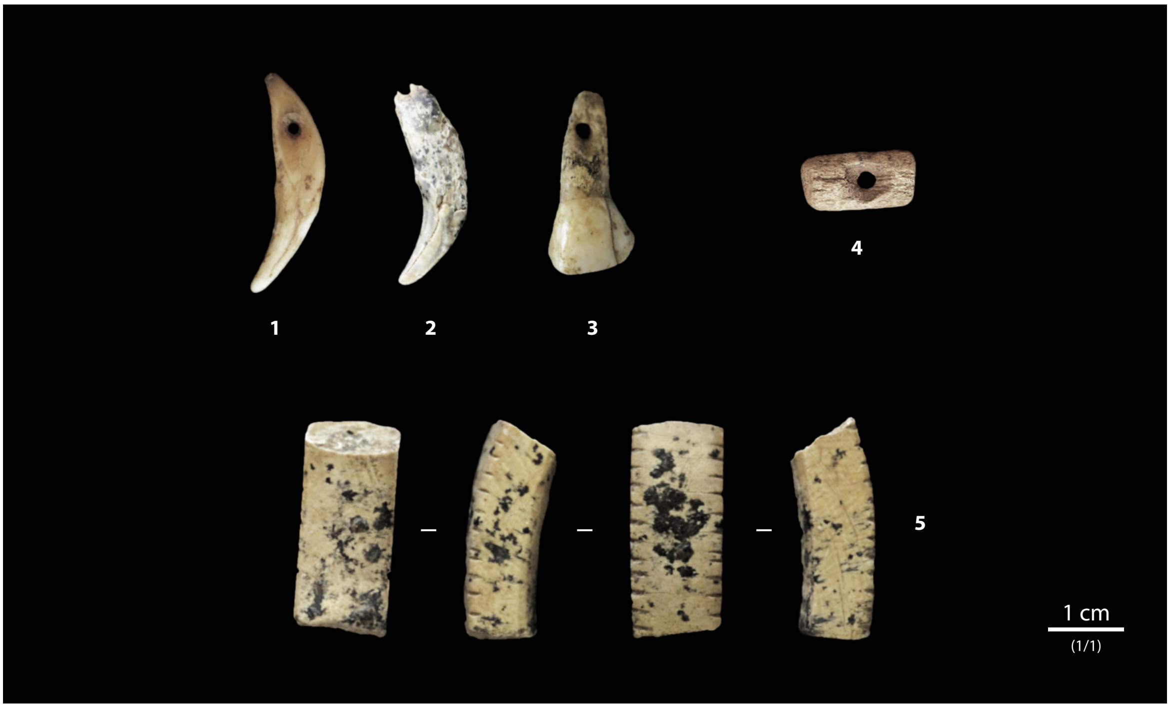

Figure 11 - Selected ornaments from Grotte de la Verpillière I: Two perforated fox canines (1-2), a perforated bovid incisor (3), the antler bead (4), and the ivory ring-fragment (5).

None of the pieces are typologically suggestive of the Gravettian, and technological traces attributable to the Gravettian (such as groove-and-splinter debitage) are also absent. Based on this evidence and the relative scarcity of Gravettian elements in the lithic assemblage, we consider it highly likely that most if not all of the osseous artifacts (wedges, lissoirs, awls, and perforated teeth) are of Aurignacian origin. As noted above, diagnostically Gravettian artifacts are limited almost exclusively to a limited zone in front of the cave, while all artifacts discussed here derive from the interior.

Given the numerous excavations conducted at the site, the known osseous industry presented here is almost certainly only a very small fraction of an originally large and varied osseous industry from Verpillière I.

Ongoing excavations still hold the potential to uncover stratified Aurignacian deposits such as those documented by J. Combier (Combier, 1959). While we are confident of a general Aurignacian attribution for most of the osseous industry, we remain much less certain regarding the phases of the Aurignacian that these artifacts represent. The technological and chronological sequence of the Protoaurignacian, Early Aurignacian, and Evolved Aurignacian remains very poorly defined in the region, and clarifying this sequence is one of the primary goals of current research in the area.

For example, the traditional role of split-based points as *fossiles directeurs* of the Early Aurignacian has been challenged by the association of such points with Protoaurignacian lithic assemblages at several sites, including l'Arbreda (Ortega Cobos *et al.*, 2005; Wood *et al.*, 2014), Fumane (Broglio *et al.*, 1996), and, notably for the region of Eastern France, at Trou de la Mère Clochette (Szmidt *et al.*, 2010). In a very general sense, antler was used in the Early Aurignacian for the production of projectile points, and ivory was primarily used for the production of portable art and ornaments (Liolios 1999; Tartar *et al.*, 2006). Exploitation of these materials in the Protoaurignacian are much less clearly structured, and assemblages from this period frequently contain points, tools, and sometimes ornaments made of ivory (cf. Tartar, this volume). Interestingly, the lithic assemblages from the Aurignacian of Trou de la Mère Clochette and Arcy-sur-Cure have been attributed to the Protoaurignacian (Bon, Bodu, 2002; Szmidt *et al.*, 2010). Some elements of the lithic assemblage at Verpillière I could support Protoaurignacian occupation of the site, but this potential remains to be confirmed by further analysis. If this proves true, the idiosyncrasies of the osseous industry could reflect occupation of the region during a particular phase of the Aurignacian. Some commonalities can be observed between the ivory industries at Verpillière I and Trou de la Mère Clochette, but these two sites do not permit regional-scale generalizations about ivory exploitation to be made. A beveled ivory piece, ivory points, and other utilitarian artifacts are known from the Aurignacian at Trou de la Mère Clochette. (Brou *et al.*, 2012). As at Verpillière I, there is little evidence of ivory bead manufacture at the site. At Arcy-sur-Cure, on the other hand, ivory beads and rings were discovered, along with round ivory rods whose purpose remains ambiguous (Julien *et al.*, 2002; White, 2002). Interestingly, two ivory beads were recovered at Solutré, typical of the Early Aurignacian of southwestern France, though one reflects morphologies also known in Swabian Jura (Connet *et al.*, 2012). It should be noted that the use of ivory for purposes other than ornament production is known in the Protoaurignacian of Western Europe, and also in the Early Aurignacian of the Swabian Jura. The latter is a context in which ivory is used on all aspects of Aurignacian material culture: portable art, musical instruments, ornaments, tools, and projectile points (Conard, Bolus, 2006; Hahn, 1972; Hahn, 1986; Wolf, 2013).

Continued fieldwork, dating of osseous materials, and ongoing analysis of the lithic assemblage are necessary to refine this preliminary understanding of patterns of osseous material use in the Aurignacian of northeastern France. But whether the patterns of osseous material use in northeastern France, and particularly the idiosyncratic use of ivory, are due to regional cultural variation or to chronological shifts in osseous industries within the Aurignacian, it is clear that the Aurignacian osseous technologies of the region present a rich area for further archeological study. Specifically, these assemblages hold the potential to improve our understanding of geographical and chronological variation in expressions of "Aurignacian Genius".

3 - Open air sites with Aurignacian affinities

Surface-finds collected by amateur archeologists have identified promising areas for additional open-air sites and cave sites, some of which will be systematically surveyed in the years to come. These include Germolles-en-Roche, Saint-Martin-sous-Montaigu, Fontaines, Culles-lès-Roches and a potential site in the village of Dracy-le-Fort. Further south, there are the sites of Chenoves/ Le Champ des Fourches and Uchizy les Molards (figure 1).

Probably the largest of these open-air sites is Germolles-en-Roche, situated at about 1.2 km east of Grotte de la Verpillière I. This site has yielded a rich laminar industry with large, thick blades (Gros, Gros, 2005), various types of burins and scrapers, among them nosed and carinated pieces. While the whole site, bearing finds from the Middle Paleolithic up to the Gallo-Roman era, measures about ten hectares, the zone bearing the early Upper Paleolithic assemblages is limited to approximately 0.6 ha. For the moment, about 100 of the 540 known pieces from this area have been analyzed by the Tübingen team thus far. Through continued survey and excavation, the assemblage is expected to grow significantly in the years to come.

About three kilometers southwest of Germolles is the vast open-air site of Saint-Martin-sous-Montaigu (more than 20 ha in total), a site whose particular geomorphological situation recalls that of Solutré. In 2009, the Tübingen University team carried out a test excavation (Floss, 2010). This expansive site complex contains several occupation areas dating from the Mousterian to the Gravettian period. At a particular spot called "Vignes de la Roche, secteur II", an area with a size of about 1 ha, lithic artifacts with Aurignacian affinities, again with nosed and carinated cores, have been discovered (Gros, Gros, 2005). These observations are further supported by some dozens of pieces from recent surveys conducted under the direction of our team, and further analysis of these materials is in progress.

Dracy-le-Fort, les Crays, also provides a small Aurignacian lithic industry, recognized on the basis of thick retouched blades (Gros, Gros, 2005).

Chenoves, Champ-des-Fourches is another open-air site, situated 16 km south of Germolles and surveyed by J.-N. Blanchot. This locality in particular has yielded thick and transversal burins, which could indicate the presence of an Evolved Aurignacian. It seems that there are several denser concentrations of Aurignacian material in this site, which covers several hectares.

Uchizy, les Molards is one of the rare Paleolithic open-air sites in the so-called Tournugeois, halfway between Mâcon and Chalon-sur-Saône. This site (0.5 ha large) has been surveyed by J. Duriaud, and the lithic industry (figure 12) is characterized by large, thick blades. Among the approximately 1000 lithics known, more than 100 retouched pieces could be identified. The presence of both carinated pieces and bladelets indicates the onsite production of bladelets. The tool assemblage is dominated by numerous endscrapers, burins, and retouched blades (Floss *et al.*, 2013).

In the extreme south of our survey area, Solutré has long stood alone as a prominent Aurignacian site. Aside from the evidence there, only some isolated finds with Aurignacian affinities were known from Azé (Floss, 2000), Vergisson IV and Roclaine II.

A new open-air site, excavated by INRAP and probably belonging to the Aurignacian is Charnay-les-Mâcon, ZAC Europarc Sud (Lecornué, 2012). In addition to the lithic industry, the conservation of an occupation surface is notable. The lithic assemblage contains large, thick

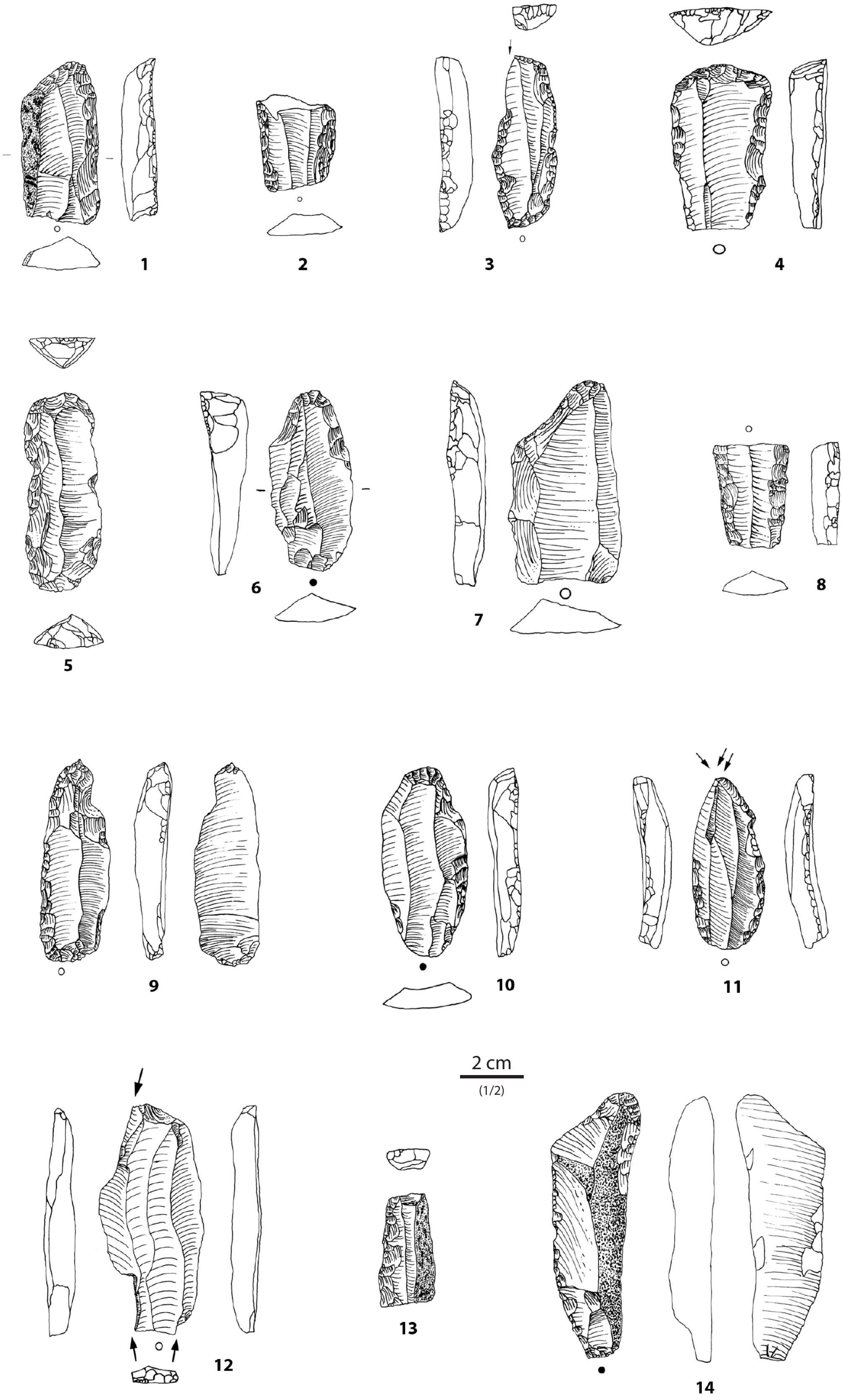

Figure 12 - Uchizy, Les Molards, lithic industry. 1: end-scraper; 2: retouched blade; 3: burin on truncation; 4-7: end-scrapers; 8: retouched blade; 9: pointed blade, laterally retouched; 10: end-scraper; 11: dihedral burin; 12: double burin; 13: retouched blade; 14: end-scraper (Floss *et al.*, 2013: figure 7).

blades, carinated bladelet cores, Aurignacian blades, and particularly elongated straight bladelets with ventral retouch. The latter reminds us of the Protoaurignacian, though such a categorization of the Charnay pieces is currently investigated by E. Cormarèche and under discussion with F. Le Brun-Ricalens.

The technological and typological affinities of all of these assemblages support the hypothesis of an Aurignacian assignment. Nevertheless, we must be cautious, as we could be dealing with assemblages dating up to the last glacial maximum.

Ongoing detailed technological analyses aim to answer the many remaining questions about the Aurignacian occupation of Southern Burgundy. Particular focus is being placed on refining a model of the internal variation presented by different phases of the Aurignacian and on the dating and absolute chronology of the arrival and dispersal of early populations of Anatomically Modern Humans in the area.

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MARINE RESOURCE EXPLOITATION DURING THE MIDDLE AND EARLY UPPER PALEOLITHIC IN EUROPE:

Overview of the Available Evidence

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MARINE RESOURCE EXPLOITATION DURING THE MIDDLE AND EARLY UPPER PALEOLITHIC IN EUROPE:

Overview of the Available Evidence

Esteban ÁLVAREZ-FERNÁNDEZ

Abstract

In this article, we propose a critical analysis of the available information relating to the first evidence of marine resource consumption in European Pleistocene sites, with particular focus on the existing data for the Mousterian and the Aurignacian. This review concentrates on different aspects, such as the identification and quantification of remains, as well as taphonomic characteristics. In spite of the rarity of the available remains, we consider that mollusks, mammals, crustaceans, echinoderms, fish and birds play a secondary role in the diet of both Neanderthals and anatomically modern humans.

Keywords

Marine archeofauna, food, taphonomy, Middle and early Upper Paleolithic, Europe.

Introduction

Coastal regions provide plentiful biomass and offer abundant and easily accessible food resources. For this reason, they were already attractive zones for the first hominins in different parts of the world (Davies, 2011; Marean, 2011; Steele, Álvarez-Fernández, 2011; Szabo, Amesbury, 2011).

Until recently, the role played by these types of resources in Europe was underestimated (Álvarez-Fernández, 2010, 2011; Colonese *et al.*, 2011). Different researchers indicated that coastal regions only began to be attractive at the end of the Upper Paleolithic, when anatomically modern human's diet was more diversified (Straus, 1992; Mussi, 2001; González, González, 2007). However, research conducted over the past decades shows that these types of resources was already consumed in different southern European regions before the beginning of the Upper Paleolithic.

In this article, we will critically review the available information concerning the earliest direct and indirect archeological evidence of the use of marine resources by hunter-gatherer groups on the European continent during the Middle Pleistocene and at the beginning of the Upper Pleistocene (figure 1). We will evaluate the contribution of vertebrates and invertebrates to the diet of Hominins, including anatomically modern humans. In addition, we will discuss other types of information, such as signs of coastal zone exploitation, quantification of the evidence, taphonomic aspects as well as the distribution of the remains in different stratigraphies.

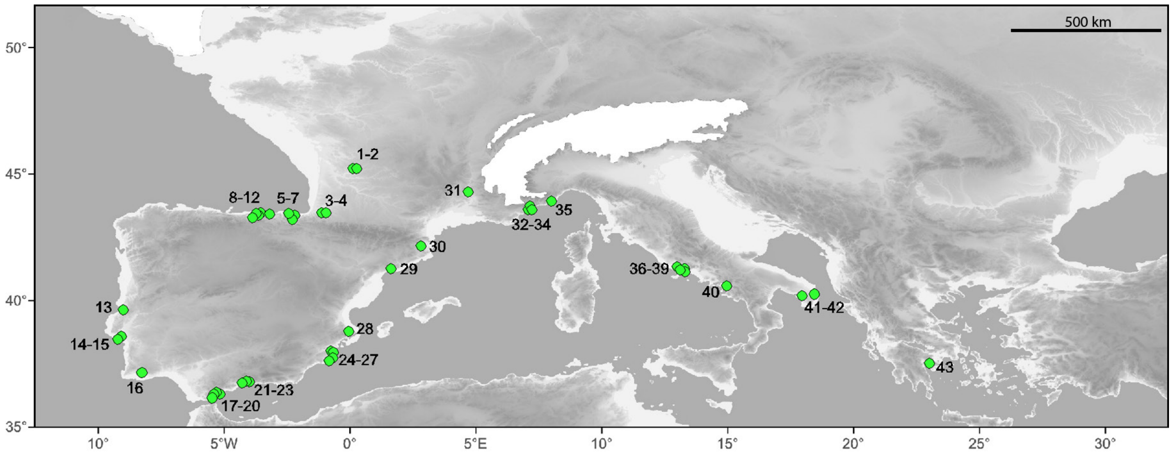

Figure 1 - Sites mentioned in the text.

1. Castanet
2. La Ferrassie
3. Olha
4. Isturitz
5. Lezetxiki
6. Ekain
7. Amalda
8. Cuco
9. Pendo
10. Morín
11. Ruso I
12. Castillo
13. Mira Nascente
14. Sta. Margarida
15. Figueira Brava
16. Ibn Amar
17. Vanguard Cave
18. Ibex Cave
19. Devil's Tower
20. Gorham´s Cave
21. Bajondillo
22. Humo 3
23. Humo 4
24. Las Palomas de Cabezo Gordo
25. Las Perneras
26. Los Aviones
27. Monte Miral
28. Foradada
29. Gegant
30. L'Arbreda
31. La Salpétrière
32. Vallonnet
33. Lazaret
34. Terra Amata
35. Riparo Mochi
36. Fosselone
37. Sant'Agostino
38. Breuil
39. Moscerini
40. Castelcivita
41. Cavallo
42. Romanelli
43. Klissoura 1.

1 - First evidence before the Mousterian

The sites with the earliest remains of marine organisms are located on the French Côte-d'Azur and date from the early Paleolithic (Vallonnet) and the Acheulean (Terra Amata and Lazaret).

Level 2 of the Vallonnet site contains abundant mollusk and fish remains, as well as other marine organisms resulting from a marine transgression that immersed the cave over a million years ago (Granier, 1988). The same explanation is valid for the mollusk, echinoderm, crustacean, fish and seabird remains from complex C1a of Terra Amata (*ca.* 400 000 BP), as they appear to be very fragmented and bear surface marks of marine erosion. In this site, above C1a, lies the complex C1b, dated to 380 000 BP. It is a coastal dune level (D) with very fragmented wind-transported remains of mollusks and marine fish. The famous Acheulean levels are above the dune, made up of short, seasonal-type human occupations. They contain numerous marine remains (the majority are mollusks), some of which are charred. However, hominins did not consume these animals. They brought them back to the site accidentally while transporting marine algae from the coast. The latter were probably destined to be used as bedding or as fuel for fires (Lumley *et al.*, 2011; *cf*. Villa, 1983). This same explanation is advanced to interpret the abundant small mollusk remains with no nutritional value (*Bittium reticulatum*, etc.) and the rare sea urchin remains in the Acheulean occupation level in Lazaret Cave (UA25, upper part of level CII), dated between 170 000 and 150 000 BP. The rare marine fish bone remains in UA25 were probably brought there by birds of prey, as were the bird remains in the upper level (CIII), dated between 150 000 and 130 000 BP (Lumley *et al.*, 2004; Vilette, 1993). The other marine organisms from levels CII and CIII are still being studied (Desse, Desse-Berset, 2002; Lumley *et al.*, 2004).

2 - Mousterian

The sites presenting the most evidence of marine exploitation are Moscerini, Los Aviones and Figueira Brava.

One of the most important Mediterranean sites where mollusks were caught for food is Moscerini (Stiner, 1993, 1994), which contains abundant remains (NRDt: 2900). The shells come from levels inside and outside the cavity, dated between 115 000 and 65 000 BP. On the basis of the published data, we estimate the MNI < 300. The mussel *Mytilus edulis* is the most abundant species (342 hinged shells) representing *ca*. 50% of NRDt, followed by the smooth clam *Callista chione* (180 hinged shells) and *Glycymeris* sp. (85 hinged shells). The latter two species represent *ca*. 40% of the NRDt. Mussels and smooth clams alternate throughout the sequence, which is several meters thick. The remaining 10% is made up of different species of gastropods (e.g., *Patella caerulea*, *Patella ferruginea* and *Phorcus turbinatus*) and bivalves (e.g., Cardiidae and *Pecten jacobaeus*). Shells (34%) appear to be affected by fire. Isotopic analyses (^{18}O) on *Glycymeris* sp. and *C. chione* shells suggest that the mollusks were gathered at the end of the spring. Breuil Cave is very near Moscerini and contains very rare limpet and smooth clam remains (Stiner, 1994).

At the site of Los Aviones (levels I to V), almost 800 mollusk shells have been recorded (level I: 58; level II: 86; level III: 361; level IV: 250; level V: 16) (Zilhão *et al*., 2010; *cf*. Montes, 1988, 1993). We estimate the MNI to be ≥ 367. *Phorcus turbinatus* (44% of the MNI) is predominant, followed by different species of limpets (*P. ferruginea*, *P. ulyssiponensis* and *P. rustica*) (38%), mussels and clams. Other mollusk remains complete the assemblage, such as *Charonia lampas*, *Glycimeris* sp and *Acanthocardia* sp. Apart from several shells with perforations on the umbos, belonging to the two latter species (interpreted as ornamental objects), almost the whole complex is considered to be made up of malacological remains of animals caught for food purposes, including the species *Cerastoderma edule* (NR from the sequence: 14). At Cueva Perneras (levels VI to IX), about thirty remains caught for food are mentioned (*P. turbinatus*, *P. feruginea* and *Mytilus* sp.), without counting the rare remains from other species (e.g., *Pecten jacobaeus* and *Acanthocardia echinata;* Montes, 1988; 1993). The presence of several marine shells is cited at Sima de las Palomas del Cabezo Gordo, including *Pecten maximus* and *C. edule* (Walker *et al*., 2004).

Cueva de Bajondillo contains mollusk remains in level 19, dated to *ca.* 150 000 BP. *Mytilus galloprovincialis* represents > 99% of the recovered species (NR: 1 305 remains, NRDt: 29). It is also the most abundant species in the upper levels (with percentages < 99%), dated between 60-70 000 BP (level 18: NR: 496; NRDt: 10; level 17: NR: 94; NRDt 3). In addition, rare remains from other species are mentioned, for example in level 19 (*Stramonita haemastoma* and *Glycymeris* sp.) and level 17 (*Acanthocardia tuberculata* and *C. chione*) (Cortés-Sánchez *et al*., 2011; figure 2). The presence of marine mollusks (mussels and limpets) is also mentioned in rock shelters 3 and 4 from Complejo del Humo (Vera *et al*., 2004).

The data from Garrod's excavations (1925-1926) at Devil's Tower indicate an indeterminate number of remains; in particular of mussels and limpets (Garrod *et al*., 1928). During the excavations at Vanguard between 1995 and 1997, the most abundant species were *Mytilus* sp. (MNI: 50) and *Patella vulgata* (MNI: 11). Large specimens were recovered at this site and some of the remains are altered by fire (Fernández-Jalvo, Andrews, 2000). In Waechter's excavations at Gorham (1951-1954; levels R to G), limpets and mussels are also noted (Baden-Powell, 1964); and during the 1998 excavation at the back of the cave, limpets were predominant (*P. intermedia*, *P. ferruginea*, *P. ulyssiponensis* and *P. vulgata*; 56%), followed by mussels (15%), and snails from the Trochidae family (*P. turbinatus* and *Gibbula* sp.; 6%; Brown *et al*., 2011). We note the presence of species living in subtidal and circalittoral zones in these caves, (e.g., *C. chione*, *P. maximus*, *Spondylus gaderopus* and *A. tuberculata*).

Figure 2 - Bajondillo (Málaga, Spain). Level 19. Mousterian. Mussel valve fragments (after Cortes Sánchez *et al.*, 2011).

In Ibn Amar Cave, mollusk remains appear to be associated with Mousterian industries. M. Stiner recorded limpet, mussel, clam and smooth clam remains (Bicho, 2004).

At the site of Figueira Brava, about thirty taxa, associated with Mousterian industries, were analyzed (Antunes, 1990-1991, 2000a; Callapez, 2001). Almost 800 shells are recorded, mainly from level 2, dated to *ca.* 30 000 BP; figure 3). Limpets are predominant (especially *P. vulgata*, but also *P. intermedia*, *P. ulyssiponensis* and *P. rustica*), accounting for more than 400 remains. There appears to be a clear preference for large specimens (with a maximum diameter of 57 mm). They are followed by *M. galloprovincialis*, with a little more than 200 remains. *Phorcus lineatus*, *Ostrea edulis* and *Ruditapes decussatus* are also cited. The remains of species from the subtidal zone are also present (*P. maximus*, *C. chione*, *Acanthocardia aculeata*, etc.).

Near Figueira Brava, different localities with beach levels and marine shells associated with Mousterian industries are attributed to MIS 3 (Haws *et al.*, 2011). In this way, the Santa Margardia terraces, for example, include a level with mollusk remains made up of both gastropods (different limpet species) and bivalves (*M. galloprovincialis*, *Glycymeris* sp., *Cerastoderma* sp., *P. maximus*, etc. (Zbyszewski, Teixeira, 1949; Pais, Legoinha, 2000).

In level 16 of Cueva Morín, an *O. edulis* valve, a *P. intermedia* specimen, and a *P. vulgata*, were identified. In levels XI, XII and XIII of El Pendo, limpet shells were documented (Madariaga, 1971, 1980). In level VII of Amalda, a limpet, several *Littorina littorea* and two fragments of *Mytilus* sp. were recorded (Borja, 1990).

As well as mollusks, other evidence of marine environment exploitation has been recorded in Mousterian sites.

With regards to the remains of marine mammals in the Mediterranean zone, a monk seal *Monachus monachus* bone fragment (level A2) and premolar (Level Ax) were found in the Grotta di Saint Agostino (Tozzi, 1970). In Gorham's Cave, a Phocidae remain was recorded (Stringer *et al.*, 2008). Vanguard Cave yielded four monk seal remains: an adult phalanx, as well as a hemi-mandible,

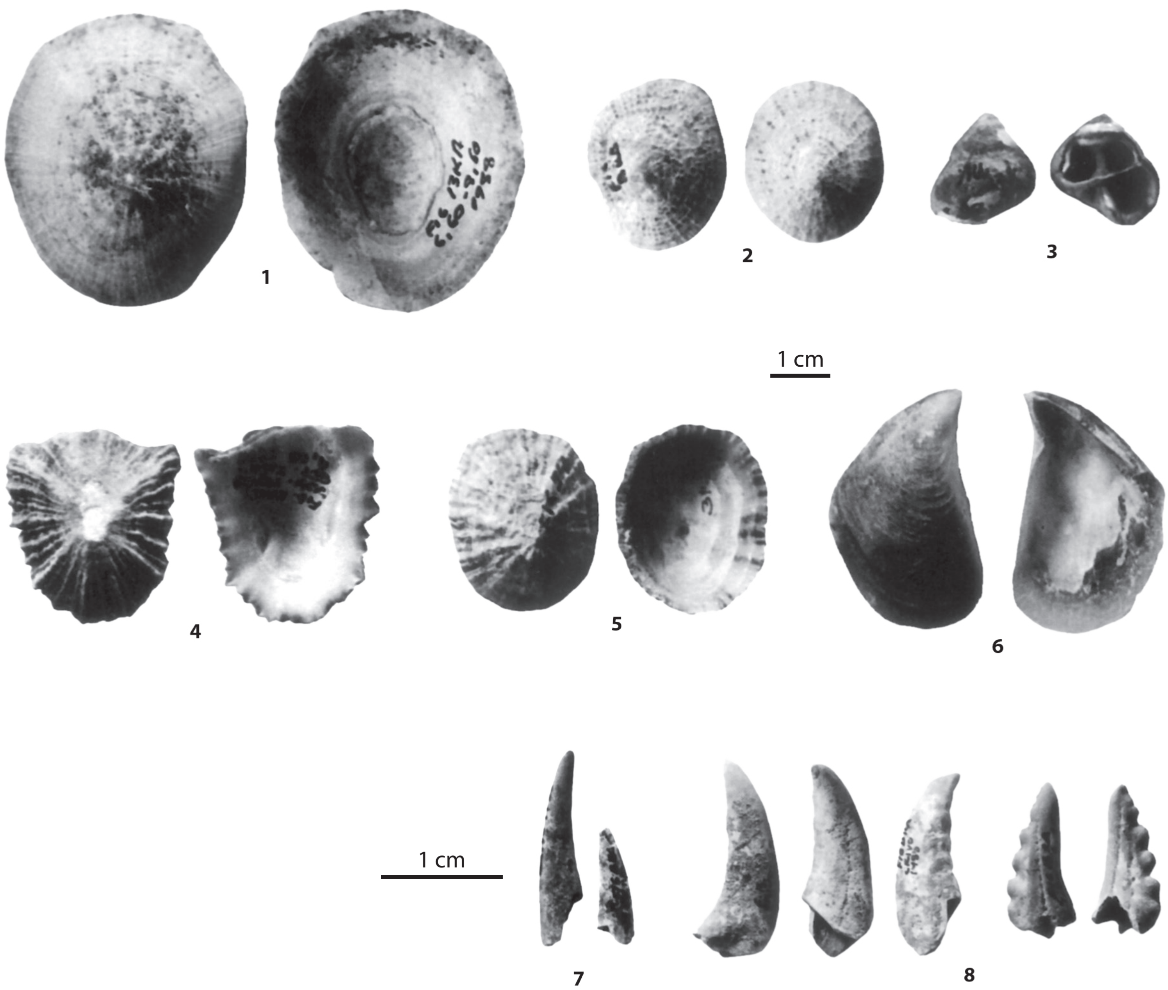

Figure 3 - Figueira Brava (Arrabida, Portugal). Mousterian. Mollusks – 1: *Patella vulgata*; 2: *Patella rustica*; 3: *Phorcus lineatus*; 4: *Patella ulyssiponensis*; 5: *Patella intermedia*; 6: *Mytilus galloprovincialis*; Crab claws – 7: *Maja squinado*; 8: *Cancer pagurus* (after Callapez 2000).

a premolar and a whole scapula from an immature specimen. The phalanx and the scapula bear butchery marks (figure 4). Two common dolphin bones *Delphinus delphis* (a metacarpal from an adult and a vertebra from an immature specimen), a vertebra from an adult common bottlenose dolphin *Tursiops truncatus* and a delphinid ulna have also been identified. Finally, at Figueira Brava, there is mention of an ulna from an immature ringed seal *Pusa hispida*, as well as six vertebrae belonging to an immature common dolphin, three of which bear anthropogenic cut marks (Antunes, 2000b) (figure 5).

In the Mousterian levels at Gorham, Devil's Tower, Ibex and Vanguard, a large quantity of strict seabirds (some of which are now extinct) were recorded, including the Great Auk *Pinguinus impennis*, the Razorbill *Alca torda* and the Atlantic Puffin *Fratercula arctica* (Brown *et al*., 2011; Cooper, 2000, 2005; Eastham, 1968). Birds were also documented in other Atlantic sites, such as Figueira Brava (Antunes, 1990-1991, 2000a; Mourer-Chauviré, Antunes, 2000) and Abri Olha (Passemard, 1924), and Mediterranean sites, like Gegant (Sánchez-Marco, 2004), Castelcivita, Romanelli (Cassoli, Tagliacozzo, 1997) and Kalamakia (Darlas, 2007).

Figure 4 - Vanguard Cave (Gibraltar). Mousterian.
Monk seal phalanx with cut marks (Stringer *et al.,* 2008).

Figure 5 - Right: Figueira Brava (Portugal). Mousterian. Dorsal (left) and caudal vertebrae of a young common dolphin; the latter two present possible anthropogenic marks (Antunes, 2000b).

As regards echinoderms and crustaceans, abundant purple sea urchin *Paracentrotus lividus* remains are cited in Vanguard Cave (Brown *et al.*, 2011). At Figueira Brava, crab claws *Cancer pagurus* (approximately 70 remains) are recorded, as well as spider crabs *Maja squinado* and *Portunidae*, with anthropogenic fracture marks for extracting flesh. There is also reference to *P. lividus* remains (Callapez, 2001; figure 3). On the Santa Margarida terraces, the goose barnacle crustacean *Pollicipes pollicipes* is mentioned, as well as the sea urchins *Psammechinus miliaris* and *P. lividus* (Zbyszewski, Teixeira, 1949).

The only cases of fish remains in Mousterian sites are from Vanguard Cave, where a sargo, *Diplodus* Spp. (Stringer *et al.*, 2008) and tuna, *Thunnus thynnus* (Brown *et al.*, 2011), were recorded.

3 - Transition industries

The only transitional industry complexes with evidence of marine exploitation are related to the Uluzzian and Chatelperronian.

In level D (evolved Uluzzian) of la Grotta del Cavallo, rare large-sized *Mytilus edulis* remains are mentioned, with *Patella caerulea*, and *Chlamys* sp., *Venus sp.*, *Cerastoderma sp.* and *Pecten* sp. valves (Palma di Cesnola, 1966). P. Gioia (1990) conducted the study of the lithic industry from the Uluzzian levels and recorded the presence of carinated and nosed end scrapers, as well as blades with Aurignacian retouch and backed bladelets in levels DII and DIb. The author concludes that the cave contains an Aurignacian level that was not identified during excavations. Moreover, these levels are disturbed by bioturbation (burrows) and pits or more recent habitat structures. The recent dating of three scaphopod shells from levels DII and DIb indicates a chronology of 37 000/35 500 BP (Benazzi *et al.*, 2011).

The only remains listed in Chatelperronian contexts are two monodonta (*Genus Trochidae*) shells from Ekain (level X) (Leoz, Labadia, 1984).

4 - Industries from the beginning of the Upper Paleolithic

Data relating to the exploitation of marine animals are even rarer in Aurignacian levels than in Mousterian levels. The most detailed information is from Riparo Mochi and El Cuco.

With regards to the mollusks, the Aurignacian (level G) from Riparo Mochi contains around 500 remains, mainly made up of bivalves (principally *M. edulis*), as well as *P. turbinatus* and different species of limpets (*P. caerulea*, *P. ferruginea* and *P. rustica*) (Stiner, 1998; 1999). More than 200 shells of *Gibbula* sp. and *Phorcus* sp. are mentioned in level IV from Klissoura I (Stiner, 2010). In Gorham's Cave (level III), the presence of limpets and mussels associated with Trochidae family specimens was documented, with similar percentages to those noted in the Mousterian level (level IV; Fa, 2008). At Cova Foradada, mussels and limpets (*P. rustica* y and *P. caerulea*) and, to a lesser extent, *P. turbinatus*, were recorded (Casabó, 1997, 2001). At Las Perneras (level V), nine specimens of the latter species were identified (Montes, 1993) and at Monte Miral, several *P. jacobaeus*, *Cerastoderma glaucum* and *Chlamys* sp. were mentioned (Martínez, 1993).

In the Atlantic region, the data only come from sites in Cantabria. In levels XIII and VIII of the El Cuco rock shelter, a total of 2 037 marine mollusks were identified, corresponding to 860 individuals, most of which are from *Patella vulgata* (Álvarez-Fernández, 2010). The majority of these are concentrated in level X (*ca.* 82% of NR and *ca.* 85% of the MNI; figure 6). Other Cantabrian sites bear the shells of species probably caught for food. Four remains of *P. vulgata* come from

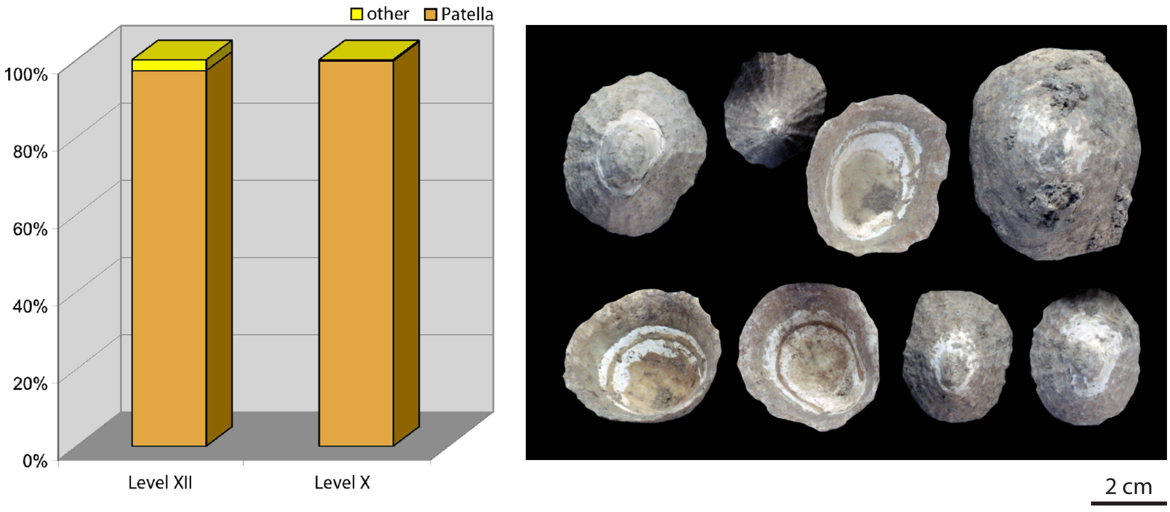

Figure 6 - El Cuco (Cantabria, Spain), Aurignacian. Right: Percentages of mollusks collected in two Aurignacian levels from El Cuco, according to the MNI: Level X (n=734) et Level XII (n=96). Left: *Patella vulgata* shell from level X.

El Ruso I (levels Vc and IVb). Level III from Lezetxiki yielded a fragment of *Ostrea* sp. (Álvarez-Fernández, 2010). In level 7 of El Pendo, two fragments of Mytilidae, 17 Ostreidae, 5 *L. littorea*, 9 *Patella* sp., one *P. intermedia* specimen and another *P. vulgata* were identified, as well as fragments of *R. decussatus*, *Scrobicularia plana* and *Solen* sp. In level 6, a mussel shell was found along with a Cardiidae or Pectinidae, and limpet fragments were unearthed in level 5b (Madariaga, 1971).

Other marine remains dating from the beginning of the Upper Paleolithic were also discovered. As far as mammals are concerned, a sperm whale tooth *Physeter macrocepalus* was found in level 18 of El Castillo (Cabrera, 1984). The tooth bears no traces of anthropogenic handling (figure 7). In level A of the Castanet rock shelter, two mandibles from the same specimen were identified, perhaps from a harp seal (Harlé, 1913).

Seabird remains were recorded in several Aurignacian sites along the Mediterranean coast, such as Castelcivita and Fosselone (Cassoli, Tagliacozzo, 1997), la Salpêtrière (Vilette, 1983) and Arbreda (García i Petit, 1995) and also along the Atlantic coast, such as El Castillo (Sánchez-Marco, 2007; 2014), Isturitz (Mourer-Chauviré, 1975; Bouchud, 1952a), Castanet (Bouchud, 1952b) and Ferrassie (Mourer-Chauviré, 1984).

Invertebrate remains, consisting of rare *Paracentrotus lividus* radioles, were identified in the Aurignacian levels of El Cuco (figure 8).

5 - Discussion

During the course of the past decades, the discovery of new sites with marine archeozoological remains, as well as the renewed study and excavation of previously known contexts, enables us to clarify the importance of marine resources in the Neanderthal diet, and in the diet of the first anatomically modern humans in southern Europe.

Paleolithic coastal sites prior to the Last Glacial Maximum (MIS 2) with marine faunal remains are relatively rare. This paucity of sites can be directly correlated with the coastal changes caused by the post-glacial marine transgression, which led to the flooding of coastal plains and the destruction of cliffs. Certain sites are presently submerged and others have been eroded by waves (Álvarez-Fernández, 2011; Bicho, Haws, 2008; Fa, 2008; Colonese *et al.*, 2011). Many of the sites attributed to

Figure 7 - El Castillo (Cantabria, Spain). Level 18. Aurignacian. Sperm whale tooth (photo: Institut de Paléontologie humaine, Fondation Albert I[er], Prince de Monaco).

Figure 8 - El Cuco (Cantabria, Spain). Level X. Aurignacian. Spines from the sea urchin *Paracentrotus lividus*.

the Middle Paleolithic and the early Upper Paleolithic are very near the present-day coast line; some are only about ten meters away (e.g., Moscerini, Bajondillo, Gibraltar caves, Figueira Brava, etc.). As we move away from the coast, sites with marine shells become rarer.

Archeozoological remains are considered by researchers as irrefutable evidence that these resources were gathered on the coast for food. However, apart from several sites (from the Middle Paleolithic: Moscerini, Los Aviones and Figueira Brava, from the early Upper Paleolithic: Riparo Mochi and El Cuco), these remains are very rare. Moreover, published information is not always clear, which makes comparisons between the different sites difficult. Thus researchers often accord more importance to the number of remains (NR) or to the Number of Identified Specimens (NISP, NRDt) than to the minimum number of individuals (MNI). In the same way, they do not provide data on the volume of sediment excavated per archeological level, which would enable us to calculate the MNI/m^3 excavated in the aim of comparing the sites. It is impossible, for example, to compare the rare mussel shells from Bajondillo, 29 in level 19, and 10 in level 18 (caught for food, or transported as shells from the beaches for other purposes?) with the 300 mollusk specimens from Moscerini recorded in about thirty cultural levels over a stratigraphy several meters thick.

It is also important to note that detailed taphonomic studies have not been carried out for all the sites. As far as the mollusks (the predominant remains) are concerned, this prevents us from identifying whether they were caught for food (for example if the limpet shells bear marks on their edges indicating that they were intentionally extracted from the rock) and from detecting any further transformation (traces of fire), or gathered on the beach once the animal was already dead (erosion by the sea and sand, sponge perforation of the valves, etc.). In nearly all the Middle Paleolithic and early Upper Paleolithic sites, there is a small proportion of shell species living in subtidal and circalittoral zones, on sandy, muddy or gravelly bottoms (e.g., *C. chione*, *Acanthocardia* sp., *Pecten* sp.; figure 9). In the case of the Gibraltar sites, although certain authors indicate that their presence is a result of fishing for food (Brown *et al.*, 2011), others state that they were collected from the beaches (*A. tuberculata* and *C. chione* at Vanguard; Fernández-Jalvo, Andrews, 2000). As for the Moscerini levels, although several sea-eroded valves were found, indicating that they were collected on the beaches, a large proportion of the *Glycymeris* sp. and *C. chione* remains appear to have been caught and transported to the cave for food (Stiner, 1993a, 1994). From our point of view, it does not seem plausible that human groups had access to these species, given the

Figure 9 - Callista chione valves gathered on Cantabrian beaches. Top: very slightly eroded valve (with preserved periostracum). Bottom: valve with almost disappeared periostracum through marine erosion blackened by a lack of oxygen. Bottom left: valve without periostracum, very eroded by the action of waves and sand.

depth that they live at. At the present time, they are only accessible during equinox tides. We thus postulate that the Moscerini shells were gathered on the beaches for other purposes. In this site (but also in other Mediterranean sites), side scrapers were made from fragments of *C. chione* (Stiner, 1998, 1999; Douka, Spinapolice, 2012), which tends to indicate that the large quantity of this species at the site (but also of *Glycymeris* sp.) probably results from gathering shells on the beach and transporting them to the cave as raw materials. Several of these valves could have been used directly, for example as spoons. Others could have been fragmented and transformed into tools by retouch.

Thus, in the light of the published data, and considering the sites for which quantified data are available, we conclude that the most abundant species would be different species of limpets, mussels and, to a lesser extent, monodontas (*Genus Phorcus*) (between 60% and 99% of the NR). These gastropods and bivalves would have been collected from rocky substrata in intertidal zones (upper, middle and lower). Limpets are more abundant at Gorham and El Cuco, mussels at Moscerini and Mochi, and monodontas at Los Aviones. It is also important to note that in spite of the fact that in certain sites, mention is made of the Neanderthal exploitation of muddy-sandy substrata, due to the presence of *R. decussatus* (Figueira Brava; Callapez, 2001) and *C. edule* (Los Aviones; Zilhão *et al*., 2010), we consider that these remains are rare and that they may not have been collected for dietary purposes.

The taphonomic data relating to other archeozoological remains are rare. For mammals, and according to Klein and Steele (2008), the presence of butchery marks on seal and dolphin remains at Vanguard could indicate (for the seal; Stringer *et al.*, 2008) the exploitation of meat and fat from moribund animals on the coast rather than hunting activities. This is also the case at Figueira Brava (Antunes, 2000b). The absence of taphonomic studies of different species of seabirds (that nest in arctic and subarctic zones and that migrate towards southern coastal zones in winter) makes it impossible to determine whether their presence in these sites is related to hominid consumption or not. We only have data for the site of Gorham, where only 1% of the bird remains (both sea and land birds) bear anthropogenic modifications (butchery marks, etc.; Brown *et al.*, 2011). With regards to the crustaceans, the only evidence of hominin activity is the broken crab claws at Figueira Brava, related to the extraction of crab flesh (Callapez, 2001). Given the rarity of Aurignacian echinoderm remains at El Cuco, they cannot be correlated with intentional anthropogenic actions (Álvarez-Fernández, 2011). Lastly, no taphonomic data have been recorded for the rare Middle Paleolithic fish remains.

Conclusion

The rarity of marine archeological remains in European coastal sites dating from the Mousterian and the early Upper Paleolithic indicates that they were probably only eaten by Pleistocene hominins on a sporadic or, at most, on an occasional basis. We cannot thus refer to a true exploitation of the marine environment. These remains would have supplemented a diet based on proteins obtained on land, mainly through hunting activities (Stiner, 2013).

Given the abundant remains at Figueira Brava (Mousterian) and El Cuco (Aurignacian), the published data seems to indicate that mollusks were collected for dietary purposes from rocky substrata in intertidal zones. As for mammals, the meat and fat from seals and dolphins washed ashore were exploited (as early as the Mousterian, at Vanguard and Figueira Brava), but probably also their bones (from the Aurignacian onwards), perhaps for making artefacts (sperm whale tooth at El Castillo, seal mandible at Castanet). There is also evidence of Mousterian crab (Figueira Brava) and bird (Gorham) predation, whereas there is no such proof for echinoderms and fish.

This occasional consumption of marine animals appears to be corroborated by isotopic analyses (carbon and oxygen), although the latter are still rare. Thus, for the time being, there is no isotopic proof that hominids (*H. heidelbergensis*, Neanderthals and the first anatomically modern humans) in Europe ate marine proteins (Salazar-García *et al*., 2013; personal communication).

Finally, other ongoing studies can provide us with information, even indirect, on the exploitation of the marine environment by Paleolithic hominins. In unit MN3 in the open-air coastal site of Mira Nascente, in Portuguese Estremadura, dated to around 42/40 000 BP, flint flakes with use-wear on their cutting edges appear to have been used to cut soft materials. These tools were associated with the preparation (scaling) and possible consumption of caught fish (Haws *et al*., 2011).

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IN SEARCH OF LOST TIME. DATING METHODS FOR PREHISTORIC ART:

the Example of Aurignacian Sites

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IN SEARCH OF LOST TIME. DATING METHODS FOR PREHISTORIC ART:

the Example of Aurignacian Sites

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Abstract

The need for an accurate chronological framework is particularly important for the early phases of the Upper Paleolithic, which correspond to the first works of art attributed to Aurignacian groups. Carbon-14 is the only method used for the direct dating of organic pigments, but indirect methods are used to date subsequent deposits on rock art (thermoluminescence, OSL, Uranium / thorium, etc.). All these methods are based on hypotheses and present interpretative difficulties, which form the basis of the discussion presented in this article.

Keywords

Rock art, absolute dating, radiocarbon, thermoluminescence, optically stimulated luminescence, Uranium/ Thorium series, oxalates.

Introduction

The accuracy of the radiocarbon dating method decreases as the age of the sample increases. The earlier the age, the higher the uncertainty, due to additional causes of error. Moreover, the ages obtained by carbon-14 do not correspond to exact calendar years and thus require correction. The effects of this correction become very significant and inaccurate beyond 30 ka. It is for this reason that the period corresponding to the advent of anatomically modern humans (*Homo sapiens sapiens*) in Europe and the transition from Neanderthal Man to modern Man remains relatively poorly secured on an absolute time scale, opening the way to all sorts of speculation and controversy. As long as it is based on dates with an accuracy of one to two thousand years and which fluctuate according to calibration curves and the technical progress of laboratories, our reasoning remains hypothetical. In such a fluctuant context, it would be illusory to place the earliest artistic parietal and portable representations from the Swabian Jura, the southwest of France, the Rhone Valley, Romania or Veneto on a relative timescale.

In this article on absolute dating methods, we will briefly recall the scientific principles on which the different methods are based, in order to allot more scope to the causes of error that blur our overall vision, but also to recent technological progress which offers an optimistic outlook for the future of our discipline. Most of this paper will deal with carbon-14 as it is the only direct dating method applicable to parietal art (although it is limited to charcoal drawings).

In order to date red paintings and engravings, indirect methods allow us to estimate the age of the deposits that form after the completion of the art works. These techniques are thermoluminescence (TL) and the uranium / thorium series, applicable to calcite deposits in caves, the dating of calcium oxalate coating and amorphous silica patinas that form on rocks exposed to daylight and lastly, optically stimulated luminescence (OSL), a technique used to date the sediments related to parietal art. In most cases, these methods provide a minimum age, a *terminus ante quem* that can be far removed from the archeological reality, as deposits can form quite late on and in an intermittent way. But other causes of error can increase uncertainty, some of which can even contribute to yielding abnormally high ages.

1 - Carbon-14

A - Principle

In the upper atmosphere, high energy cosmic rays transform nitrogen atoms (^{14}N) into ^{14}C, a radioactive element that disintegrates into ^{14}N with first-order kinetics characterized by a half-life period of 5 568 years (period of time required for half of the initial ^{14}C to disappear). The concentration of ^{14}C in the atmosphere and the oceans as carbon dioxide then remains almost stationary. This $^{14}CO_2$ passes directly into the metabolic cycle of animals and plants, so that the proportion of ^{14}C is constant in all living creatures and begins to decrease from their time of death, when there is no further exchange with the environment. Libby (1949) inferred from this that it was possible to determine the date of the death of the organism by measuring the residual proportion of ^{14}C.

B - Technique

For many years, the proportion of residual ^{14}C was measured by counting the number of disintegrations after the transformation of carbon into gas (*gas proportional counter*) or into liquid (*liquid scintillation counter*), which required considerable quantities of organic matter (10 g. of charcoal for example). More recently, the mass spectrometry accelerator technique (AMS) results in the direct measurement of the $^{14}C/^{12}C$ ratio on samples of a few milligrams, thereby making it possible to directly date charcoal drawings.

C - Causes of error

There are many but they are of disparate importance.

1) The half-life period used by Libby (and used since by convention) turned out to be erroneous. It is now calculated at 5 730 years (and not 5 568 years), which represents an age underestimation of about 3%. Calibration curves correct this error (see calibration below).
2) Measurements of ^{14}C concentration are flawed by statistical error and the age is given as an average value m and a standard-deviation σ. There is a 68% chance that the age is in the [m-σ, m+σ] interval and a 95% chance that it is in the [m-2σ, m+2σ] interval. Throughout the years, techniques have improved and standard-deviations have decreased, but it is important not to confuse the *accuracy* of the measurements expressed by σ with the *uncertainty* surrounding the real age of the dated object.[1]

1. Several measurements carried out on the same object sometimes present a low standard-deviation, but the averages can be very different. For example, the same bison from the cave of Castillo (Cantabria) yielded two ages of 12 620 ± 110 BP (GifA-96079) and 13 520 ± 130 BP (GifA-96068). These measurements are quite accurate, but the age of the painting is very uncertain, since the difference between these two averages is 900 years (or seven times the value of σ!).

3) The main cause of error does not stem from the measurements, but from sample purification. A physico-chemical pretreatment in the laboratory is required to eliminate any potential organic contaminants. Yet, laboratories use different procedures and these have evolved throughout time. We must thus focus on these procedures as they can yield considerably different results, especially for samples with an age of more than 30 ka. But we must first of all discern two types of impurities; those that increase the age and those that result in younger dates (figure 1).

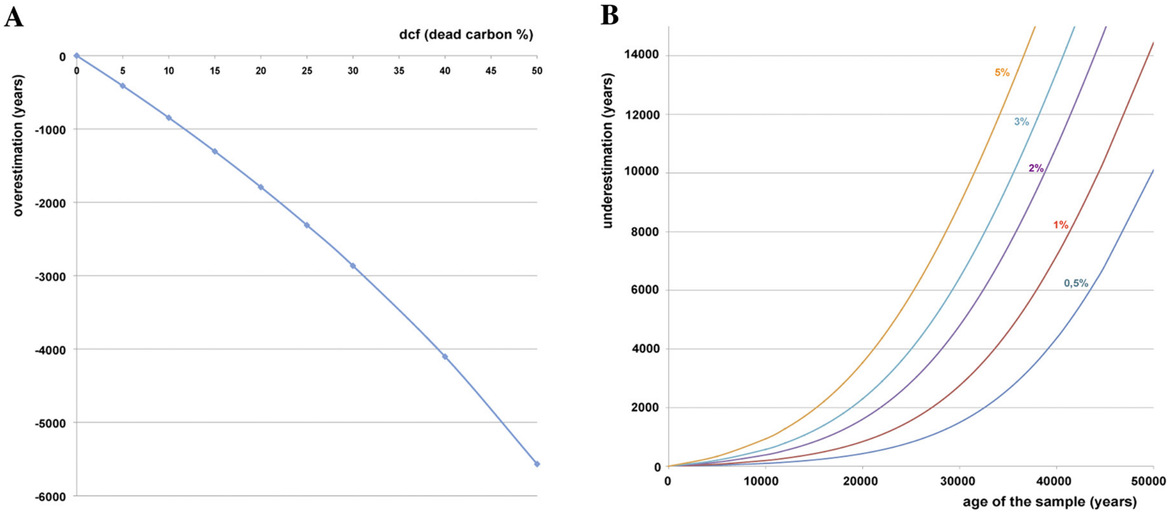

Figure 1 - Influence of impurities on radiocarbon dating. A: Ageing by dead carbon (containing no more ^{14}C);
B: Rejuvenation by recent carbon according to the impurity percentage.

If the dated sample contains an impurity of an infinitely early age (which no longer contains ^{14}C, what we refer to as "dead carbon", for example from carbonates of geological origin), then the age is older, but this is independent from the age of the sample and the effects are limited (less than 900 years for 10% of dead carbon; figure 1A).

On the other hand, impurities containing recent carbon are a particularly serious source of error, especially for older samples. A sample with a real age of 40 000 years, only containing 1% of recent carbon, would yield an apparent age of 32 800 years, which corresponds to a rejuvenation of 7 200 years! (figure 1B).

Therefore the main cause of error in radiocarbon dating is the presence of recent carbon leading to more recent dates. In comparison, the ageing of samples through the presence of "dead carbon" is almost negligible.[2] Note that for paintings exposed to air, contamination by organic matter of

2. This double observation can be applied to the well-known, but still unresolved case of the black dots superposed on yellow aurochs in Candamo Cave (Asturias, Spain) (Fortea, 2002). Two dates yielded ages of 32 310 ± 690 BP (GifA-96138) and 33 910 ± 840 BP (GifA-98201). Later, two dates conducted by another laboratory yielded 15 870 ± 90 BP (GX-278-42) and 15 160 ± 90 BP (GX-278-41). The gap between these two series gave rise to controversy (Pettitt, Bahn, 2003). Two hypotheses can be envisaged: 1) if the "real" age is ≈16 ka, an apparent age of ≈33 ka would imply that the sample contained 87% of dead carbon, which is totally improbable! 2) if the "real" age is ≈33 ka, an apparent age of ≈16 ka would imply that the sample contained 12% of recent carbon, which is also very unlikely. The only remaining possibility is that the two series correspond to totally unconnected parietal events, but no satisfactory explanation has yet been proposed. A third series of recently published dates (Corchón *et al.*, 2014) gave dates for these same dots varying from 18 020 ± 230 BP (GifA-11450/SacA-26192) to 22 620 ± 260 BP (GifA-12092/SacA-28706) with $\partial^{13}C$ varying between -20.6 and -34‰, which could indicate carbon matter of different origins.

indeterminate age must also be taken into account. Calcium oxalate deposits can be mixed in with pigments and skew the results as their age can vary from the age of the paintings to the present-day (see below the paragraph on oxalates). It is thus essential to ensure that oxalates have been eliminated (Bonneau *et al.*, 2011).

The significance of these contaminations explains why all current research is aimed at improving pretreatment procedures. In sum, the classical method of charcoal preparation, called ABA (three steps consisting of an acid treatment, then basic, then acid again) has now been replaced by a variant known as ABOx-SC (an oxidation stage and step combustion are added to the acid and basic treatment). In nearly all cases, the ABOx-SC procedure yields dates 3 000 to 5 000 years older than the ABA procedure, which shows that the elimination of impurities containing recent carbon has greatly improved (table 1).

Site	Cultural attribution	Material	^{14}C BP (ABA)	^{14}C BP (ABOx-SC)	^{14}C cal BP (Intcal13) (95,4 %)	Reference
Fumane	Proto-Aurignacian	charcoal	30 650 ± 260 (OxA-11347)	35 640 ± 220 (OxA-17569)	[40860-39700]	Higham *et al.*, 2009
	Proto-Aurignacian	charcoal	31 830 ± 260 (OxA-11360)	35 180 ± 220 (OxA-17570)	[40320-39140]	Higham *et al.*, 2009
	Proto-Aurignacian	charcoal	32 530 ± 240 (OxA-19411)	34 940 ± 280 (OxA-19412)	[40040-38880]	Higham *et al.*, 2009
	Proto-Aurignacian	charcoal	33 380 ± 210 (OxA-19525)	35 850 ± 310 (OxA-19584)	[41230-39780]	Higham *et al.*, 2009
	Mousterian	charcoal	33 700 ± 600 (OxA-6463)	40 150 ± 350 (OxA-17980)	[44470-43110]	Higham *et al.*, 2009
Mochi (Grimaldi)	Proto-Aurignacian	charcoal	34 870 ± 800 (OxA-3592)	36 350 ± 260 (OxA-19569)	[41550-40380]	Douka *et al.*, 2012

Table 1 - ^{14}C dating of charcoal from Proto-Aurignacian sites.
Comparison of pretreatment protocols by the ABA and ABOx-SC method.

For bone dating, a new method of collagen extraction and purification has also been developed. An ultrafiltration technique isolates collagen macromolecules, which often results in much older dates (Higham *et al.*, 2006; table 2). If the samples are “clean”, the different methods give similar results, but if they are very polluted, purification by ultrafiltration can yield ages several thousand years older, which calls into question certain archeological hypotheses, like for example the notion of a Neanderthal “refuge” south of the Ebre (Wood *et al.*, 2013; Higham *et al.*, 2014).

Site	Cultural attribution	Material	^{14}C BP (ion-exchange resin)	^{14}C BP (ultrafiltration)	^{14}C cal BP (Intcal13)	Reference
Geissenklösterle	Early Aurignacian	Bones (collagen)	30100 ± 550 (OxA-6256)	35 050 ± 600 (OxA-21659)	[41030-38470]	Higham *et al.*, 2006
Arrillor	Mousterian (level lmc)	Bones (collagen)	37100 ± 1000 (OxA-6106)	44 900 ± 2100 (OxA-21986)		Higham *et al.*, 2014

Table 2 - ^{14}C dating of bones from the Early Aurignacian site of Geissenklösterle and the Mousterian site of Arrillor.
Comparison of collagen purification protocols on ion-exchange resin and by ultrafiltration.

More recently, a dating method of an amino acid extracted from collagen (hydroxyproline) aged the Sungir graves by almost 5 000 years, dating them to 30 000 BP (Marom *et al.*, 2012; Nalawade-Chavan *et al.*, 2014). Note that the new dates obtained for the initial phase of the Aurignacian are now more consistent and the Neandertal-*Homo sapiens* transition is currently placed at beyond 40 000 BP in calendar years (see calibration below).

Another area in which laboratories have made great progress is with the maximum measurable age, which has gone back by more than 10 000 years. Today, 50 000 year-old samples can be dated with acceptable levels of accuracy (Higham *et al.*, 2006; Cottereau *et al.*, 2007).

D - Calibration

Libby's hypothesis stating that the rate of formation of ^{14}C in the upper atmosphere has always been constant turned out to be erroneous, as variations in the earth's magnetic field and solar activity lead to variations in ^{14}C concentration. At certain periods, this was very different from the current value, resulting in a first cause of error. A second cause of error is due to what we call the reservoir effect of oceans. The CO_2 dissolved in the oceans tends to become concentrated in the depths where there is very little exchange with atmospheric CO_2. Consequently, the proportion of $^{14}CO_2$ tends to decrease with depth. During cold periods, the thermohaline circulation decreases, which results in the rate of ^{14}C in living organisms and an overestimation of their age (plateau effect).

The calibration of radiocarbon ages is carried out through correlation with other methods yielding calendar ages, such as dendrochronology (until 10 000 BP), marine or lacustrine varves or dating of corals or speleothems with uranium series. The calibration curves vary according to research progress and are regularly revised (CalPal-2007, IntCal09, Intcal13; figure 2). It is thus

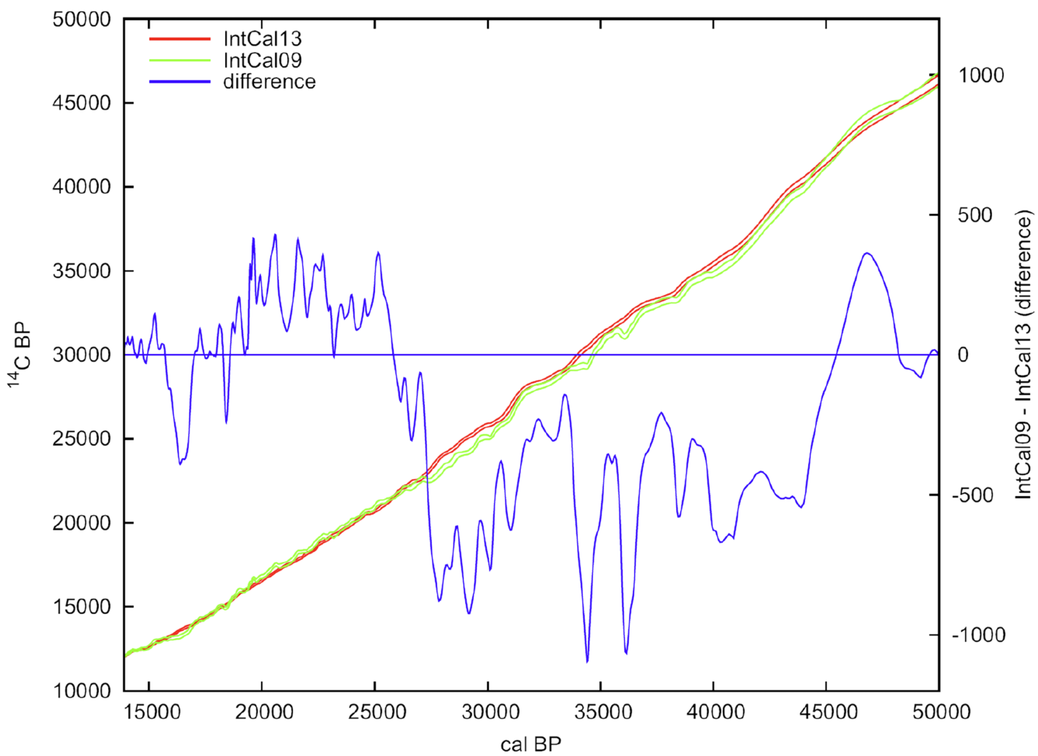

Figure 2 - Intcal 13 calibration curves (northern hemisphere) and Intcal 09 between 15 and 50 ka cal BP (after Reimer *et al.*, 2013).

imperative to always indicate the ^{14}C age with its standard-deviation σ, calibrated age brackets with a probability of 95% (2 σ) giving the calibration curve used, as these present non-negligible differences. For example:

36 000 ± 500 ^{14}C BP = [39660-42380] (calPal-2007-HULU) 95%
[40150-42040] (Intcal-09) 95%
[39610-41640] (Intcal-13) 95%

E - Interlab comparison

Some intractable opponents of the early age of Chauvet Cave have questioned the fact that the dates were obtained by a single laboratory (Pettitt, Bahn, 2003), even though the six direct dates on pigment used for the paintings are remarkably consistent and compatible with a single episode in the cave, with an average date of 30 890 ± 250 BP (probability > 95%). In reply to this objection, three large pieces of charcoal retrieved from the Megaloceros Gallery were cut up and sent to four different laboratories (LSCE-Gif sur-Yvette, Oxford, Groningen and Poznan). The results are perfectly consistent, both in relation to each other and in relation to the age of the black paintings (Cuzange *et al.*, 2007).

Charcoal no. 1 : 32 151 ± 83 BP (average of 8 measurements)
Charcoal no. 2 : 31 857 ± 79 BP (average of 9 measurements)
Charcoal no. 3 : 31 755 ± 105 BP (average of 7 measurements)

Unfortunately, this experiment did not silence the antagonists, who were taken off guard and advanced improbable hypotheses to continue to refute the age of the paintings from Chauvet Cave (Combier, Jouve, 2012).

2 - Thermoluminescence (TL)

A - Principle

When solid matter such as flint or calcite is bombarded by cosmic rays, electrons are trapped in high energy levels. When this matter is heated to 275°C, the trapped electrons revert to their fundamental level by emitting radiation (luminescence peak). The technique consists in subjecting the sample to additional known irradiation doses, in order to calculate the paleodose (which is to say the irradiation that the sample was exposed to during the period of time since it was last heated (for flint), or since its formation (for calcite). The main difficulty consists in measuring the dose of annual radiation (this is the main cause of error).

The method is widely used for dating burnt flints found during excavations and generally gives quite consistent results with radiocarbon dating.[3] Conversely, TL has not often been used to date calcite deposits on prehistoric paintings.

3. For example, TL dating of six burnt flints from layer III of Geissenklösterle (early Aurignacian) yielded an average age of 40.2 ± 1.5 ka (Richter *et al.*, 2000), whereas reindeer bone from the same layer dated by ^{14}C recently gave ages of 36 650 ± 750 and 36 850 ± 800 by ultrafiltration, which corresponds to an age of about 41.2 ka in calibrated ages (Intcal13) (Higham *et al.*, 2012).

B - Applications to rock art

TL dating of calcite deposits was used in the Paleolithic caves of Pondra and La Garma (Cantabria). In Pondra Cave, the simultaneous dating of the calcite underlying and overlying the paintings provided a timeframe for the probable age of the paintings. In this way a red deer protome yielded a minimum age of 26 972 ± 2 747 years, which is the approximate equivalent of 22 ± 2 ka ^{14}C BP (figure 3) and would place the technique of punctuated painting used in this cave in the recent Gravettian (González Sainz, San Miguel Llamosas, 2001). In La Garma Cave, a calcite cord with the lower end covering the outline of a red ibex gave a TL age of 34 175 ± 3 850 years (or about 29 000 in equivalent ^{14}C years) (González Sainz, 2003), but the sample came from higher up on the cave wall so it is possible that the calcite flow began at an earlier stage (figure 4). These experiences show the potential of the method but archeological reasoning must always be backed up by in-depth knowledge of local hydrogeological conditions.

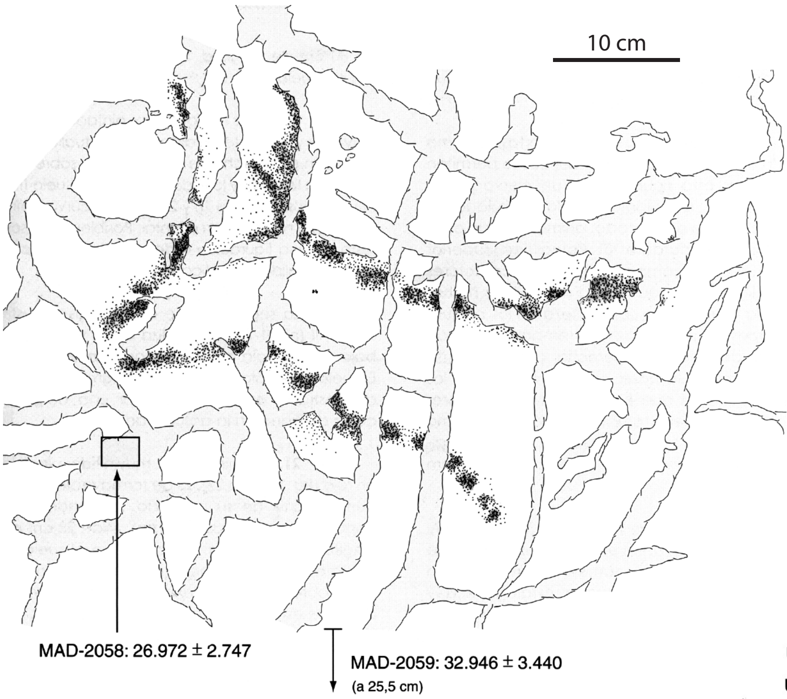

Figure 3 - Deer from Pondra Cave (Cantabria) with localization of samples taken for dating by thermoluminescence and dates obtained (after González Sainz, San Miguel Llamosas, 2001).

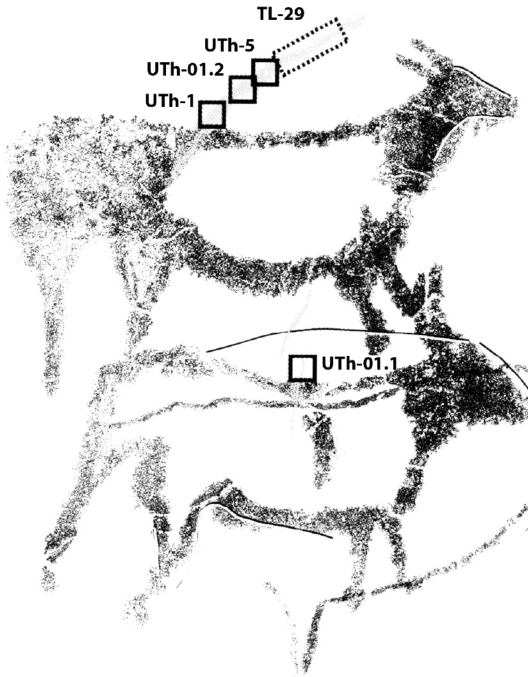

Figure 4 - La Garma Cave (Cantabria). Localization of samples and dates obtained by TL and U/Th (after González Sainz, 2003, modified).

TL-29 : 34 175 ± 3 850
UTh-5 : 26 800 ± 480
UTh-01.2 : 28 800 ± 1 850
UTh-1 : 26 100 ± 960
UTh-01.1 : 37 000 ± 1 100

25 cm

3 - Optically Stimulated Luminescence (OSL)

A - Principle

The principle is similar to TL and this method is applied to materials such as quartz grains and feldspar. In this case, light and not heat is used to stimulate luminescence. What is dated here is the last previous exposure to solar light. This is based on the assumption that this exposure completely wipes out the history of the crystal, as otherwise ages would be overestimated. However, when OSL-^{14}C correlations are possible, results are generally satisfactory.[4]

B - Applications to rock art

OSL applications to rock art are relatively infrequent, as it is only an indirect method for dating sediments assumed to be related to cave art. The dating of the sediments from two decorated rock shelters in Tassili can be cited as an example, although the link between the dated levels and the paintings was not backed up by a geomorphological study (Mercier *et al*., 2012), and, in particular, the dating of engravings from Qurta in Egypt (Huyge *et al.*, 2011). Four dates between 10 and 17 ka were obtained for sediments clearly covering the engravings. In spite of the wide time bracket (probably due to post-depositional reworking), it confirms that these are Pleistocene engravings. These limits appear to be acceptable, as a ^{14}C date of around 14 ka cal BP was obtained on small animal bones from the same sediments.

4 - Uranium / Thorium Series

A - Principle

When calcite precipitates to the surface of a limestone wall, it traps a small quantity of uranium transported by infiltration water (but no thorium which is not soluble in water). Uranium ^{234}U then disintegrates into thorium ^{230}Th. Assuming that calcite acts as a closed system with no exchange with the outside environment, the imbalance between these two elements, that is the $^{230}Th/^{234}U$ activity ratio, should allow us to determine the date when the calcite precipitated (assuming that no thorium was initially present, which must be confirmed, as detrital thorium contributions are sometimes possible). The dating method by U/Th series yields satisfactory results for massive speleothems (stalactites or flowstones), as dating is carried out on small samples taken from the core of the mass. It is even one of the means used to establish ^{14}C calibration curves (by simultaneously measuring the age of calcite by U/Th dating and ^{14}C on the same samples, taking account of the "dead carbon" fraction).

B - Applications to rock art

In certain hydrogeological conditions, fine layers of calcite can cover a painting or an engraving and the U/Th method can be used to determine the minimum age of the prehistoric artwork. However, this involves specific problems, as the interface of these calcite veils with the surrounding environment remains open to exchange.

4. For an anthropogenic level in the southwest of Australia, an average date of 28 ± 2 ka cal BP was obtained by ^{14}C and 25.5 ± 1.4 ka by OSL (Turney *et al*., 2001).

C - Causes of error

The $^{230}Th/^{234}U$ ratio used to determine the age of the calcite can be skewed for two reasons:

- an error with the numerator (^{230}Th), as solid particles of detrital origin containing thorium (in the form of two isotopes ^{230}Th and ^{232}Th) can be trapped in the calcite when it forms. If the presence of detrital thorium is revealed by an abnormally low ^{230}Th and ^{232}Th ratio (< 50), a correction is required.
- an error with the denominator (^{234}U). Errors of this kind are very probable when the walls are subjected to strong run off and the calcite layer is thin, as in these conditions, the closed system hypothesis is no longer valid; uranium, which is relatively soluble, can be partially eliminated. Note that even with massive speleothems, an opening of the system can be observed. This occurs in particular when environmental conditions have changed dramatically in comparison to conditions during calcite precipitation (Borsato *et al.*, 2003).

If the proportion of detrital thorium is underestimated and if the lixiviation of uranium is ignored, this leads in both cases to *abnormally early dates*. This situation was encountered in a cave in Borneo where a stalagmitic drapery covering a hand print was dated by both U/Th and ^{14}C. The ^{14}C ages are identical at the base of the drapery and near the outer edge (9 000 ± 1 000 cal BP depending on the value adopted for the dead carbon fraction, which indicates that the drapery probably formed over a very short lapse of time). Conversely, the U/Th dates are very variable: 9 800 at the base, which is consistent with the ^{14}C age and indicates very little leaching, whereas near the outer edge, the unexpected age of 27 000 years shows that a significant fraction of uranium was eliminated and effectively the uranium concentration is twice lower than at the base (Plagnes *et al.*, 2003).

We can learn several lessons from this example. First of all, the age of a prehistoric work of art determined by the U/Th dating of overlying calcite can be greatly over-estimated. This observation thus calls for a degree of elementary caution: when results yield an older date than expected given the archeological data, several precautions must be applied:

1) checking the U/Th dates with an independent method (the systematic association of the ^{14}C method applied to the same calcite samples);
2) indicating the concentrations in uranium so that we can assess certain local anomalies;
3) proceeding with an in-depth study of the hydrogeological conditions of the cave walls in order to detect former or present-day run off zones, liable to interfere with results.

In the absence of such checks, very early U/Th dates must be viewed with the utmost caution. For example, this is the case for certain dates obtained for Cantabrian cave art (Pike *et al.*, 2012). Out of about fifty published dates, three-quarters of them are not worthy of discussion as they are post-Paleolithic and represent far removed *terminus ante quem* from the archeological context (figure 5). This situation was foreseeable, as in several French caves, speleothem growth was shown to restart towards 16 ka after a long period of interruption spanning most of the Upper Paleolithic (Genty *et al.*, 2004; Genty, 2008). It is thus not surprising that calcite yields ages from the end of the Tardiglacial or the Holocene. Only a small number of extremely early dates (including one of 41 400 ± 570 years) have seized the attention of authors, who developed a discussion on the archeological significance of these dates without questioning the implications of the measurements. Yet, given the fact that part of the uranium may be dissolved, which is a particularly probable hypothesis for thin layers of calcite in an active cave, and in the absence of information excluding this hypothesis, any discussion of these early dates should be adjourned, as it would be redundant (Clottes, 2012; Bednarik, 2012). It is better to wait patiently for the dates to be confirmed...

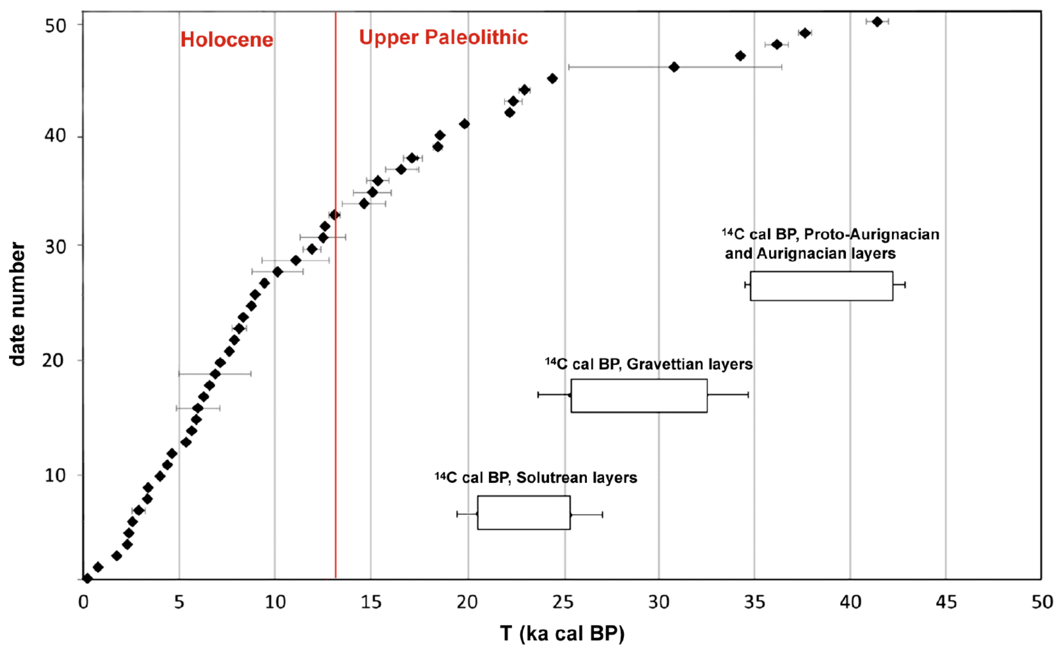

Figure 5 - Dates obtained by U/Th in eleven Cantabrian decorated caves (after Pike *et al.*, 2012, modified).

The same conclusion also applies to the U/Th dates on a panel of red representations from La Garma (figure 4), where concretions on two neighboring caprids, in strictly the same style, yielded dates ranging between 26 100 and 28 800 years for one and 37 000 ± 1 100 years for the other (González Sainz, 2003), showing that unexpected phenomena can differentially affect very close zones.

There is one remaining point to discuss. In most cases, samples are taken by scraping the calcite with a scalpel, which is not a good solution as it only gives the age of the outer layer; the layer furthest away from the paintings! In these conditions, it is not surprising that we very often obtain sub-contemporaneous ages for Paleolithic paintings. The ideal solution consists of sampling the whole calcite layer and establishing a microstratigraphy in order to date very fine layers separately. Yet, this is possible today with the MC-ICPMS (multi-collector inductively coupled plasma mass spectrometry) technique. In a cave in Timor, it was possible to date calcite layers about 0.1 mm thick separately using laser ablation (Aubert *et al.*, 2007). In this way, the superficial layer bearing the paintings gave a *terminus post quem* of 6 ka, which is probably a realistic age, given the local archeological data. In the underlying layers, a red pigment layer was bracketted between 24 and 29 ka. Note that if the whole thickness of the calcite had been dated without discernment, it would have yielded an average age of no archeological significance. Another lesson to bear in mind when presenting rock art dates obtained with the U/Th method.

5 - Calcium oxalates

A - Principle

In shelters receiving daylight, the colonization of rock walls by bacteria, fungi and lichens leads to the formation of a biofilm containing oxalic acid. This biofilm forms calcium oxalate crystals (whewellite or weddellite), when it comes into contact with calcium carbonate, and these crystals can be dated by ^{14}C, giving a minimum age for the paintings.

Blocks bearing oxalate surface coatings have been identified in a site in Kimberley (Australia). As the formation of oxalates ceases during burial, the age should be close to the age of the layer. In effect, the dating of the oxalates yielded 36 400 ± 1 800 BP and 34 870 ± 740 BP, which is consistent with the age of the layer dated by charcoals to 36 010 ± 790 BP and 40 100 ± 1 220 BP, given the important margins of error (Watchman *et al*., 2005).

B - Application to rock art

A remarkable example comes from Australia where a micro-stratigraphy was carried out on an oxalate layer with a thickness of 2.1 mm recovered from a wall. Each layer was dated by AMS and the tens of dates obtained all conform with the expected order, with a very wide time range from 3 340 ± 60 BP to 28 100 ± 400 BP, from the surface to the host rock (Campbell *et al.*, 1996). Several layers of pigments were identified in the cross-section of the sample, in particular a layer of goethite between 22 800 and 25 800 BP.

Only Holocene examples are known in Europe, notably a Chalcolithic rock art shelter in Spain where underlying and overlying deposits yielded a maximum age of 4 675 ± 35 BP and a minimum age of 2 610 ± 60 BP (Ruiz *et al.*, 2012).

6 - Amorphous silica

Films of amorphous silica form on sandstone or schistous surfaces exposed to the elements. They trap organic matter that can potentially be dated. This was attempted for the engravings in the Côa Valley (Portugal), but with rather disparate results (Watchman, 1995) and several causes of error have been identified (Dorn, 1997). The main cause is undoubtedly the heterogeneous nature of the trapped organic matter, some of which can be much older and some very recent, resulting in average values of no significance.

Conclusion

The dating of prehistoric parietal art in general and Aurignacian art in Western Europe in particular, is a challenge both for specialists of physico-chemical dating methods and for archeologists, as our knowledge of the first modern human cultures across the world depends on it. The ^{14}C method is undoubtedly currently the most reliable method, but it also entails its share of problems. The other methods, most of which are reliable in certain circumstances (dating of burnt flint by thermoluminescence, dating of massive speleothems by the U/Th series method) still present difficulties and at times, inconsistencies when we attempt to apply them to parietal art, mainly due to poor knowledge of disruptive factors affecting calcite deposits in caves. Although these results are not yet totally convincing and should be considered with extreme caution, studies of these methods must continue in order to identify the causes of error, to minimize their effects and to specify the optimal conditions of use and the validity limits for each method.

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EARLY UPPER PALEOLITHIC PARIETAL ART:

Shared Characteristics and Different Symbolic Traditions

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EARLY UPPER PALEOLITHIC PARIETAL ART:

Shared Characteristics and Different Symbolic Traditions

Stephane PETROGNANI

Abstract

What symbolic traditions can be defined at the beginning of the Upper Paleolithic? Can we characterize specific Aurignacian, Gravettian or Solutrean approaches? This thematic-stylistic analysis applied to a sample of 2 000 representations in nearly 110 caves provides some partial answers to these questions and reveals continuity in the "artistic traditions" of early Upper Paleolithic groups. Other observations show the complexity of artistic representations through time-bound and location-bound "traditions" and speak to the plurality of symbolic behavior in prehistoric societies.

We highlight a decrease in the diversity of stylistic resources used by Paleolithic groups throughout the Upper Paleolithic. Graphic standards imposed by the group tend to become more rigid, limiting the scope of the prehistoric artist and leading to a set repertoire of certain formal graphic representations. Due to this decrease in the "freedom" of iconographic codes, which become increasingly standardized, the role of the Paleolithic artist in society is reconsidered and appears to reflect social changes.

Keywords

Parietal art, Upper Paleolithic, style, themes, Aurignacian, Gravettian, Solutrean.

Introduction

The aim of this article is to contribute to current knowledge of the parietal art of the Aurignacian, Gravettian and Solutrean. Several observations emerge from a study of 107 European parietal sites. Some of these are characteristic of the period and emphasize continuity between the "artistic traditions" of early Upper Paleolithic groups. Others bring to light the complexity of artistic representations through time-bound and location-bound "traditions" and illustrate the plurality of symbolic behavior in prehistoric societies. It is these temporal or territorial variations that make these human groups and their successive cultures unique.

What symbolic traditions can be defined at the beginning of the Upper Paleolithic? Can we characterize Aurignacian, Gravettian or Solutrean approaches?

1 - Characteristic traits at the beginning of the Upper Paleolithic

Three main formal pre-Magdalenian traits are present throughout the duration of "early" Paleolithic art: the concave ventral line of mammoths, the frontal view of bisons' horns and the depiction of horses' jaws as "duck bills". These ways of drawing are already visible on the walls of Chauvet Cave and characterize many decorated complexes until the advent of the Magdalenian. As well as highlighting continuity in these stylistic representations throughout time, it is also imperative to focus on their geographic distribution.

Horses' jaws shaped like "duck bills" were first mentioned and named by H. Breuil in 1910 (Capitan *et al.*, 1910). We suggest the following definition: marked convexity of the upper jaw, marked jowl with a more or less pronounced line at the end of the muzzle: sinuosity running from the concavity of the forehead to the convexity of the nose with at times a pointed end (Chauvet 22; Cosquer 14; La Croze-à-Gontran 01), or a very rounded end (Ardalès 02; Gargas 08; La Pileta 04) (figure 1). It is interesting to develop the study of this criterion, as it remains a strong anchor point in the literature for linking cavities that are sometimes separated by considerable distances and lapses of time. For certain horses, it is difficult to determine whether or not they present this stylistic criterion, and in order to resolve the issue, it is essential to study not only the graphic representation itself, but also the more general parietal context. Which equids are depicted in this way? Why were others not? A number of horses are at the limits of determination, prompting us to widen the corpus of "duck-billed" horses to representations meeting most of the formal criteria when the parietal context includes clear "duck-billed" horses. This is the case in particular for the horses Ardalès 06 and Pair-non-Pair 02. The first shows the characteristic narrowing between the jowl and the chin and is part of a parietal context with unambiguous "duck-billed" horses (Ardalès 02; Ardalès 03; Ardalès 04; Ardalès 07; Ardalès 08). As for the other horses in the cavity, they are very different as far as the morphological criteria used are concerned. The second horse, Pair-non-Pair 02, is very similar to the other horses on the walls of the same chamber of the cavity (Pair-non-Pair 01; Pair-non-Pair 03; Pair-non-Pair 04). On account of its rectilinear forehead, it was initially excluded from the corpus, but due to the jowl and the break in the line between the forehead and the mane, it is similar to the others. This absence of geographic continuity for these two parts of horse anatomy is one of the fundamental elements of "duck-billed" horses for E. Guy: "Another revealing trait of this particular conception, [...] consists in not systematically linking the contours to their intersections [...] with the virtually systematic interruption of the lines intersecting at the mane and the forehead. This is probably a way of affirming the independence of these pre-established lines but also a better way of differentiating the different anatomic parts using a particularly economical representation system (a single contour line)" (Guy, 2004: 3).

This is not a simple graphic convergence issued from universal schematics. The depiction of a "duck's bill" probably represents "a specific intention consisting of abandoning or deliberately neglecting the representation of general details, more or less common to all, in favor of details, such as the jowl, that directly characterize the animal" (*ibid.*). It is thus a deliberate aspect of early Upper Paleolithic parietal art. On the basis of work on representations from the Côa Valley and using Franco-Iberian examples, E. Guy suggests identifying this particular way of depicting the horse's head as a characteristic element of "Gravetto-Solutrean" graphic culture (Guy, 2000, 2003). However, we are skeptical of this chronological attribution of horses with "duck bills". The author uses this initial axiom to propose a second phase of representations from Chauvet Cave, based on the observation of a characteristic horse (Chauvet 22, figure 34...), "I infer that it is highly probable that the engraved horse from the Skull chamber belongs to the Gravetto-Solutrean" (Guy, 2004: 4). Our reservations concern both the varied character of the Ardeche sanctuary, and the role of the "duck bill" as a Gravetto-Solutrean chronological marker. Indeed, Guy partly bases his arguments on the horses from the cave of Pair-non-Pair. Yet, recent work by G. Sauvet, C. Fritz and G. Tosello, based on data from F. Daleau, shows that the representations from this cavity could well be Aurignacian (Sauvet *et al.*, 2007). This chronological attribution is also favored by B. and G. Delluc (Delluc, Delluc, 1997). In addition, certain cavities cited by the author are not solidly chronologically secured: La Croze-à-Gontran and Ardalès were compared to Pair-non-Pair for a long time on the basis of the equine representations (Cheynier, Breuil, 1963). It is difficult to define the exact chronological role of these complexes in pre-Magdalenian parietal art. More recently, R. Pigeaud pointed out a stylistic complex defined by "[...] Mayenne-Sciences-Roucadour-Pair-non-Pair,

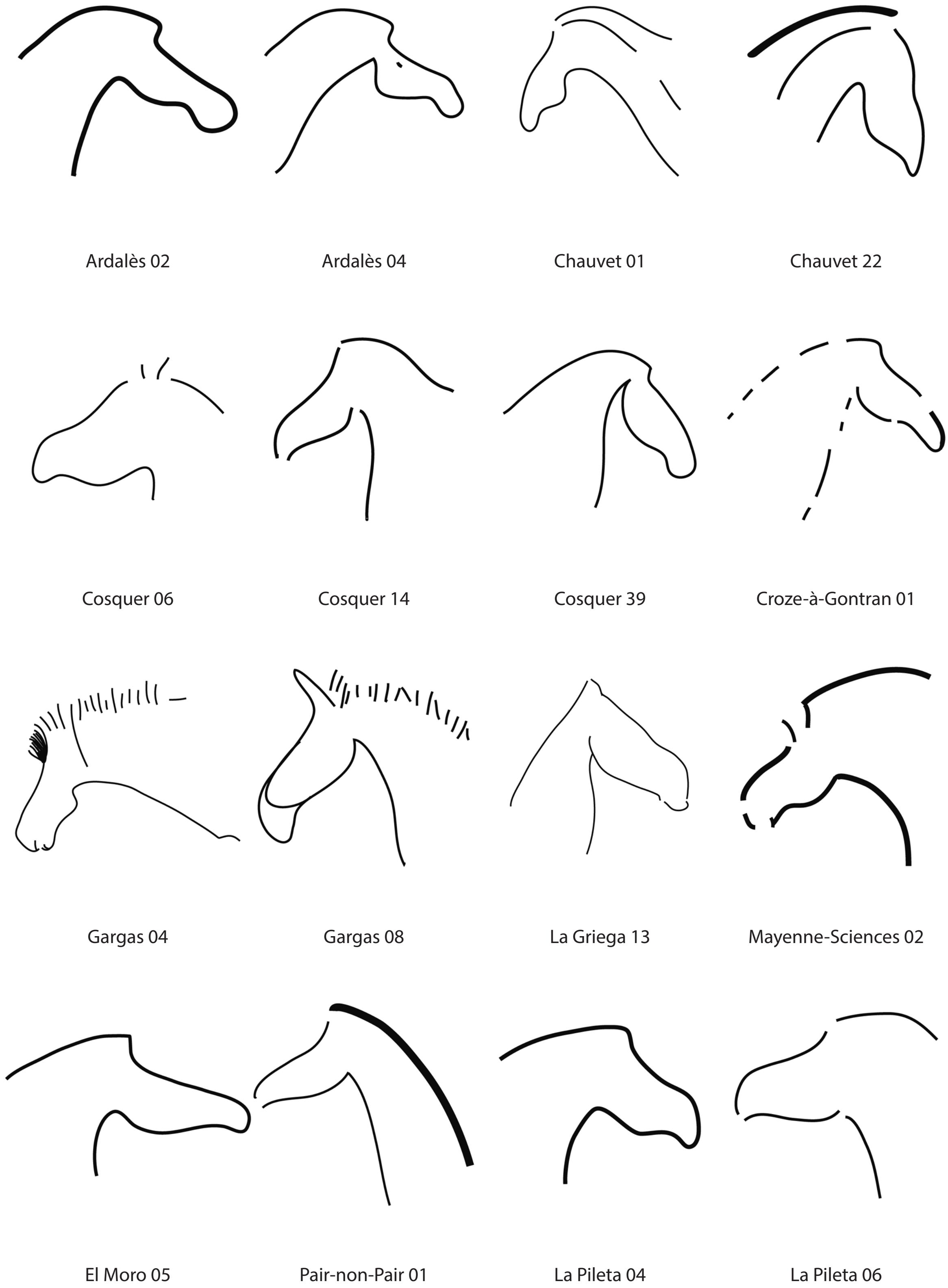

Figure 1 - Horses with “ducks bills” after : Chauvet 01 (D. Baffier/V. Feruglio) ; Chauvet 22 (E. Guy) ; Pair-non-Pair 01 (B./G. Delluc) ; Croze-à-Gontran 01 (B./G. Delluc) ; Ardalès 02-04 (P. Cantalejo Duarte) ; Gargas 04-08 (C. Barrière) ; Cosquer 06-14-39 (J. Clottes) ; Mayenne-Sciences 02 (R. Pigeaud) ; La Pileta 04-06 (J. L. Sanchidrian Torti) ; El Moro 05 (S. Ripoll Lopez) ; La Griega 13 (G. Sauvet).

all three of which include horses with "duck bills" and linear tails, a comma-shaped nostril and, for Mayenne-Sciences and Pair-non-Pair, a half-twisted ear in perspective" (Pigeaud, 2005: 260). Thus, if we consider the relatively consensual Aurignacian attribution for Pair-non-Pair, and the remaining chronological uncertainties for La Croze-à-Gontran and Ardalès, certain "duck-billed" horses clearly precede what E. Guy calls the "Gravetto-Solutrean". From Foz Côa to Parpalló, from the Andalusian caves to Mayenne-Sciences, "duck-billed" horses span the whole geographic extension of decorated caves and the entire pre-Magdalenian period (figure 2). Several of the most recent complexes in this chronology show the increasing rarity, then the disappearance of this stylistic criterion, which does not materialize *stricto sensu* in Magdalenian art. The work of V. Villaverde on the Parpalló plaques illustrates this disappearance of the "duck-beaked" horses. The author affirms, on the basis of thousands of portable remains from the Iberian site, that this type of equine head depiction does not continue after the mid-Solutrean (Villaverde *et al.*, 2009). The portable art from Parpalló clearly demonstrates that a stylistic convention can transcend the different materials and the site of Bouil-Bleu backs up this observation. An engraved stone from the site in Charente depicts a "duck-billed" horse. Yet, the records show that the portable art from Bouil-Bleu comes from the Aurignacian layers (Airvaux, 2001). This chronological attribution underlines the presence of formal traits and characteristics from the beginning of the Upper Paleolithic over a very wide geographic area.

Figure 2 - Geographic distribution of "duck-billed" horses (CAD: S. Petrognani, F. Tessier).

The situation is very different for the mammoth and the bison. The proboscidean represents 10.7% of pre-Magdalenian parietal representations and only rarely occurs in the Iberian region, and not at all in Andalusian assemblages. However, the mammoths from Los Casarès, El Arco B, Castillo and El Pindal, all present a concave ventral line. This ventral line also characterizes the engraved mammoth on a plaque from Bouil-Bleu. These observations, associated with the absence of this animal from Magdalenian complexes, underline the importance of this behavior within the scope of the graphic norms chosen by pre-Magdalenian groups for their symbolic depictions.

In the current state of research, the bison is absent from Andalucía and the center of Spain. In the north of France, few bison occurrences are known. The northernmost specimen (Mayenne-Sciences) presents a head-on view of the horns. Like for the ventral line of the mammoth, when the bison is present in a region, the depiction of the horns systematically represents a local domination of frontal perspective. This formal trait becomes rare or disappears during the Magdalenian, when artists opt for more natural perspective.

Is it possible to suggest a distribution pattern for these representation modes throughout time? It would be tempting to begin by examining the earliest occurrences, but future discoveries would overturn a theoretical model only based on a very incomplete record of Paleolithic sanctuaries. Currently, we observe that Chauvet Cave presents these three "early" formal treatments and the greatest number of early Upper Paleolithic dates. However, we refuse to deduce from that that this mode of representation began in Ardéche and then spread from there throughout space and time. Several authors have brought to light elements enabling us to place Chauvet Cave in a wider artistic context. Let us cite, in particular, the comparison of the "hand-dots" from Chauvet, recorded by D. Baffier and V. Feruglio (Baffier, Feruglio, 1998, 2001), with their counterparts in the Grotte aux Points (Gély, 2005). D. Sacchi also underlines the formal similarities between the "arc-shaped" rhinoceros ears from Chauvet with Aldène Cave in Hérault (Sacchi, 2000; Tosello, Fritz, 2004), and the almost identical ear on a representation (rhinoceros) from La Baume Latrone (Azéma *et al*., 2012). This similarity is all the more interesting given that Aldène is now ascribed to a period contemporaneous with the Chauvet parietal art (Ambert *et al*., 2005), and that the main themes of both these cavities focus on felines, rhinoceroses and mammoths.

The Swabian Jura hosts another concentration of Aurignacian artistic representations. The sites of Geissenklösterle, Hohlenstein-Stadel, Hohle Fels and Vogelherd contain many animal statuettes, also depicted on the walls of Chauvet Cave (Clottes, 1995). We will take a closer look at the impact of this thematic similarity as it gives us the opportunity to compare productions on different types of materials from a stylistic viewpoint. It is difficult to propose morphological analogies between these statuettes and the figures from Chauvet Cave. Some authors have pointed to parallels as regards "[...] highly sinuous necklines also observed on two specimens from Chauvet [...] and a figurine from Vogelherd" (Tosello, Fritz, 2004: 85). However, these formal parallels do not stem from a "shared" pre-Magdalenian stylistic base, but more specifically from an Aurignacian "artistic tradition". They show to what extent certain graphic traits reveal precise chronological moments, bound at times to more or less extensive geographic areas.

2 - Aurignacian symbolic "traditions"?

The publication of the dates of the representations from Chauvet Cave (Clottes, 1995) soon led to a comparison between the thematic range of this site with German portable art from the Swabian Jura (Clottes, 1995). The ivory statuettes from southwest Germany represent species such as the bear, but especially the mammoth and the lion, which dominate the walls of Chauvet Cave. This thematic parallel is all the more striking, given that these animals are only rarely depicted in Paleolithic parietal art and that the portable art from the Swabian Jura, is like Chauvet, associated with a very early Upper Paleolithic phase. Although researchers have been convinced for a long time of the early age of these sculpted, rounded figurines (Riek, 1934; Hahn, 1986), the Aurignacian chronology of these objects was only revealed over the past twenty years through a series of radiocarbon and TL dates, yielding ages between 36 000 and 30 000 BP (Richter *et al*., 2000; Conard, Bolus, 2003; Conard, 2003, 2005; Conard, Floss, 2010). The sites of Geissenklösterle, Hohlenstein Stadel and Vogelherd contain a concentration of statuettes, in addition to the recent discoveries from Hohle Fels (Conard, 2003), including a very similar "lion-man" to the figurine from Hohlenstein-Stadel dated to around 32 000 BP (Conard, Bolus, 2003), as well as a small feminine statuette discovered in 2008 in Hohle Fels. These four sites represent the hub of a chronologically and thematically consistent zone of artistic profusion. The discovery of a mammoth statuette at Vogelherd, during excavations by N. Conard in 2007, underlines the consistency of the Swabian Jura sites.

La Grande Grotte at Arcy-sur-Cure is also probably part of this early "tradition". This site comprises a majority of mammoth representations, but also a bear, a feline, two horses and a bison, all attributed to the Aurignacian-Gravettian (Baffier, 2005). These shared characteristics are also manifest at Aldène Cave, Hérault, which appears to represent the southernmost extension of the Aurignacian symbolic current. The range of themes at this site is dominated by rhinoceroses and felines, as well as one mammoth representation. According to a recent study and flowstone dating, these representations are chronologically situated between 37 000 and 24 400 BP (Ambert *et al.*, 2005). This relationship between the Rhone and Rhine valleys represents a real artistic "tradition" with shared animal themes, but how does Aurignacian art in the southwest of France and in Italy fit into this wider picture?

The animal themes from Bernoux Cave in Dordogne have been related to the range of subjects depicted in the Swabian Jura and on the walls of Chauvet Cave (Clottes, 1995). Recently, B. and G. Delluc identified a mammoth, a rhinoceros and a bear in Bernoux (Delluc, Delluc, 1991). For us, the latter representation does not depict a bear (Petrognani *et al.*, in press) (figure 3), but the association of the mammoth and the rhinoceros relates Bernoux to Aurignacian "tradition" sites in the Rhone and Rhine valleys. Other artistic productions, on different types of mediums, provide a regional context for the Aurignacian themes. The engraved stones from Chanlat (Corrèze) are also part of this Aurignacian range of themes "with a bear engraved on one side and a mammoth on the other' and "a plaque of schist presenting traces of a bear or a rhinoceros outline" (Delluc, Delluc, 1991: 298). On the other hand, Jean Clottes notes that 32% of the animals identified by B. and G. Delluc in complexes "considered to be archeologically dated to the Aurignacian" are mammoth, rhinoceros or bear representations (Clottes, 1995: 24). The ibex is predominant at these sites, accounting for 35% of all illustrated animals. They are recorded at Jovelle, Belcayre, Croze-à-Gontran and Abri Pataud-Movius, and establish a link between the six caprid representations

Figure 3 - Engraved feline from Bernoux Cave (drawing: S. Petrognani).

at Pair-non-Pair. These ibex images outnumber the five horses and three mammoths. The proboscideans recall the Aurignacian themes, in keeping with the recent chronological attribution of the site after the re-examination of the François Daleau excavations (Sauvet *et al*., 2007).

The Aquitaine sites recorded as Aurignacian correspond well to this Aurignacian "horizon". There is no evidence of different "traditions" or of a noticeable rupture between the artistic productions from the Swabian Jura and the Rhone Valley and those from the southwest of France. The predominance of the ibex in Aquitaine and the feline in the Rhone and Rhine valleys represents regional variations. Unfortunately, the collapsed parietal blocks from la Ferrassie and Blanchard do not provide any insights into our perception of the earliest phases of Upper Paleolithic art, but remind us that our knowledge of this period is truncated and subject to the conservation of remains. The abundant vulvas on decorated blocks from Dordogne find echoes in Chauvet Cave, and emphasize the important role of feminine images in this Aurignacian artistic tradition.

The horse is not often brought to the fore in thematic approaches to early phases, yet appears as a constant iconographic element of Aurignacian art. Equine figures are discreetly present and represent 8% of the animals in the southwest of France, 10% of the German representations, and 9.6% in Chauvet Cave (Clottes, 1995; Conard, 2005). But the depiction of horses is often spectacular due to techno-stylistic methods or the topographic location of these animals. The *Agnus Dei* horses in Pair-non-Pair or the Horse Panel in Chauvet are good illustrations of this. For the time being, no horses have been identified on the decorated stones from the site of Fumane, in the Plain of Veneto. These rock fragments are elements of the colored walls and generally bear incomplete images with paint extending over the fractured surfaces (Broglio *et al*., 2005). A frontal view of an anthropomorphic silhouette has been identified. The radiometric dating of the archeological layers containing these cave wall fragments, as well as traces of hematite identical to the pigment used for these paintings, indicate ages between 35 000 and 32 000 BP (Broglio *et al*., 2005). N. Conard suggests different "Aurignacian artistic traditions" for these spatially dispersed symbolic concentrations (Conard, 2005). This cultural diversification of symbolic depictions is also proposed by F. Bon, in his technological study of the early phases of the Aurignacian in the South of France (Bon, 2002). The author recalls that "[...] although it is still impossible to correlate these artistic expressions with industrial facies [...], it appears that, within the artistic domain, the Aurignacian conveys different traditions" (Bon, 2002: 184).

3 - Gravettian images: between continuity and originality

The Pyrenean site of Gargas Cave is the most important rock art complex associated with the Gravettian. This site contains a corpus of over a hundred animal figures and 250 hands. The animals depicted are dominated by the horse/bison combination which represents nearly 75% of the identified animal representations. Due to this fact, as well as the absence of the rhinoceros and felines in the cave, J. Clottes advanced the hypothesis of a "[...] thematic change [...] in the South of France from the beginning of the Gravettian onwards" (Clottes, 1995: 29). The seven mammoth representations in Gargas qualify this conclusion and reflect the proboscideans from other complexes from the same epoch. The mammoth is predominant at Pech-Merle with 27 occurrences and represents 28% of the identified animal figures at Cougnac. For the time being, our knowledge of the parietal art from Cussac Cave is limited, but the presence of mammoths also appears to be characteristic of the site. These complexes are directly related to the Gravettian period and underline the important role of a major Aurignacian theme. The mammoth depiction from the Chouettes du Tréfonds gallery at Trois Frères is also consistent with this idea and reinforces the techno-stylistic link between the gallery of this cave and Volp and Gargas (Bégouën, Clottes, 1987).

The presence of the mammoth points towards relative thematic continuity with earlier sites and this continuity is underscored by the occurrence of hand prints. The latter are present in Chauvet Cave, but also in the Grande Grotte of Arcy-sur-Cure during an early period (Baffier, 2005), and herald the geographic and quantitative explosion of these representations during the course of the Gravettian period. The irrefutable importance of hand prints during the Gravettian remains unmatched during subsequent periods. Another theme related to the Aurignacian tradition that also undergoes a spectacular pan-European expansion during the Gravettian is that of feminine representations. The latter are depicted by vulvar images on decorated blocks in Dordogne and in Chauvet Cave, where they denote a marked change of image. Gravettian groups abandoned segmented feminine representations and opted for more complete, very stylized depictions. From cave walls in the southwest of France to the plains of Ukraine, Gravettian Venuses are represented on all kinds of mediums: on blocks (Laussel), portable clay art (Dolni Vestonice), in stone (Willendorf), or in ivory (Lespugue). This characteristic portrayal of the feminine image denotes symbolic unity across the continent between 22 000 and 21 000 BP, and points to the tight cultural unity of Gravettian groups over long distances. The feminine image is still present in symbolic Gravettian imagery, but the animal themes from Central and Eastern European sites display the most spectacular continuity with Aurignacian subjects.

Portable Pavlovian and Kostienkian art provides the best illustration of this Aurignacian-Gravettian continuum in the form of the symbolic animal bestiary in the East of Europe. The Pavlovian includes statues of 21 bears, 8 mammoths, 9 felines, 6 horses, 6 birds, 4 rhinoceroses, 1 caprid, 1 cervid and 11 small carnivores, "[...] at Dolni Vestonice, for example, the most frequently represented animals are felines and bears" (Kozlowski, 1992: 68). This range of themes is similar to Kostienkian portable art for which J. Hahn identified 36 mammoths, 11 birds, 8 rhinoceroses, 6 felines, 5 bears, 3 horses, 2 bison, 1 caprid, 1 cervid, 1 small carnivore and 17 non-identified animals (Hahn, 1990). These themes are strikingly similar to those represented in Chauvet Cave, but also to the ivory statuettes from the Swabian Jura. Given the persistence of certain parietal themes like the mammoth or the megaloceros, but also hand prints, there would appear to be relative continuity between the Aurignacian "artistic tradition" and Gravettian themes. However, in the light of the immense geographic and temporal expanse under consideration here, it is imperative to remain cautious.

For C. Fritz and G. Tosello "[...] it appears that Aurignacian and Gravettian parietal art presents thematic [...] and perhaps even stylistic affinities. Considering the available dates and records, a certain Aurignacian-Gravettian continuum exists and at times it is not easy to resolve the matter solely on the basis of formal criteria" (Tosello, Fritz, 2005: 84). Although we can discard the idea of a rupture between these two chronological phases, the omnipresence of hand prints or the characteristic representation of the feminine image are original elements typical of the Gravettian "symbolic tradition" in Europe between 28 000 and 22 000 BP.

4 - The Solutrean: a move towards a regionalization of artistic representations

Between approximately 22 000 and 17 000 BP, Europe underwent a very cold and dry period corresponding to the Last Glacial Maximum. Groups of hunter-gatherers were no longer bound by strong cultural unity across the continent and the Solutrean technocomplex developed in a relatively limited western European territory (Aubry, 1991). The decorated sites related to this chronological period cover a relatively extensive zone. The complexes of Placard, Gabillou or the sculpted art from Roc-de-Sers, Fourneau du Diable and Abri du Poisson are examples of Solutrean art in the southwest of France. The sites of Oulen, Chabot, Bayol, Ebbou, or Tête-du-Lion are part of the parietal corpus from the Rhone during the same period, whereas the Iberian Peninsula, with the complexes from the Côa Valley, Parpalló, or the Andalusian sites of Ardalès or La Pileta, illustrates the southernmost extension of Solutrean art.

The Cantabrian region in the North of Spain is also marked by the presence of Solutrean art. However, most of the early parietal art in this region is associated with Magdalenian representations and Solutrean art is thus difficult to identify due to the scarcity of direct absolute dates. From a thematic viewpoint, regional traits can be observed. On one hand, the doe and the horse are predominant, accounting respectively for 31.8% and 17.9% of the animal representations. On the other hand, the abstract patterns, in particular quadrangular signs, make up a key element in the interpretation of pre-Magdalenian Cantabrian art. This thematic originality is emphasized by the almost systematic use of red pigment for parietal representations (González Sainz *et al.*, 2003; Garáte Maidagan, 2006). This iconographic unit, which also encompasses techniques, brings to light a phenomenon of symbolic regionalization. No evidence currently relates the Cantabrian artistic representations to those of other regions. What of the other symbolic territories? Do they confirm this trend?

Cave art from sites in the Rhone Valley such as Oulen, Chabot, Bayol, Ebbou, or la Tête-du-Lion, is similar to "early" parietal art from Quercy (Combier, 1984; Lorblanchet, 1989). The high frequency of the mammoth and certain graphic conventions, such as portraying the limbs in an "X" shape or the ventral mammoth line in a "horse shoe" shape, are traits representing a parallel between Quercy and Solutrean art from the Rhone. These parietal complexes attributed to a Solutrean phase illustrate the development of a regionalization trend. Red does are predominant in Cantabria, the mammoth is widespread in the Rhone Valley and the horse is the principal animal in Aquitaine. Portable art from Central and Eastern Europe presents few Solutrean traits; Gravettian art subsists and is directly followed by the Magdalenian with "inversed themes", such as the predominance of the horse / bison combination for sculpted objects. In our opinion, this thematic Solutrean regionalization is part of the development of graphic rigidity, a theme developed below.

5 - Diversity and formal rigidity: discussion and conclusion

The conclusions of our formal analysis of horses, the inter-specific comparison of the portrayal of limb extremities, cervid antlers or bovine horn perspective, emphasize the decrease in diversity in the range of stylistic resources used by Paleolithic groups. Given these data, we advocate a "pre-Magdalenian parietal" art sequence (figure 4). The graphic standards imposed by the group become more rigid and the range of graphic possibilities decreases considerably for prehistoric artists, to such an extent that they become set and limited to certain formal representations. The establishment of a coding process is already in motion in Chauvet Cave and is just one stage of the process. The standardization of bison heads or the ventral line of the rhinoceros illustrates the existence of mental schemas at Chauvet. The formal analysis by C. Fritz and G. Tosello underlines that "[...] Chauvet Cave is double-faceted. A certain stability transpires through the respect of affirmed graphic conventions, but the dominant impression is one of originality, creative effervescence prompting the artists to test various formulas, for each representation, each panel or monumental composition" (Tosello, Fritz, 2005: 167). The spectacular use of the third dimension heightens this impression of creativity and opportunism at Chauvet: a bison head depicted from a frontal view on a first wall, and with a profile view of its body on a second wall orthogonal to the first, giving this representation exceptional perspective (figure 5). The formal aspect of certain

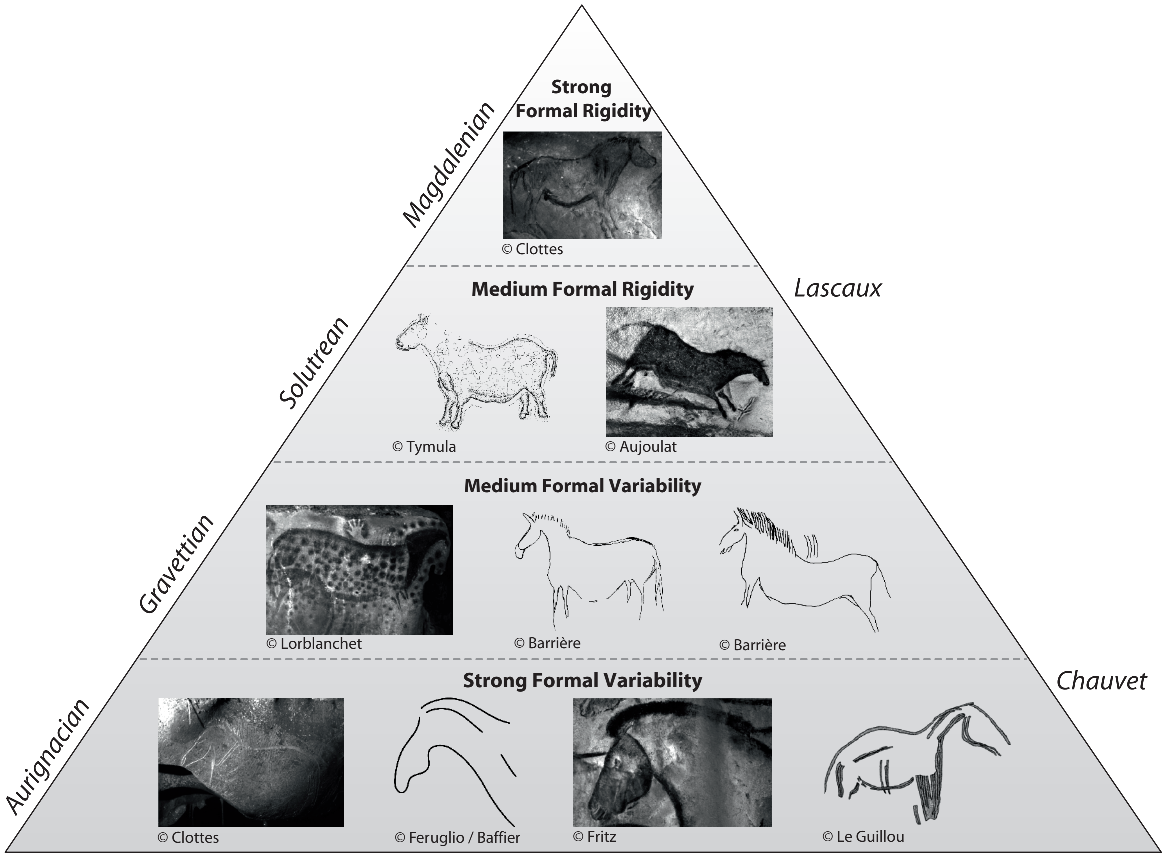

Figure 4 - Proposition for the sequencing of Paleolithic parietal art (CAD: S. Petrognani).

Figure 5 - Black bison from Chauvet Cave
(photo: J. Clottes / Ministry of Culture and Communication, DRAC Rhône- Alpes).

figures from Chauvet Cave or ivory statuettes from the Swabian Jura clearly shows that the full range of iconographic possibilities was already mastered by the first Upper Paleolithic artists. "It appears that progress is an alien concept to the world of art and representation, or at least as far as figurative art is concerned [...]. The opinion focusing on the storage and improvement of artistic knowledge with the sole aim of achieving a "perfect" naturalism is based on the concept of technical progress, as if art shared the same ultimate aim as the efforts of subsequent generations" (Tosello, 2003: 537).

At the end of the "early" period, complex and repetitive geometric symbols appear in several sites, raising the question of a possible regional dimension. The presence of these signs at the end of this period, perhaps even at the junction of the early period and the Magdalenian could herald the emergence of constructed Magdalenian signs. The tectiform symbols in Dordogne and the claviform symbols in the Pyrenees would thus represent the outcome of increased codification and the regionalization of complex abstract shapes. D. Vialou underlines that "[...] the abundance and the extreme typological diversity of Magdalenian parietal signs provides evidence of a profound change in relation to previous cultures, [...] the abstract codification of graphic representations is preponderant" (Vialou, 1989: 182). What are the implications of this decrease in graphic representations and the increase in codification throughout time? If we consider the terms diversity and rigidity through the prism of social analysis, we can attempt to evoke the concept of "artistic freedom" (Petrognani, 2013). Does this decrease in "freedom" throughout time, with increasingly stricter representation codes, reflect an ever more complex social organization, with increasing control over its images and symbolic productions? The relationship between the prehistoric artist and the group appears to evolve throughout the Upper Paleolithic. The influence of society on the formal characteristics of the figures is increasingly important, leading to a reduced stylistic range. C. Lévi-Strauss recalls that "art is [...] the conveyor of collective language; in order to remain significant, it must be incorporated into a system of stable codes controlled by the group, which is its guarantor" (Lévi-Strauss, 1961: 65). The study of art from "early" periods shows to what extent prehistoric society becomes increasingly "normative" until the advent of Magdalenian art. Collective images are ever more important and leave less and less leeway for the individuals responsible for portraying symbolic imagery on cave walls, representing the group to which they belong.

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EVALUATING AURIGNACIAN ART IN IBERIA...

If it Really Exists

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EVALUATING AURIGNACIAN ART IN IBERIA...

If it Really Exists

Diego GARATE, Olivia RIVERO, Joseba RIOS-GARAIZAR

Abstract

Recent discoveries over the past years have confirmed the existence of figurative art from the very beginning of the Upper Paleolithic. Researchers have focused on the identification of this phenomenon in some regions (Dordogne, Ardeche or Swabian Jura), whereas others, such as the Iberian Peninsula, have been somewhat neglected. After a thorough analysis of the Iberian artistic record, we are now in a position to characterize the early stages of figurative art (both portable and rock art), which was mainly concentrated in the northern region of the Iberian Peninsula. This concentration corresponds to the dense distribution of archeological sites attributed to the Aurignacian culture. Although the existing literature is at times incomplete or somewhat inconclusive, we consider an attribution to Aurignacian art to be possible in certain cases.

Keywords

Aurignacian, dating, rock art, portable art, Iberian Peninsula

Introduction: towards a new paradigm for the origins of Paleolithic art

In the last years, abundant information pertaining to the knowledge of the origins of graphic activity in Europe has become available, giving rise to the proposal of a new paradigm. This new paradigm renders the conception of progressive art (from the rudimentary towards the excellent) obsolete and instead considers that art in finished form appeared at the beginning of the Upper Paleolithic and mastered the different graphic techniques.

The ^{14}C dates on paintings and contextual dating from Chauvet Cave using different dating systems and laboratories have yielded similar results. These dates partly corroborate an attribution to the Aurignacian culture (Genty *et al*., 2004; Valladas *et al*., 2005; Cuzange *et al*., 2007; Sadier *et al*., 2012). In addition, the recent ^{14}C dating of other major sites: Aldène (Ambert *et al*., 2005), Baume Latrone (Azéma *et al*., 2012), Abri Castanet in Dordogne (White *et al*., 2012), the revised dates from other sites in this same region (Chiotti *et al*., 2007), in Quercy (Lorblanchet, 2007), the painted slabs from the site of Fumane (Broglio *et al*., 2005) or the rock art in Coliboaia (Clottes *et al*., 2010-2011), are examples of a new reality. Former theories on early art based on chronostylistic comparisons, such as A. Leroi-Gourhan's "style I" (Moro-Abadía, Garate, 2012) are thereby rendered obsolete.

1 - The first modern human occupations in the Iberian Peninsula

The Aurignacian in the Iberian Peninsula displays an irregular distribution. On the one hand, the Cantabrian region in the north, the western and eastern Pyrenees comprise many Aurignacian sites, some of which contain several levels and many of which include characteristic tools. On the other hand, in the center and the south of the Peninsula, the presence of the Aurignacian has only been confirmed at a few sites with limited and rather uncharacteristic collections.[1]

Proto-Aurignacian toolkits have only been clearly identified in the north of the peninsula, mainly in the Cantabrian region. This latter area, along with south-western France, and in particular the sites of Isturitz and Gatzarria, make up one of the major distribution zones of this techno-complex (Barshay-Szmidt *et al*., 2012; Normand *et al*., 2007; Sáenz de Buruaga, 1991; Szmidt *et al*., 2010; Tartar, this volume). The main levels with this type of toolkit are identifiable at Labeko Koba (VII-V), Cueva Morín (9 – with reservations - and 8), at Covalejos (C), Castillo 16 and La Viña (XIII) (Arrizabalaga, 2000; Fortea *et al*., 2010; Maillo-Fernández, 2002; Maíllo-Fernández, Bernaldo de Quirós, 2010; Maroto *et al*., 2012; Rios-Garaizar, 2012; Sanguino, Montes, 2005). In Catalonia, the sites of Arbreda, Reclau Viver or Abric Romaní (Camps, Higham, 2012; Ortega Cobos *et al*., 2006; Vaquero, Carbonell, 2012), display marked similarities with the proto-Aurignacian series from the southeast of France and the north of Italy (Bazile, 2002). The available dates for this period are problematic, as they range between 39 500 and 38 500 cal BP, and are thus 2 000 years older than the Proto-Aurignacian from Arcy-sur-Cure or Les Cottés (Hublin *et al*., 2012; Talamo *et al*., 2012).

The early Aurignacian is not as well represented in the Cantabrian region. It has been identified in the sites of Labeko Koba, Ekain, Polvorín, Covalejos, Morin, Pendo, Castillo and La Viña (Arrizabalaga *et al*., 2009; Fortea Pérez, 1995; Rios-Garaizar, 2011; Sanguino, Montes, 2005). In the eastern Pyrenees, it is present in the sequences of Arbreda or Reclau Viver, as shown by the occurrence of split-based bone points (Liolios, 2006; Soler i Masferrer, Maroto, 1987), and, to a lesser extent, in levels 479D of Cova Gran de Santa Linya (Martínez-Moreno *et al*., 2010). Dates for this techno-complex are sparse and display marked convergence with the evolved Aurignacian. This dearth of sites contrasts sharply with the abundant sites in the south-western end of France (Barshay-Szmidt *et al*., 2012; Bon, 2000; Normand, 2002; Sáenz de Buruaga, 1991).

Evolved Aurignacian levels occur in Gatzarria, Isturitz, Aitzbitarte III, Antoliñako Koba, Askondo, El Otero, Cobrantes, Cofresenedo, La Garma A, El Pendo, Morín, El Castillo, Ruso I, Hornos de la Peña or La Viña, mainly in the center of the Cantabrian region (Barandiarán Maestu *et al*., 1996; Rios-Garaizar *et al*., 2013). Currently available dates range from 34 000-30 000 cal BP, and are thus slightly more recent than the Abri Pataud dates (Higham *et al*., 2011) and similar to those from Isturitz (Szmidt *et al*., 2010). In the Cantabrian region, several lithic elements point to continuity with the Gravettian (Rios-Garaizar *et al*., 2013). The evolved phases of the Aurignacian are also present in Abric Romaní and Arbreda (Soler i Masferrer, Maroto, 1987; Zilhão, 2006a), with a date of 33 000-32 000 for level G of the latter site (Maroto *et al*., 2012).

Evidence of the Aurignacian south of the Ebre is less plentiful and difficult to contextualize. We can cite level C of Peña Miel Cave, dated between *ca*. 41 000-39 000 cal BP (Montes *et al*., 2001), although these dates are considered to be questionable (Zilhão, d'Errico, 1999). In Portugal, the number of sites attributed to the Aurignacian is also low and generally concerns the most recent periods (Aubry *et al*., 2006). The site of Pego do Diablo or the open-air sites of Rio Maior Basin are examples of these (Zilhão, 2006b; Zilhão *et al*., 2010). In Andalucía, the sites of Bajondillo (Cortés, 2007), Gorham and Zafarraya may correspond to this period, although the latter two are controversial (Barroso Ruiz, 2003; Finlayson *et al*., 2008; Zilhão, Pettit, 2006; Zilhão, 2006a). In the Spanish Levant, the sites of Cova Beneito, Cova Foradada and Mallaetes (Casabó, 2001; de la Peña, 2011; Fortea, Jordá, 1975; Iturbe *et al*., 1993; Pantoja *et al*., 2011; Villaverde *et al*., 1998; Tejero, 2013; Zilhão, 2006a) are associated with recent Aurignacian phases but yield problematic dates.

1. The dates are given as BP dates. The ^{14}C dates were calibrated with OxCal and given with confidence intervals of 95.4%.

Thus, the Aurignacian expansion further south in the Iberian Peninsula only appears to have begun during the recent phases (around 32 000 cal BP), as attested by several remarkable sites in the Mediterranean zone (for example, Beneito) and in the Cantabrian region (for example, Aitzbitarte III). In the rest of the peninsula, the increase in populations seems to begin during the Gravettian (de la Peña, Vega Toscano, 2013; figure 1).

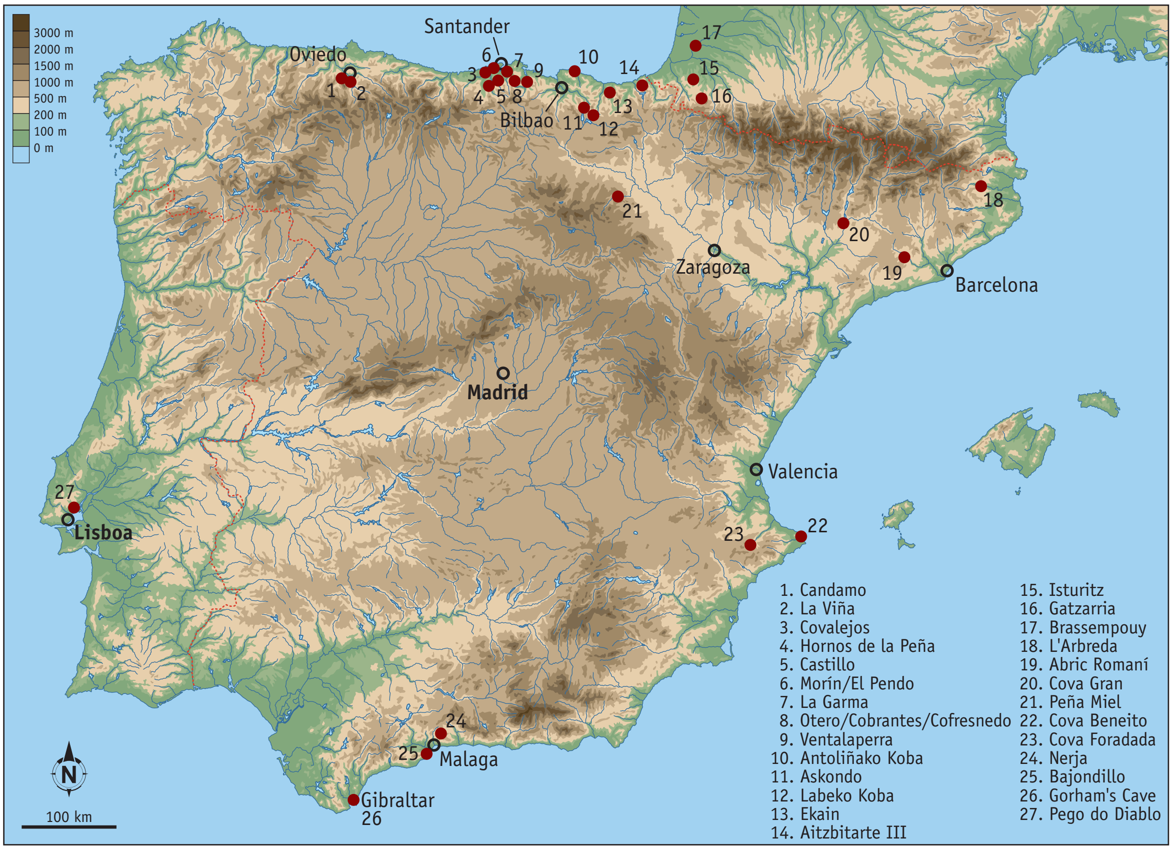

Figure 1 - Main Aurignacian sites from the Iberian Peninsula (CAD: F. Tessier).

2 - A critical reappraisal of the first artistic expressions in the Iberian Peninsula: striking a balance between certainty and caution

The identification and characterization of the repertoire of symbolic manifestations attributed to this period in the Iberian Peninsula is not easy for two main reasons. Firstly, in some cases, the archeological contexts and stratigraphies are somewhat uncertain, particularly for early excavations. Secondly, as most of the portable art is non-figurative, the symbolic nature of these representations is often unclear.

A - Portable art

The first question, the very definition of the category of "portable art", has already been debated by a number of archeologists (D'Errico, Vanhaeren, 1999). In Cantabria, different objects of diverse types have been classified in this category for many years: decorative elements, decorated bone fragments, decorated bone tools, etc. (Barandiarán, 1973; Corchón, 1986).

This (too) wide heterogeneity incited us to organize the existing data on this subject in a different way, by separating the ornamental or decorative objects from the rest of the complex, broadly referred to as decorated objects.

a - Decorative objects

The general evaluation of the currently available information highlights the lack of quality images for most of the objects. This is particularly unfortunate for the objects with uncertain taphonomic processes and / or where the anthropogenic nature of the incisions is questionable. For some pieces, after renewed microscopic analyses, the incisions turned out to be defleshing cutmarks, as for example in Castillo (Zilhão, d'Errico, 2004). Similar doubts can be raised for the "incised" bone fragments from levels 6 and 5 of Cueva Morín, or for the 21 bones with "intentional marks" from level B8-B9 in Beneito (Iturbe *et al*., 1993).

In addition, the identification of portable art is also subject to vague chronological attributions. This applies to a considerable part of the record, in particular to objects identified in the early excavations, such as the engraved bone from El Salitre. Due to the stratigraphic problems at El Pendo and Hornos de la Peña, the portable artistic production from these sites must also be approached with caution (Corchón, 2004).

In other cases, such as Santimamiñe and Lumentxa, the revision of the stratigraphy and/or the archeological materials reveals that the assertion of Aurignacian occupation is not founded (López-Quintana, 2011; Garate, 2012). The objects from these sites attributed to this period must therefore be excluded from present counts.

Evidence of portable art in the Iberian Peninsula is thus radically reduced. No figurative elements can be confidently identified. The several examples given below are from the Cantabrian coast:

- on bone supports: an engraved metapodial from level 18 of El Castillo; an engraved bone from the excavations of level D by H. Obermaier (Corchón, 2004); a rod in cervid antler from level IV of Labeko Koba (Mujika, 2000); a bone engraved with parallel lines from lower level 13 and a bone point with parallel notches from level 13 of the western sector of La Viña (Fortea, 1992); a bone point decorated with linear incisions from level 7 of El Rascaño (Corchón, 1986);
- on stone support: the slab from level Vb of Aitzbitarte III, with a row of parallel lines (Garate, Ríos, 2011); a pebble from Labeko Koba with two convergent incisions (García-Díez, Arrizabalaga, 2000); the triangular slab with linear incisions from El Castillo 18c (Bernaldo *et al*., 2010); four slabs from level 2 of Covalejos that appear to be decorated with abundant incisions, although only a tracing with no photographs has been published (Sanguino, Montes, 2005; figure 2). As for the pebble from La Viña (Fortea, 1992), no rendering has been published so far, and therefore the decorated nature of this piece cannot be confirmed.

b - Perforated objects

The same problems apply to the corpus of perforated objects (which includes decorative elements), as regards the anthropogenic nature of the perforations or the uncertainty of their chronological attribution. In the same way as for engravings, the microscopic analysis of the perforations is essential to rule out a non-anthropogenic origin. The revision of a substantial part of the perforated material from the Cantabrian coast and the Ebro Valley by E. Álvarez-Fernández (2006) guarantees the reliability of the currently available data for these regions.

For certain objects, the ambiguous nature of the perforations has been pointed out, such as a phalanx from level VI (Mousterian) from Lezetxiki with a perforation identified as resulting from carnivore activity (d'Errico, Vanhaeren, 1999). The same is true of the "naturally perforated"

Figure 2 - Examples of Cantabrian portable art assigned to Aurignacian. The pieces of El Castillo on bone support (A, B, C) (Bernaldo *et al.*, 2010) are not regarded today any more as decorated objects (Zilhão, d'Errico, 2004). Lithic supports like the one of Labeko Koba (D) (García Díez, Arrizabalaga, 2000), Aitzbitarte III (E) (Garate, Ríos, 2011) and El Castillo (G) (Bernaldo *et al.*, 2010) only show some linear features. The case of the engraved frontal of Hornos of Peña (F) (Texnai) would be the only example of figurative Aurignacian art in the Iberian Peninsula, but its stratigraphic attribution remains problematic.

shells from the site of Cova Gran de Santa Linya, categorized as "shell ornaments" on the basis of wear marks (Martínez-Moreno *et al*., 2010).

Doubts as to the chronological attribution of certain perforated pieces also surround the site of El Pendo. Six perforated pieces in gypsum (talc) were recovered from level VII during the early excavations of the site. In spite of the chronological doubts about this level, this type of object presents marked analogies with two other gypsum (talc) pebbles from the Aurignacian level of La Garma A (Arias, Ontañón, 2004). A similar hypothesis could be suggested for a gypsum (talc) pendant found out of context in the cave of El Arco B (González-Sainz *et al*., 2003). This type of object is also present in Aurignacian contexts in the north of the Pyrenees, like Gatzarria (Álvarez-Fernandez, 2006), which points towards an Aurignacian attribution for these pieces of uncertain chronology.

In spite of these factors, the corpus of perforated objects in the peninsula is significantly more numerous than that of decorated objects, and in general they can be assigned to the more recent phases of the period. The majority of pieces are beads made on marine or fluvial shells from the Mediterranean or the Atlantic. The presence of Mediterranean shells in sites located on the Atlantic coast or vice versa, like in other regions, in particular in the Castanet and Blanchard sites (Dordogne), is currently unknown in Iberia. The number of perforated pieces is considerable (e.g. 14 pendants and 12 shells from level 2 of Covalejos or 18 pendants from level B8-B9 from Beneito (Sanguino, Montes, 2005; Iturbe *et al*., 1993). This could be considered to be the result of the use of these pieces on a single set (a necklace or an item of clothing), as at Isturitz where a series of 73 beads was retrieved from a hearth in the Aurignacian level (Saint-Périer, Saint-Périer, 1952), or at Tuto de Camalhot, where two groups of 60 and 30 shells suggest a similar scenario (Vezian, Vezian, 1970).

Decorative objects on teeth (deer canines, carnivore incisors) are also abundant but are generally isolated finds (e.g., Cobrantes, La Garma A, El Ruso I, Covalejos, El Conde, El Castillo, Cueva Morín, l'Arbreda H, Abric Romaní, Reclau Viver, Mollet, Cova Foradada or Cova Beneito) (Álvarez-Fernández, 2006; Vanhaeren, D'Errico, 2006).

B - Rock art

The data for rock art are based on different dating systems (Sauvet, this volume) which yield more or less accurate information. The cross-referencing of these systems should enable us to confirm or at least to clarify the chronological attributions (table 1).

Dating system	Stratigraphy	Context	TL	U/Th	^{14}C AMS
Sites	La Viña	Altxerri	Pondra	La Garma	Peña Candamo
	El Conde	Tito Bustillo	La Garma	Castillo	
		Nerja		Altamira	
				Tito Bustillo	

Table 1 - Sites revealing a parietal art in Iberian aurignacian and dating system employed for each case.

a - Sedimentary stratigraphy

Parietal representations in direct relation with the stratigraphic layers are rare, but nonetheless provide *ante quem* information by correlating the dates of the levels with those of the rock walls.

In the Cantabrian region, and more specifically in the upper Nalón Basin, two sites provide this type of data; La Viña and El Conde. In the La Viña rock shelter, two graphic complexes were identified according to their height on the wall: a lower pre-figurative complex and an upper figurative representation. They were attributed to two separate phases (Fortea, 1992). Nonetheless, these two complexes are partly superposed in the central sector of the rock shelter. In other sites, where two complexes have also been identified, they are not considered to belong to two diachronic phases. This is the case, in particular, at Venta Laperra, where the synchronic nature of the two separate phases has not been questioned. In addition, two TL dates on each complex yield a similar result of approximately 25 500 calendar years (Arias *et al.*, 1999). In the case of Hornos de la Peña, a limestone block located outside the site (destroyed at the beginning of the 20th century) displayed figurative representations, a bison and a doe, as well as a series of vertical lines. These engravings shared the same space in much the same way as the engraved bison in the deep zone of Chufín (González-Sainz, 2000). In the central sector of La Viña, for J. Fortea, "the first and the earliest Gravettian levels covered the lower third of the vertical incisions" (Fortea, 1992: 27). Moreover, the last Gravettian level was only separated from the figurative engravings by 60 cm. Given the available manual access, all of the engravings are probably linked to earlier occupations, like level VIII which corresponds to the Aurignacian.

In El Conde Cave, series of vertical lines on both walls of the entrance have been covered by archeological deposits. The revision of the excavated material led to the establishment of an *ante quem* date of 28 417-27 676 and 26 511-25 866 cal BP, that is to say, Gravettian (Fortea, 2000-2001). More recently, a study of the engravings and their position in relation to the archeological layers suggests that the cave wall paintings would be contemporaneous with the sedimentation in levels 2A and 2B, dated between 36 260-34 696 cal BP and 34 584-33 462 cal BP (Fernández-Rey *et al.*, 2005), that is to say, attributable to the evolved Aurignacian.

b - Archeological context

In some cases, it is possible to establish more or less close links between the artistic representations and other types of activities carried out nearby, in the absence of any sedimentological connections.

In the Iberian Peninsula, very few examples of this type of dating are available, and these are often very controversial. At Nerja, for example, a link was envisaged between the decorated walls and a charcoal date from the back of the Cataclysm Chamber of 40 795-39 032 cal BP, whereas in other parts of the same karstic network, other ^{14}C dates correspond to diverse phases of the Upper Paleolithic (Romero *et al.*, 2010-2011). In the case of Altxerri B, three dates on bones found at the base of a decorated panel close to charcoal and ocher remains yielded dates of 41 560-36 073, 35 705-32 445 and 39 343-38 454 cal BP. The absence of evidence of later activity in the cavity lends support to the association between the remains identified at the base of the wall and the cave wall representations (Gonzalez-Sainz *et al.*, 2013). At Tito Bustillo, although only one date of 38 420-36 137 cal BP is available for the annex context in the Anthropomorphic Gallery (Balbín *et al.*, 2003), it yields a similar result to the recent U/Th dates obtained directly from calcite associated with the anthropomorphic figures, as we will see below (figure 3).

c - Analysis by thermoluminescence

The dating of calcium carbonate samples by TL was experimentally developed at the end of the 20th century (Beneitez *et al.*, 2001). This method does not date a single event but provides an average age for calcite deposition and thus offers broad calendar dates that cannot be compared with ^{14}C dates. The method has been criticized (Fortea, 2005). In the case of Pondra Cave, two superposed layers of calcite, infra-posed to a red deer yielded a coherent result but with an interval of more than ten thousand years, between *ca.* 36 500 and 24 000 calendar years.

On another panel, a red line infra-posed to a calcite layer gave a date of 30 000 and 40 000 years. Ultimately, these dates indicate that the representations of this cave can be attributed to the beginning of the Upper Paleolithic, with no further precision. At La Garma, a panel was dated using TL and U/Th (González-Sainz, 2005; Arias, Ontañón, 2008), but the results are inconsistent and many doubts persist.

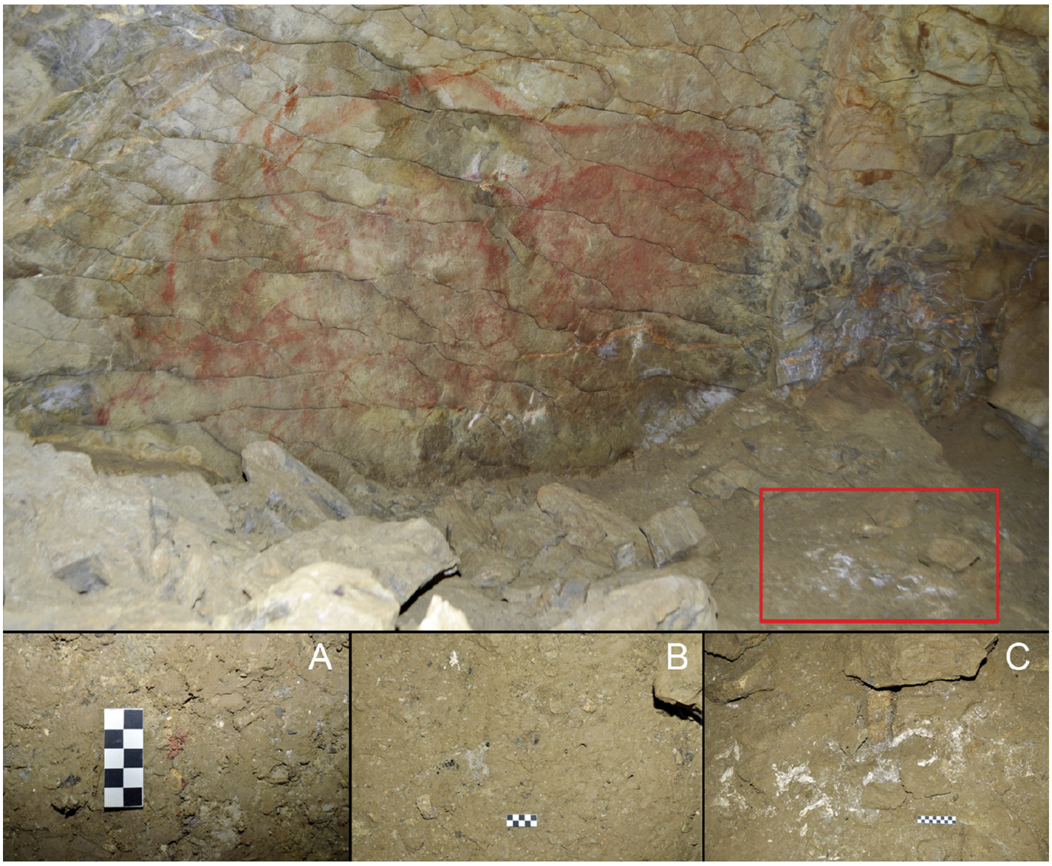

Figure 3 - Dating from the context of the decorated panel of Altxerri B, with associated remains of ochre (A), charcoal (B) and bone, some of them burned (C) (González Sainz *et al.,* 2013).

d - Analysis by U/Th

The Uranium/Thorium method was applied for the first time to La Garma. Recently, new dates (more than 52) were conducted on a series of Cantabrian sites (Pike *et al.*, 2012). Following the implementation of a new protocol by Pike *et al.*, it is possible to sample less matter and provide dates with closer intervals. Seven of these dates on calcite samples for rock art patterns (apart from two) are attributable to the Aurignacian. In the Disc Chamber of Castillo, a small concretion superposed on a red disc gave a date of 34 250 ± 170, whereas the infra-posed calcite yielded a *post quem* date of 35 720 ± 260 years. Still in Castillo, a sample of calcite taken from a red hand stencil from the "hand panel" gave a date of 37 630 ± 340, whereas a sample from the red disc turned out to be earlier, with a date of 41 400 ± 570. At Altamira, under the polychrome bison, the horses, hands, digitations and red painted symbols have also been dated. In particular, a layer of calcite covering one of the Cantabrian claviform symbols yielded a date of 36 610 ± 610. Lastly, at Tito Bustillo, the calcite covering a red stain beside the anthropomorphs yielded a result of 29 650 ± 550, then 35 540 ± 390 for the calcite beneath the painting.

Even though these data provide new perspectives for the beginning of art in the Cantabrian region, both the substance and the form of these results have been subjected to widespread criticism (Clottes, 2012; Bednarik, 2012; Pons-Branchu *et al.*, 2014). In spite of the inconsistencies in data presentation (in particular, the differences between the article and the supplement), some elements appear to corroborate the dates obtained, particularly in the case of the infra-posed layers superposed on the panel patterns, like at El Castillo and Tito Bustillo. Nonetheless, it would still be imperative to test these results with other laboratories and other dating systems in order to validate the chronological attributions (figure 4).

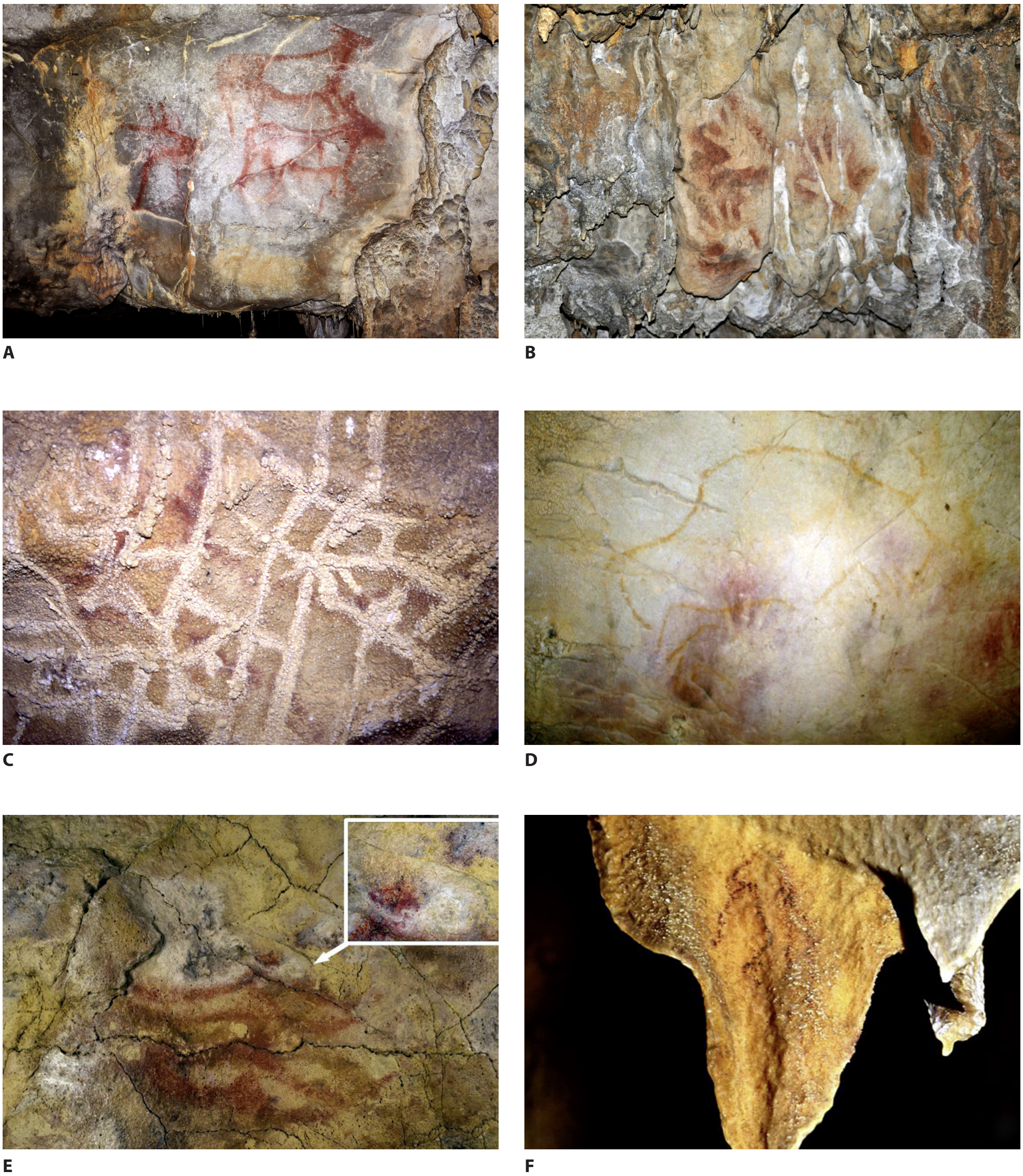

Figure 4 - Panels dated by TL in Pondra (C), TL and U/Th in La Garma (A), and U/Th in La Garma (B) (González-Sainz, 2005), El Castillo (D), Altamira (E) and Tito Bustillo (F) (Pike *et al*., 2013).

e - ^{14}C Analysis

The direct dating of art using ^{14}C led to the attribution of rock art representations to the Aurignacian, particularly for Chauvet Cave or Peña de Candamo. For the latter, the results oscillate between 34-37 000 cal BP and have generated widespread misgivings. Sampling problems combined with the fact that the same representations were dated by a second laboratory to *ca*. 16 500 cal BP cast doubt on the first dates. Nonetheless, at the present time, there is no explanation for the "aging" of these dates, and recent new analyses have still not resolved the issue (Corchón *et al*., 2014) (figure 5).

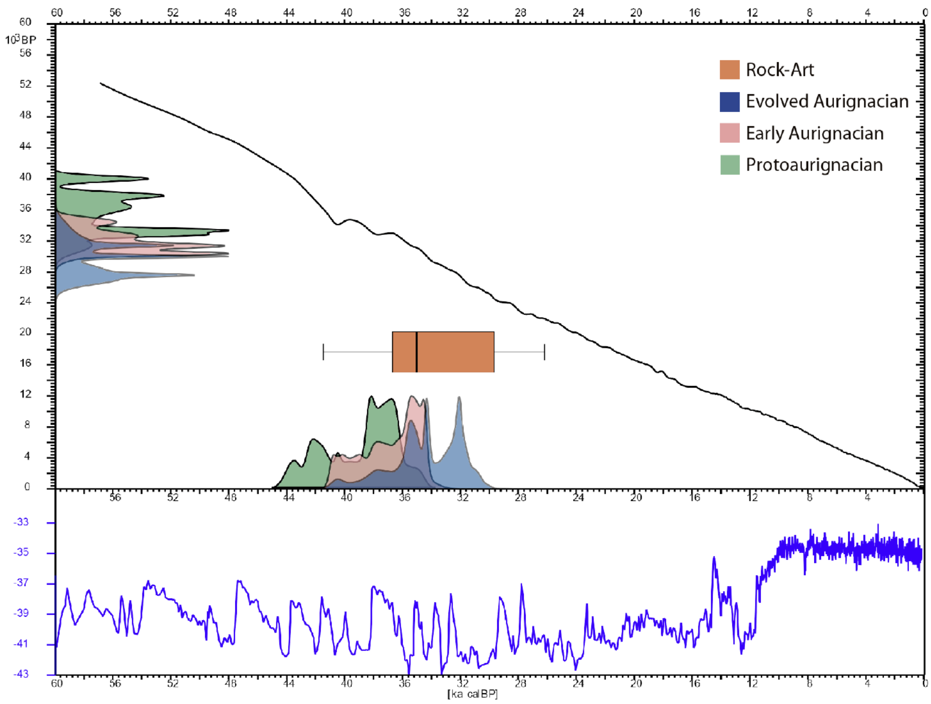

Figure 5 - Diagram of the ^{14}C datings from the aurignacian sites of the Cantabrian area and datings of parietal art for the same time (^{14}C, TL and U/Th).

4 - Summary: a new vision of Iberian Aurignacian art

The critical revision of the data currently available for the artistic sequences attributed to the Aurignacian in the Iberian Peninsula highlights the multiple problems linked to the diverse dating methods. Consequently, at the present time, these data do not allow for a clear vision of the beginning of artistic activity in this region. This is further confounded by the low quantity of graphic representations recorded in most of the decorated complexes.

The archeological evidence shows that the north of the Iberian Peninsula, adjacent to the south of France, is one of the main Aurignacian expansion zones in Europe. This is in principle, linked to the appearance of the first symbolic representations, on both objects and rock walls. As far as the archeological record is concerned, the links between the Cantabrian region and the sites of the south of France, such as Isturitz or Gatzarria, are obvious, just as the sites of the eastern Pyrenees can be compared with those of southeast France and Italy. Nonetheless, as regards the rock art, only the complex from Altxerri B can be integrated into the artistic movement developing in parallel in Ardèche, with very large-sized animals – unknown in the rest of the Cantabrian region – such as the bison, the feline and a possible bear associated with parallel lines. The exterior deep engravings (does, horses and aurochs) at La Viña and Venta Laperra are also associated with vertical lines (isolated in the case of El Conde), and seem to correspond to a more local artistic development. However, the Dordogne sites also comprise deep engravings in rock shelters although they display different graphic characteristics (Bourrillon, White, this volume). This specific style seems to have a wider temporal extension, until the Solutrean (probable chronological attribution for the rock shelter of La Lluera), in the same way as paintings with dotted lines, instigated during the Gravettian and also present during the Solutrean (Garate, 2008). Even if we retain the U/Th Aurignacian dates for the El Castillo hands, most of them are Gravettian (Clottes, 2000; figure 6).

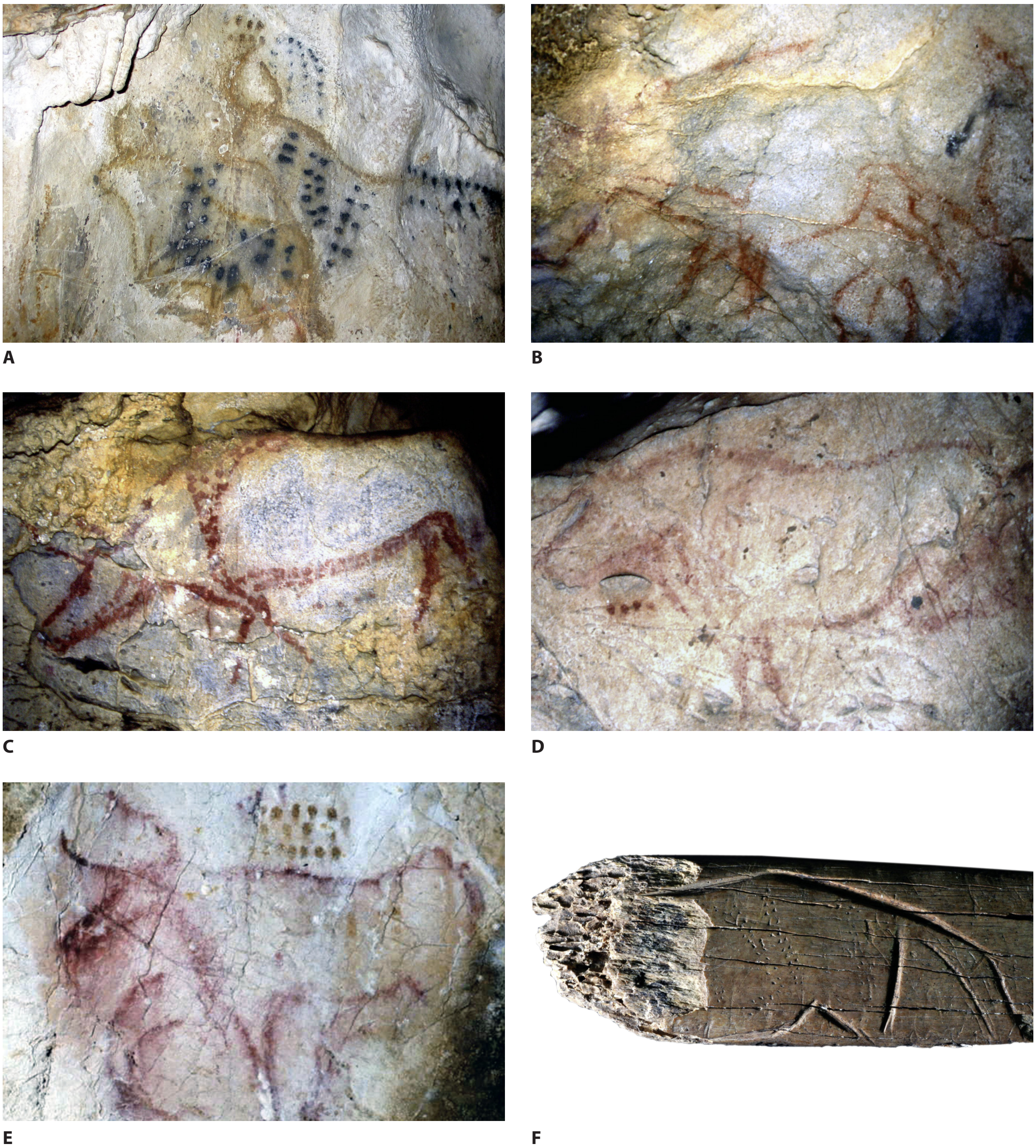

Figure 6 - Association between figures of aurochs and spot lines is a good example of the persistence of a graphic tradition which starts in Aurignacian (Blanchard; Bourrillon, White, this volume) and continue until Solutrean in Tête-du-Lion (E) (Combier), or the Gravettian from Isturitz (F). In the Cantabrian area, this same association is present in Peña de Candamo (A), where the dates are problematic, and in Trescalabres (B), Covalanas (C) and Pasiega A (D), whose chronological attribution is based on stylistic comparisons.

In conclusion, no specific Cantabrian Aurignacian art exists, since, on the one hand, most of the chronological attributions are unsure, and on the other hand, the majority of the artistic representations that could date to this period extend over a long time period, until the Gravettian and the Solutrean. There is thus no clear cut boundary between each phase. This does not mean that no artistic representation can be attributed to the Aurignacian, but implies that the absence of individual features characteristic of this period, as is the case in other regions in Europe, renders their identification complex.

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ANIMATION AND GRAPHIC NARRATION IN THE AURIGNACIAN

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ANIMATION AND GRAPHIC NARRATION IN THE AURIGNACIAN

Marc AZÉMA

Abstract

What was the purpose of the images conceived and produced by prehistoric groups? Our research into the animation of these images leads us to propose a new method of analysis that shows their primary function to be narrative. The identification of mechanisms for graphic narration can help to decipher the exact content conveyed by these messages beginning as early as the Aurignacian. The main images from two parietal art caves from this period, Chauvet-Pont d'Arc and Baume Latrone in the South of France, provide a remarkable example of the different animation processes and sequencing underlying these first Aurignacian stories.

Keywords

Aurignacian, parietal art, animation, ethology, graphic narration, movement breakdown, sequence, action, Chauvet-Pont d'Arc, Baume Latrone, interpretation.

Introduction

Given the current state of knowledge, the earliest evidence of the existence of figurative art goes back to the Aurignacian. What was the purpose of these "first" animal images, mostly large mammals? Although the interpretation of Paleolithic art remains a perilous exercise, impossible for some and feasible for others, it is, in our opinion, possible to identify the mechanisms defining the primary function of these images: narrative. Whatever the message(s) conveyed by this graphic narration, it seems an essential component of the earliest images, as our more than twenty years of research into the study of animation in Paleolithic art (Azéma, 2009, 2010, 2011) has shown.

In the scope of this article, we will first of all summarize the research leading to the formulation of our hypothesis. We have shown that animation played a major role in Paleolithic art, contrary to specialist opinion which regarded these parietal images as simple inert symbols linked between them by basic logic (decorative, sexual, religious...); particularly A. Leroi-Gourhan (1975: 390) when he said: "it is clear that the subject (bison, deer...) takes precedence over the action (running away, charging, falling...), since a majority of the figures are not in a state of animation or are in motionless vertical extension". In the same way, we established that animation led in a logical and subtle way to the graphic narration process, as the "scene" concept (or "sequences") is not an exceptional but rather a recurring occurrence, in our opinion.

Secondly, we present the method of analysis of graphic narration in parietal art developed during this research. To conclude, by way of an example, we will apply this analytical tool in a number of ways to the decoration of two neighboring Aurignacian caves with parietal art, where we have had the privilege to work: Chauvet-Pont d'Arc in Ardèche (figure 1) and Baume Latrone in the Gard (figure 2). It is clear that Aurignacian art is not limited to these two caves but the more isolated and apparently less animated images from Coliboaia (Romania), Castanet or Blanchard (Dordogne), are less suited to such a demonstration.

Figure 1 - The eight-legged bison from Chauvet-Pont d'Arc Cave (Ardèche): movement breakdown effect of the legs? (photo: J. Clottes, Chauvet scientific team).

Figure 2 - Cave lion and mammoths from La Baume Latrone Cave (Gard) (photo: M. Azéma).

1 - Animation in cave art

For Upper Paleolithic artists, movement was an integral part of the process of identification and therefore of depicting the animal. In this context, the identification, then the analysis of these animations required good knowledge of animal anatomy, biology and ethology. Our approach is thus part of the naturalist study approach initiated several decades ago, in particular by the work of Léon Pales on the cave of La Marche (1969, 1981, 1989) and, surprisingly, by André Leroi-Gourhan, who, towards the end of his life began to reinterpret parietal art from an ethological viewpoint, as shown by his last lectures at Collège de France (Leroi-Gourhan, 1974, 1975, 1980).

In 2003, we calculated that 41.1% of the animals in French parietal art, or nearly one animal out of two, are represented in movement. If we take into account the dynamic properties of Paleolithic lighting, consisting of flickering torch light or oil lamps, of the interaction of parietal images with the rocky relief they are painted on, and the existence of optical effects such as anamorphism, we can reasonably assume that the majority of the images appeared to be animated by Paleolithic humans. But it is still difficult to quantify statistically these latter parameters, which will require future experiments involving virtual reality.

Animation can affect either the whole or just one part of the animal's body. The head is animated in 86.7% of the studied cases, which is perfectly logical as the head is the most widely represented body part. Limbs are depicted in movement in 52.9% of the cases and the tail in 31%. The importance of segmental animation for the cave lion can be explained by the used of the synecdoche for a considerable proportion of the felids in Chauvet Cave, the predator most represented in parietal art. These movements can be isolated or combined. In this case, we refer to segmental or coordinated animation to simplify the classification proposed by André Leroi-Gourhan (1974: 385-388). According to our calculations, segmental animation is less frequent than coordinated animation for most of the animals: horse (36% compared to 64%), bison (35% / 65%), etc.

Based on the classification of movement for each species, we were able to demonstrate the very wide diversity of animations, which is much greater than previously thought and which will probably increase further with future studies. In this way, for the horse, the head is depicted in about a hundred different positions (figure 3). At the scale of a single cave, in this case Chauvet, the sample of feline head movements also shows a wide variety of facial expressions (figure 4).

As we can see, these movements can be discreet, when they concern the subtle animation of an ear, an eye or the tail, or else they can be more spectacular when they evoke rapid movements. In all cases, they made sense for the hunter-gatherer artists who were used to observing nature. These artists went a long way with the representation of movements, particularly for the faster ones that escape our perception due to the limits of our vision. They devised conventions that we find throughout art history, many millennia later.

But they did not just represent snapshot images, or frozen instants of time on the rock. Some of them, probably the most talented artists, sought to expand these short moments. They even managed to graphically simulate the fourth dimension, using two processes of movement deconstruction: deconstruction through the *superposition* of successive images and deconstruction through the *juxtaposition* of successive images.

The first process is easier to define than the second. It consists of the multiplication effect of the body parts in movement (multiple outlines). This generates a sort of "graphic blur" on the most naturalistic representations. This process is present throughout the Upper Paleolithic, on several tens of figures (53, or 3.5% of the animated figures), all species combined; from the Périgord (Lascaux), the Pyrénées (les Trois-Frères, Gourdan, Massat), the Quercy (Sainte-Eulalie) and the Ardèche (abri du Colombier, Chauvet). But we have recorded the most cases of this at Lascaux, nearly always on equids. Magdalenian portable art (La Marche; figure 5, Limeuil, La Madeleine) and parietal art from the Iberian Peninsula (Altamira, Foz Côa) provides other examples.

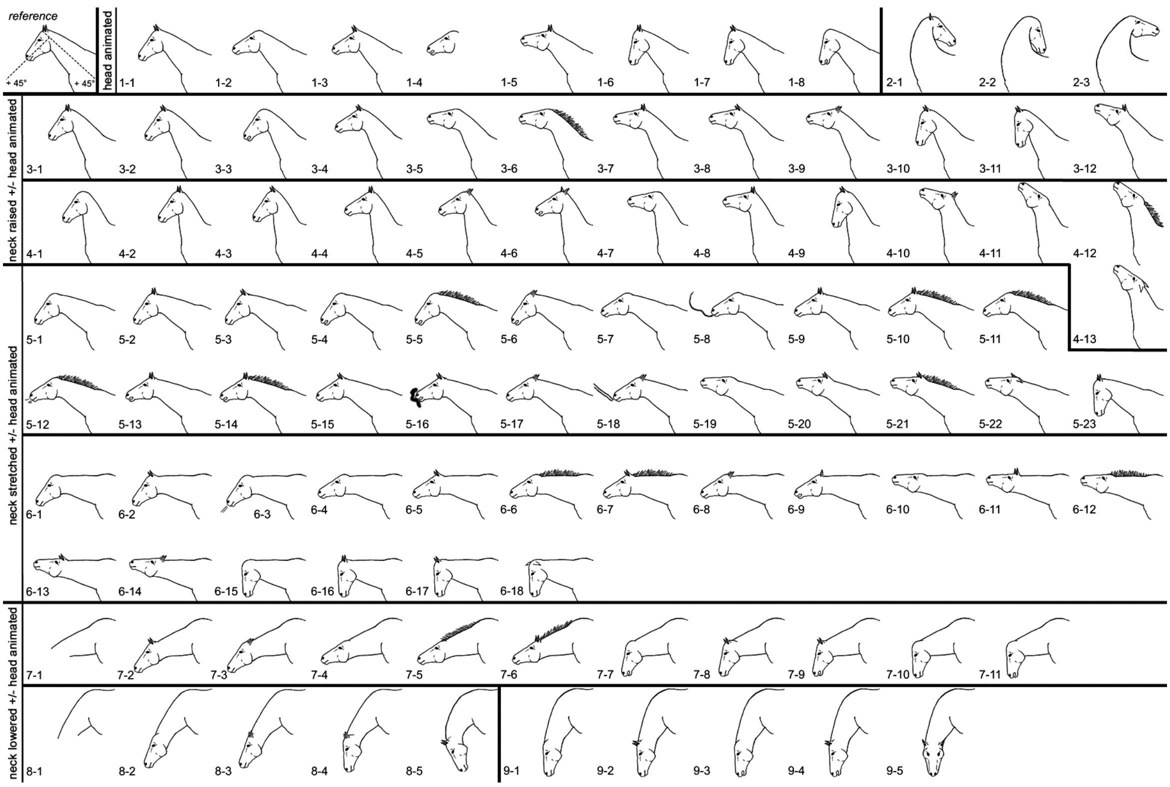

Figure 3 - Inventory of horse head and neck movements in French parietal art (after Azéma, 2003: table 3).

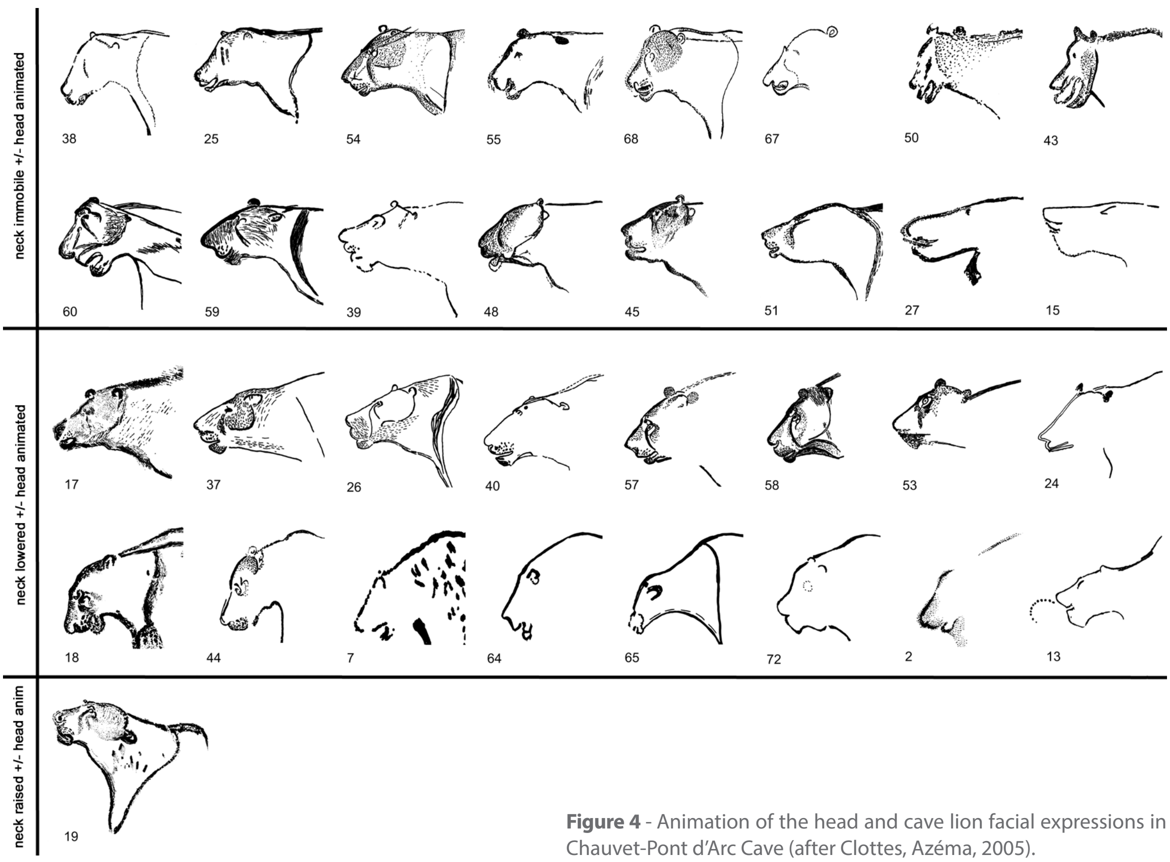

Figure 4 - Animation of the head and cave lion facial expressions in Chauvet-Pont d'Arc Cave (after Clottes, Azéma, 2005).

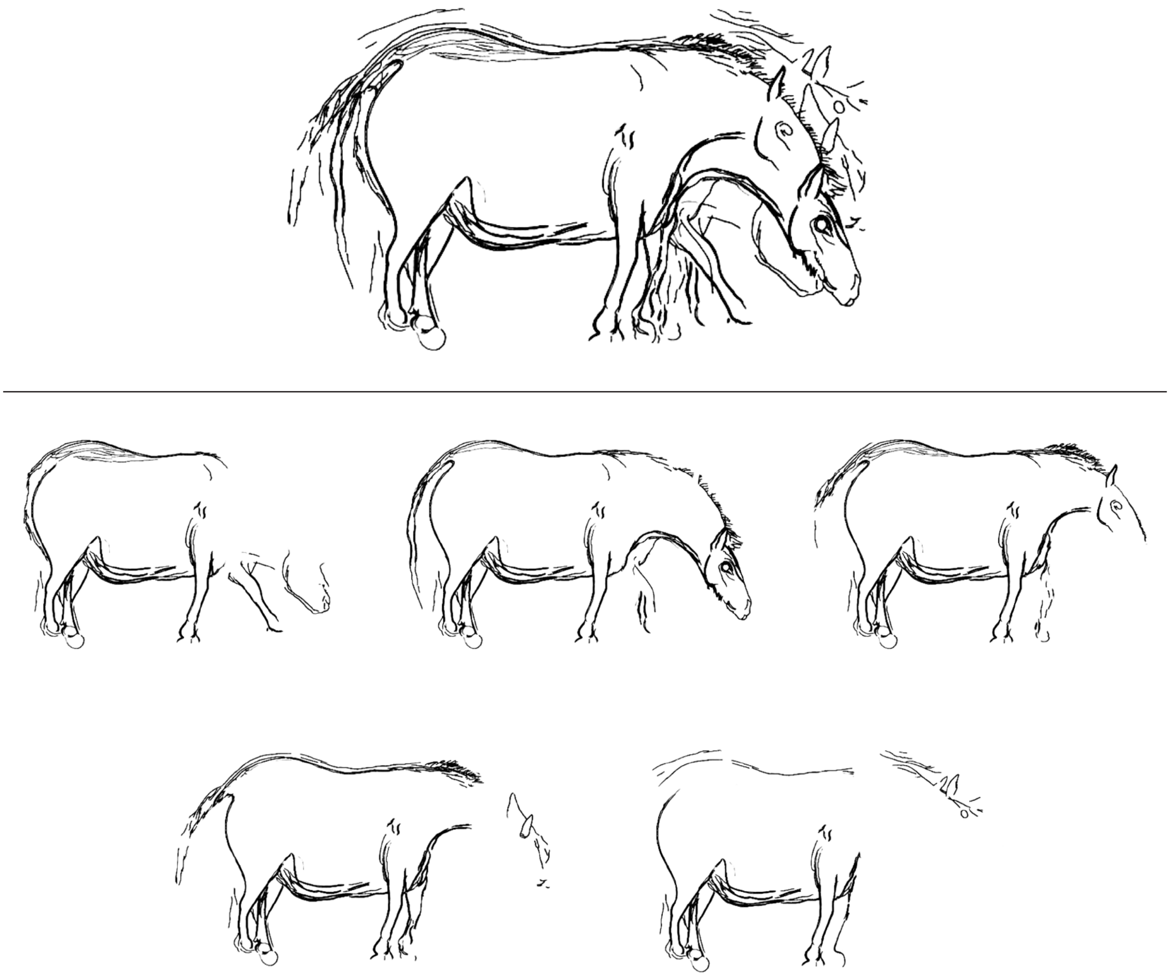

Figure 5 - The breakdown of movement through the superposition of successive images in portable art from La Marche (Haute-Vienne): a horse portrayed using multiple outlines (after Pales, Tassin de Saint-Péreuse, 1981, pl. 71-73).

The second process is more difficult to discern: the positions of the animal throughout time must be juxtaposed and oriented in the same direction, following the single file principle. The hypothetical cases of the "swimming deer" panel from Lascaux (Prudhommeau, 1984: 12) and the rotunda frieze of horses from Villars (Groenen, 1997: 71-72) suggest this process in parietal art, without being fully convincing. On the other hand, the feline panel from the grotte de la Vache in Ariège (figure 6) is sufficiently convincing to affirm that it at least existed in portable art at the end of the Magdalenian.

In this way, Paleolithic artists would have prefigured the modern concept of animation. Better still, some Magdalenian objects may have been used to reconstruct these broken down movements: cut out discs, like the one from Laugerie Basse (Roussot, 1984) where two successive images of a chamois is the process of falling are engraved on each side of a bone disc could represent an optical game prefiguring pre-cinema "thaumatropes" (Azéma, Rivère, 2012: 320-323). For the time being, there are no comparable objects of this type in the Aurignacian (figure 7).

1

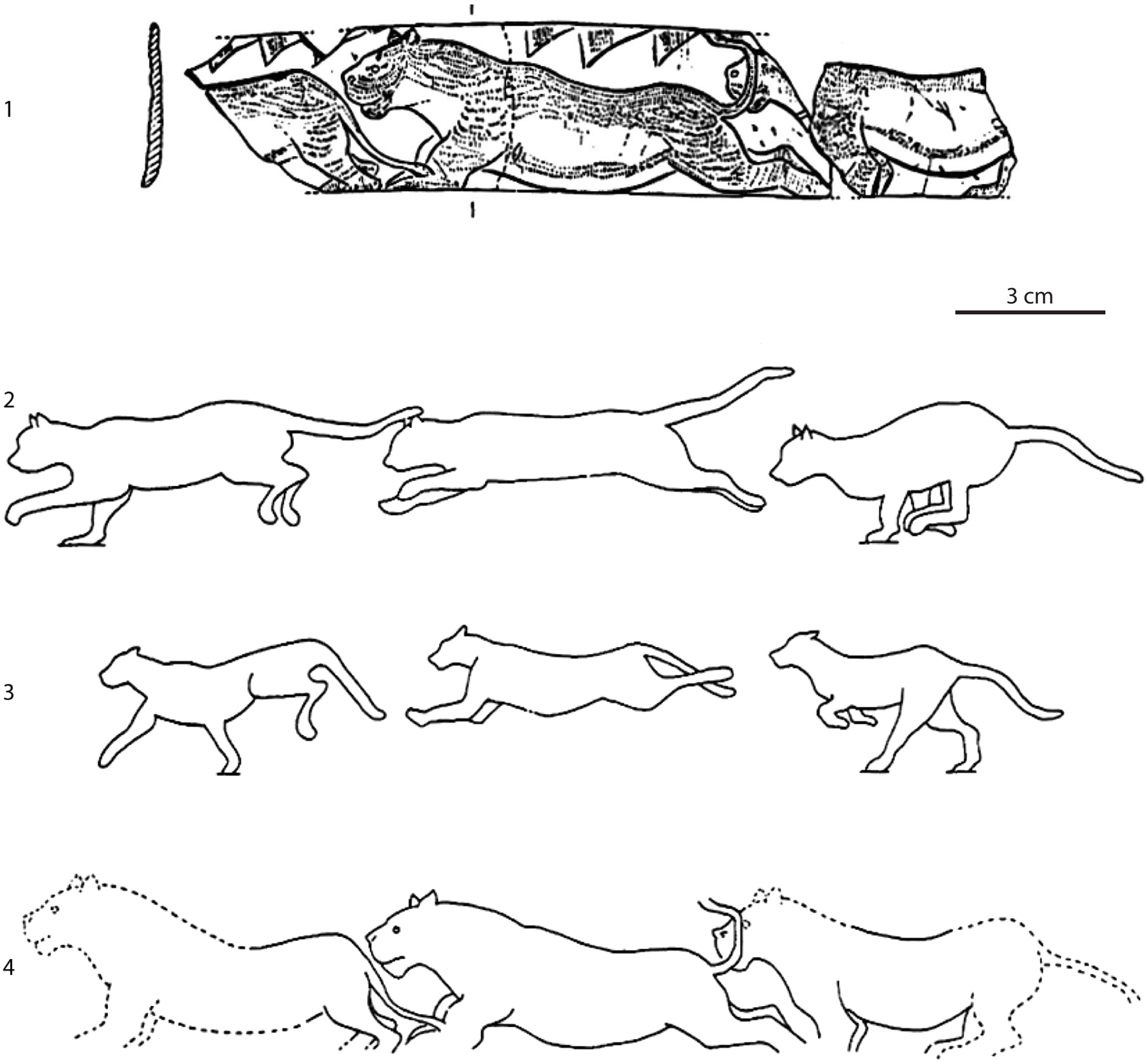

Figure 6 - Movement breakdown through the juxtaposition of successive images in French Paleolithic art: the lion frieze from la Vache (1: bovine rib) along with the broken down sprint of a cat (2) and a leopard (3); suggestion for interpreting the frieze (4) (after D. Buisson in Buisson, Delporte, 1988; Azéma, 1992).

Through ethological studies, these animations, representing instantaneous or broken down movements, can in many cases be compared to specific animal behavior observed in the artist's environment. We established behavioral inventories for each animal represented in the bestiary (table 1). The identified themes have been classified into three main categories, "non-aggressive behavior", "aggressive behavior" and "hunting behavior". Several patterns emerge: majority of male specimens, predominance of herbivores represented just before or during the mating season, preponderant role of felines (predators) when they are represented on the cave walls, etc.

These behavioral themes imply individual or collective actions. These actions can be associated with each other and make up a coherent unit within a composition, on a cave wall or on an object, at the scale of a cave chamber, and define in this way the basis of the earliest graphic narration.

Figure 7 - The disc with chamois in movement from Laugerie Basse (Magdalenian): experiment conducted by Florent Rivère (after Azéma, 2011: 155).

	Behavior non aggressive			**Behavior aggressive**			**Behavior hunting**		
Attitude of the animal on site	listening, attentive	49	(4?)	alert	10	(1?)	wounded	6	(1?)
				breathing	2				
	listening; mutual observation	8		calling or belling	7	(1?)	wounde; hunt	1	
	listening								
	mutual observation in maternal; behavior	2		agitated	26	(3?)	slipping	1	
							slipping; wounded	7	
	listening; *mutual nostril flaring*	1	(1?)	female in heat	5	(4?)			
	listening			female in heat; before copulation	4	(2?)	laying down; at rest	2	
	(nostril flaring in maternal behavior	3					laying down; dead ?	7	
				excited male; before copulation	2				
	listening; *pre copulation*	1		male, with tongue out	6	(1?)	overturned	2	
				male with erection	3	(1?)	falling	1	(1?)
	feeding	3		male with erection					
				pre copulation	1				
	giving birth	1							
				pawing the ground	6	(3?)			
				threatening	4				
				on the defensive	17	(4?)			
				nostrils flaring, intimidation	2	(2?)			
				agitated; in confrontation	5	(2?)			
				head to head confrontation	2	(2?)			
				threatening; confrontation	1				
				on the defensive; confrontation	6	(3?)			
				upright	1	(1?)			
Attitude about the locomation	trotting	15		walking, calling	2		walking, wounded	2	
	trotting while listening	9		trotting,with tongue out	2				
	walking, feeding	1		trotting, excited; pre copulation	2	(2?)			
				trotting, agitated	6				
				trotting, agitated; confrontation	1				
				trotting, agitated; intimidation	4	(3?)			
				galloping	15		galloping with tongue		
				galloping with head high, alert	21		out suffering?	1	
				galloping, calling	1				
				galloping agitated	25				
				galloping with tongue out	4				
				galloping, agitated or excited	1				
				galloping, excited; pre copulation	1				
				galloping with erection	3				
				galloping, excited; intimidation	6	(1?)			
				galloping, intimidation	1				
				charging	10	(3?)	charging, hunt	1	
				charging, confrontational	6	(1?)			
				falling, confrontational	1	(1?)			
	Total	93	(5?)		222	(40?)		31	(2?)

Table 1 - Behavioral themes for the bison in parietal art in France (after Azéma, 2003).

2 - Proposition of a method of analysis for graphic narration in Paleolithic art

The identification of such a degree of image association fills the "conditions for iconic narration", according to the terms established by Philippe Sohet, professor of social communication at the University of Québec. We drew on his work on "recital images" (Sohet, 2007) to propose a grid of analysis for the different levels of narration present in Paleolithic art. This grid is made up of four successive levels:

- **Level 1 corresponds to individual "action"**

The action designates a posture, a static or dynamic animal (attitude, pace) and depicts a moment, a precise behavioral state. It is important to add that the fact that there appears to be no action does not necessarily signify that there is no narration: ethology shows that an animal depicted in a static, immobile position can potentially convey a specific form of behavior: sleep, listening...

- **Level 2 corresponds to the "co-relation", according to the term used by Philippe Sohet**

This consists of the association of at least two individual simultaneous actions, or a collective action. This association can, but does not necessarily involve a level of interaction: such as a troop of animals moving together or a confrontation. In the history of art, this is referred to as a "scene", but in the scope of our naturalist approach, the use of this term could create confusion as its meaning differs from one domain to another: in theater, it is used to evoke a segment of the staged show. In cinema, it is used to fragment parts of narration presenting unity in terms of time or place. It is also used by forensic experts to refer to the place of crime, etc.

- **Level 3 is the sequencing level ("succession")**

Several actions follow each other in space and time and make up a sequence in the same graphic space. This succession is linear and includes more or less spread out temporal ellipses. Based on our work, P. Sohet classifies the process of movement deconstruction in this level, and the successive images then correspond to distinct moments. In art history, this level of narration is reached in "multi-scene" paintings.

- **Level 4 is the "interlinking" level**

Several sequences are associated in space and time: narration can be continuous or can integrate actions and sequences taking place at the same time in the overall tale. This complexification of the narrative process can introduce several levels of interpretation, at the scale of a graphic composition or a chamber, the cavity itself or a complex of sites.

We have successfully implemented this method of analysis in the naturalist context of Paleolithic art from the Aurignacian to the Magdalenian (Azéma, 2011). It is of course, just a theoretical tool and as such, it can evolve, namely by integrating the symbols, abstract lines and anthropomorphic figures (especially in portable art) often associated with images of animals. It can be adapted to different forms of rock art and other cultural contexts.

3 - Application of this analysis method to Aurignacian parietal art

To illustrate these points within the chronological framework of this article, this method of analysis was applied to two painted caves in the South of France, Chauvet-Pont d'Arc (Ardèche) and Baume Latrone (Gard). The chronological attribution of the parietal art from Chauvet Cave to the Aurignacian is irrefutable, given the abundant ^{14}C dates made directly on paintings, yielding an average age of 37 000 cal BP (Valladas et *al.*, 2004, 2005). Our recent work in Baume Latrone revealed that thematic, technological, stylistic and even geographic evidence, associated with the discovery of charcoal welded into the soil by calcite several meters away from the decorated panels and dated by ^{14}C to 37 464 cal BP, enable us to date the parietal art from this cavity to the early Aurignacian (Azéma *et al.*, 2012). These two caves are thus part of the short-list of Aurignacian art sites and contain the most accessible images for our demonstration. We will focus on the large representations in which the image of the cave lion appears to have fascinated the Aurignacians.

A - Chauvet-Pont d'Arc

At Chauvet-Pont d'Arc, the "Salle du Fond" is located 400 m from the cave entrance and hosts a concentration of the cave's decoration. This space contains abundant representations and clear scenography, including "dangerous" species typical of Aurignacian art, such as mammoths, cave lions, woolly rhinoceros, then, bison, cervids, symbols and schematic vulvae. However, the horse is absent from this area, unlike in other parts of the cave. In the center of the chamber, the left wall bears a frieze over 10 m long, referred to as the "large panel". Within this panel, several actions portray the cave lion (figure 8).

Figure 8 - "The large panel" from the "Salle du Fond" from Chauvet-Pont d'Arc Cave (Ardèche), an example of Paleolithic graphic narration with, on either side, two successive hunting actions depicting the cave lion in action (inset) (photo: J. Clottes, Chauvet scientific team).

On the left, on the edge of the cave wall, several life-sized felines are drawn in characteristic look-out posture, with their heads down and their ears turned back (figure 9). They seem to be looking at a virtual prey outside the picture, unless they are watching the small rhinoceros drawn on another part of the cave wall, in the background. In our opinion, the artists could have associated actions on several cave walls and this is not an isolated case, as we will see below. The notion of the association of the depicted figures must not be reduced to the physical limits of panels and complexes but must approach the whole parietal space in three dimensions. The ethological approach helps us to do this.

Figure 9 - Left side of the Large Panel from the Salle du Fond in Chauvet-Pont d'Arc Cave (Ardèche): cave lions on the lookout, perhaps watching a prey out of the picture, a rhinoceros on a cave wall in the background (photo: J. Clottes, Chauvet scientific team).

Another collective action is visible on the right hand side of the "large panel" where the well known "lion panel" features 16 felines pursuing a troop of bison (figure 10). Some of the predators are growling, others are roaring. These individual actions are associated in a fast movement towards the left. The dynamism of the different stances increases from right to left, with the heads facing to the front and the jaws more widely open, until they are deformed as the predators approach their prey. This time, the prey are depicted on the same part of the panel: on the left several bison are just represented by the head or nearly-whole fleeing figures. Predators and prey in action are thus co-related. According to C. Packer (in Clottes, 2001), a specialist in lion behavior, the pack is a mixture of females and males (who had no manes at that time). This presents a problem as present-day male lions do not generally intervene in the pursuit of game. Several explanations are possible: either the distribution of tasks within the pack was different during the Paleolithic, which does not seem probable, or the artist did not take account of this distinction, adopting a symbolic, rather than a realist perspective.

Figure 10 - Lion panel from the Large Panel in the Salle du Fond in Chauvet-Pont d'Arc Cave (Ardèche): a pack of lions pursues a troop of bison (photo: J. Clottes, Chauvet scientific team).

As we have just seen, the two collective actions drawn on either side of the large panel represent the successive instants of a hunting sequence (level 3 of sequencing). But other moments of this type are present in the "Salle du Fond".

On the right of the lion panel, a young bison drawn in perspective using a cave wall angle bravely faces two aggressive lions (figure 11). It is raising a leg against the forehead of the first feline as if it was pushing off the attack. We can thus wonder if these individuals were part of the groups depicted in the panel of the lions or if another hunting action is occurring at the same time. The young bison could have been left behind by its herd and trapped by predators aiming to isolate the weakest prey.

A little further to the right, on a rocky overhang, several juxtaposed lions are in characteristic lookout positions (figure 12). They seem to be watching the two large bison drawn further down on another wall panel in the background. As for the left side of the large panel, the predator-prey co-relationship takes depth of field into account, such as it is defined in photography. In the same way as for the left side of the large panel, the level of the predator-prey relationship operates in three spatial dimensions, and must have been based on the lighting of the underground cavity.

Opposite this, on the right-hand wall, the large panel situated above the passage towards the Belvedere shows a finely-engraved feline in the process of devouring what is probably its prey (figure 13): the half-open mouth of the predator seems to be tearing off the bison's horns. This intense moment symbolizes the end of the hunt. It is also materialized by a line common to both protagonists: the outline of the predator's inner eye and cheek also merges into the left horn of its prey. Through this graphic effect, the artist affirms his virtuosity but also adds a symbol of naturalist inspiration to the narrative association.

Figure 11 - On the right of the Large Panel, another hunting action is represented:
an isolated bison wards off an attack by two cave lions (photo: J. Clottes, Chauvet scientific team).

Figure 12 - Near the Large Panel, several lions are drawn on rocky overhangs, visible from top to bottom.
They seem to survey their future prey, bison portayed in the background (photo: M. Azéma, Chauvet scientific team).

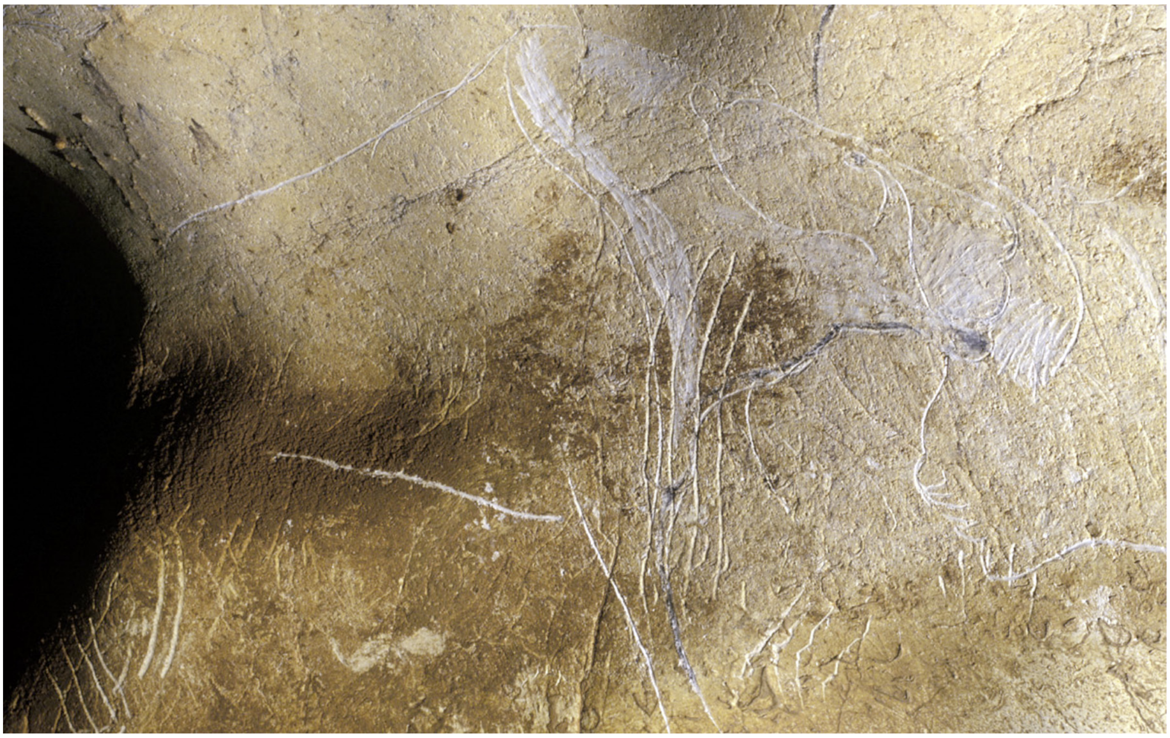

Figure 13 - Opposite the Large Panel, the right cave wall depicts the end of the hunt: the cave lion seems to devour its prey (photo: J. Clottes, Chauvet scientific team).

The Salle du Fond contains another fundamental moment in the life cycle of the cave lion. If we move back near the entrance to this chamber on the left side, two felines are depicted beside each other (figure 14). The smaller of the two animals has its head raised as though it was rubbing against the larger animal. This is an exceptional image in Paleolithic art as it depicts the scrotum. This association was interpreted by C. Packer (in Clottes, 2001) as a couple of lions just before mating: the female rubs against the male in this way just before the act of copulation.

Let us now put all this data from the Salle du Fond together (figure 15). It is clear that this is not a final result, but rather the state of present research and these observations will be refined when all the walls have been studied. The first observation is that actions involving cave lions are positioned all around the chamber. Secondly, they seem to follow on from each other in time if we approach them moving from the entrance towards the back of the cave, following the walls from left to right. We can imagine an Aurignacian moving in this way with a torch to discover the story unfolding along the cave walls, in much the same way as people during the Middle Ages, for example, to discover the scenes of Christ's life in cathedrals or the exploits of William the Conqueror in the Bayeux Tapestry.

In this case, the story recounts different moments or fundamental episodes in the life cycle of cave lions. The four narrativity levels presented above are all effectively reached here. The link between the mating sequence and the hunting sequences meets the criteria for the fourth inter-linking level. Better still, the presence of actions and sequences depicting other animals from the bestiary alongside or at the same time as the lion story, shows that there are probably several narration levels in these large Paleolithic compositions. This representation from the Salle du Fond is one of the masterpieces of Paleolithic art. The complexity of the narrative escapes us but reflects the extent of creative thought of these prehistoric artists.

Figure 14 - Another instant in the cave lion life cycle represented in the Salle du Fond: a female rubs against a male, before mating (photo: J. Clottes, Chauvet scientific team).

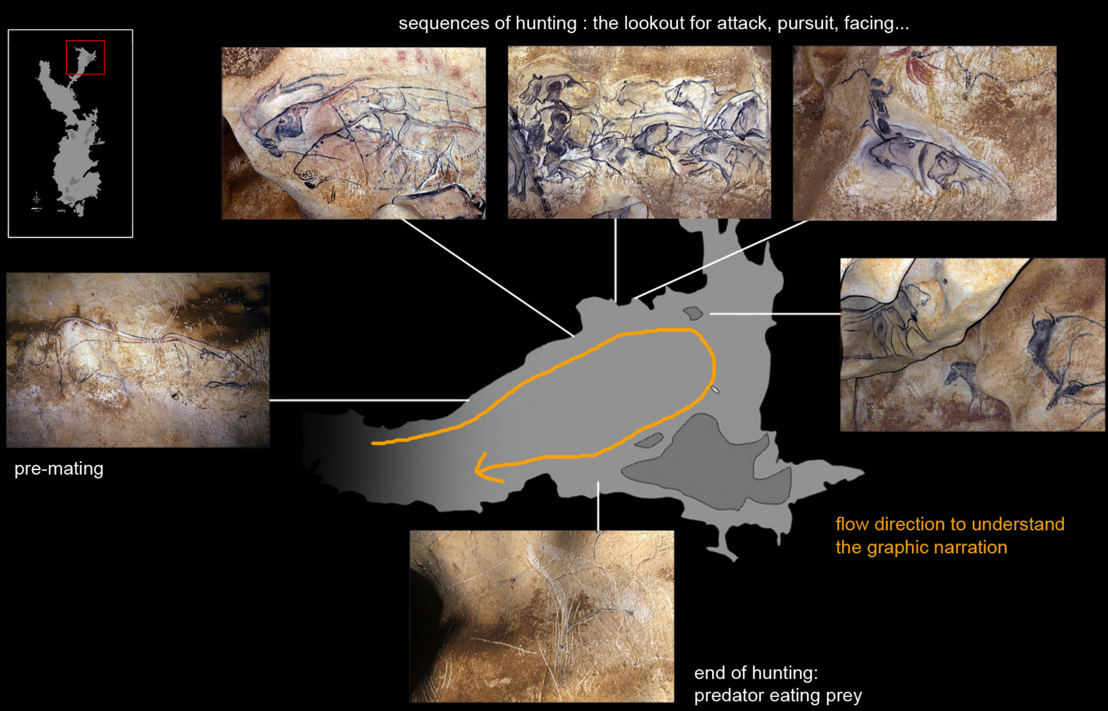

Figure 15 - A graphic story developing in the Salle du Fond of Chauvet Cave: one of the main themes of this cave, the cave lion, is depicted at different stages of its life cycle (reproduction, food) (photo: M. Azéma, Chauvet scientific team).

These essential episodes in the life of the lion (reproduction, food, hunting technique, social organization…), fascinated the artist-hunters, who could identify with their behavior. The symbol of life itself is depicted through the feminine genitals near the felines, clear signs of fertility. At the center of the panel on the right-hand wall, a vulva drawn in charcoal dominates two lions facing each other, depicting a possible confrontation between two young adults. Opposite the panel of the lions, the "pendant du sorcier" illustrates two or three felines, a bison and the lower half of a female figure portraying the genitals. This rocky overhang is located at the center of the Salle du Fond and could operate as a sort of narrative and symbolic pivot encapsulating the whole story.

The shape of the cavern itself could also be part of the narration. In this way, the natural niche at the center of the large panel resembles a vulva. The same observation applies to another part of the cavity, the horse sector. The median part of this large frieze, which presents similar graphic and thematic construction to the large panel in the Salle du Fond, also presents a hollow space shaped like an inversed triangle, where a trickle of water sometimes flows. The "Alcôve des Lions", as it is called, contains several predation actions but this time the lion's prey is no longer a bison but a horse (figure 16). On the left, a lion is closing in on a horse. In the center, two felines intersect: either they are interacting (a young animal soliciting a female?), or else each of them is pursuing a prey. The animal turned towards the left is raising its hind legs towards a horse on the run, the animal facing right is looking at a bison escaping at full speed (its eight legs express movement deconstruction). Inside the alcove a vertically depicted feline is pouncing on a horse, represented by the head and neckline. In what appears to be a sort of natural den, felines are causing intense agitation that seems to spread towards the exterior. On the left part of the horse sector, the horses and aurochs in the horse panel seem to be escaping towards the Skull Chamber.

The famous horse panel is the greatest work of art in this part of the cave (figure 17). It was studied in detail by C. Fritz and G. Tosello (2004) and is the subject of much discussion. The dynamism of these four drawn and partly juxtaposed horses is fascinating. We can question whether these four images represent four horses involved in a collective gallop, or if the same individual is portrayed in four successive positions. R. White (2003: 79) favors the latter option: "From left to right, a horse at a steady pace is followed by a second animal with a more aggressive attitude, with its ears back; then a third animal at rest, perhaps asleep, with its ears up facing forwards; and a fourth, which looks like a pony, quick, with its jaw open suggesting that it is snorting or neighing. Yet it is impossible to come across four horses so close together in nature with such different attitudes. Thus it is not a scene painted in perspective, but the representation of a single horse in different positions or at different periods of its life".

B - Baume Latrone

The Baume Latrone Cave, in the Gardon gorges north of Nîmes, is just 70 km away. One of the many similarities between Baume Latrone and Chauvet-Pont d'Arc is the view. For the former site, the view from the entrance porch of a meander in the Gardon is reminiscent of the view from the entrance of the Ardèche cave of the Cirque d'Estre fossil meander.

About 20 parietal images, situated more than 240 m from the entrance (figure 18), were discovered in 1940 by a group of high school students from Nîmes. Around twenty animals and hands were recorded. They are located in the "Salle Bégouën" and a number of them are part of the "Grand Plafond" (figure 19). They portray a rather particular style. The animal profiles are limited to the essential. This reflects a will to reduce the shapes, rather than any kind of awkwardness. The artists drew with clay, the coated hand was used as a paintbrush and left three or four parallel marks on the wall, depending on the number of fingers in contact with the rock. This technique using several fingers is atypical, unique in Paleolithic art and renders the images very expressive, or even expressionist.

Figure 16 - At the center of the Sector of the Horses in Chauvet Cave, the Alcôve des Lions and its immediate surroundings show several actions depicting the cave lion: here the predators are hunting horses (photo: M. Azéma, Chauvet scientific team).

Figure 17 - The Horse Panel from Chauvet-Pont d'Arc Cave: collective action (co-relation) or breakdown effect (consecution)? (photo: M. Azéma, Chauvet scientific team).

Figure 18 - La Baume Latrone Cave. Topographic survey Blancart, Lebret, Rouquette, 2000-2001; Panel of the hands, diagram M. Azéma; Charcoal in context, photo: B. Gély; Large ceiling, diagram A. Glory (after Azéma *et al.*, 2012).

Figure 19 - The Large Ceiling in La Baume Latrone (photo: M. Azéma).

The drawing technique with clay is specific to Baume Latrone (figure 20), but can be related to the multi-fingered lines visible in the Salle Hillaire in Chauvet Cave. At Baume Latrone the image was drawn by adding matter (clay), whereas at Chauvet, matter was removed (soft cave wall). In both cases, this results in very similar drawings. Another stylistic comparison can be made: an indeterminate animal on the Grand Plafond in Baume Latrone displays far set ears on either side of the skull. This specific depiction of ears is only used in Chauvet-Pont d'Arc and Aldène (Hérault), another Aurignacian parietal cave (Ambert *et al.*, 2005).

Figure 20 - Diagram of a mammoth on the Large Ceiling of La Baume Latrone drawn in lines using several fingers (drawing: M. Azéma).

Another of the shared characteristics between Baume Latrone and Chauvet, is related to the way animation and graphic narration focus on the cave lion. However, there are several noticeable differences between the two sites. The circular composition of the Grand Plafond in Baume Latrone catches the observer's eye (figure 21): the representations are arranged around a central figure, a large 3 m long feline, in order to depict several different moments (in much the same way as a painting with several scenes from the Middle Ages). When it was discovered, the very schematic head, shown in profile, was interpreted as a snake's head (figure 22). This lion is roaring and attacking a troop of mammoths on its own, even though mammoths are more dangerous than the Chauvet bisons or horses.

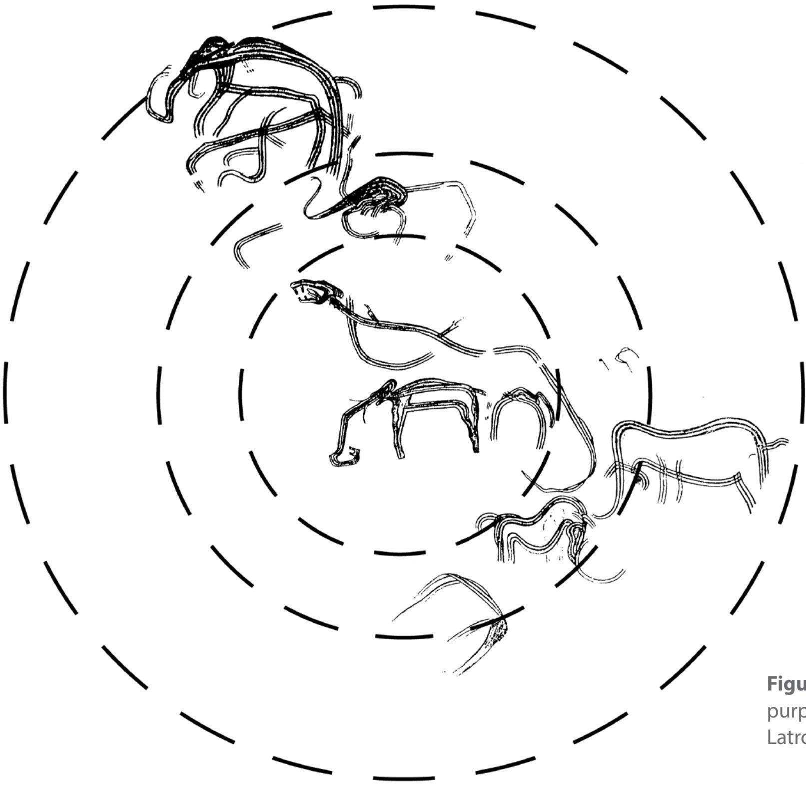

Figure 21 - Circular composition for narrative purposes from the Large Ceiling of La Baume Latrone (drawing: Azéma, 2003).

Figure 22 - The schematic and very expressive cave lion's head portrayed in the center of the Large Ceiling at La Baume Latrone (photo: M. Azéma).

Although the essence of the narration is naturalist, it is also symbolic. First of all, it is naturalist as present-day African lions sometimes attack elephants when they are starving; in which case they seek to isolate the weakest animals, such as the young. This appears to be the case at Baume Latrone. The large feline is represented in a position that could correspond to two successive actions in time, depending on the body part in question: on one hand, it is roaring in the direction of a small group of mammoths running away towards the top (pursuit), on the other, it seems to be picking up two small mammoths with its long tail, perhaps isolated young (capture). This spectacular hunt seems to suggest a second, more symbolic interpretation. Indeed, the size of the predator is disproportioned in comparison to its prey and it appears to be gigantic. This is not an error as the reduced-sized mammoths are all portrayed using the same scale, if we assume that the smaller animals are the youngest. The lion is magnified by the artist, in both its size and its position at the center of the Grand Plafond. It is more than AN isolated feline, unlike at Chauvet where predators hunting in packs respect ethological reality; it is THE cave lion, in all its splendor, depicted as a symbol (totem?).

Conclusion

In the first stories of Chauvet and Baume Latrone, partly brought to light by our ethological approach and the application of an analysis of graphic narration, the natural role of each protagonist, both predator and prey, is respected. The Aurignacians must have felt close to large herbivores, mainly bison, in terms of social organization and struggle for survival (Azéma, 2010). But they seem to be fascinated by lions with which they shared a fundamental preoccupation: access to meat resources and thus predation. The hunting story from Chauvet is more than a naturalist report; it must be considered as an allegory probably signifying the identification of man with the cave lion. The same must be true of the mythic “larger than life” lion at Baume Latrone taking on a troop of mammoths by itself. We concur with the anthropologist J. Robert-Lamblin (2005: 204) who uses analogies between hunter-gatherer-fishermen from arctic regions and Aurignacians from Chauvet to evoke the hypothesis of a belief in an “identity between Man and the lion (...). The lion would be the image of Man, of the hunter: the incarnation of virility”. The Aurignacian statuette of the man with a lion’s head from the site of Hohlenstein-Stadel in the Swabian Jura (Conard, 2003) may be the symbiosis of this.

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FROM GESTURE TO MYTH:

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Artists' techniques on the walls of Chauvet Cave

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Abstract

The walls of the Chauvet-Pont d'Arc Cave are decorated with charcoal drawings dated to an average of 36 000 cal BP, red paintings, engravings, and finger-traced designs, all grouped in distinct panels. Examination of the ^{14}C dates, which are increasingly revealed to be of great antiquity, dating to the Early Aurignacian, allows for more precise modeling of human use of the cave. The attribution of certain components of the parietal art to the Gravettian, based on directly dated torch-marks on the walls and charcoal on the cave floors, remains secure. A survey of the techniques employed, organized around the three colors used (white, black, red), reveals formal diversity in the site, and at the same time confirms multiple points of convergence and commonality in terms of the themes and composition of the panels, which underline the homogeneity of the works as an ensemble. Ethology and the theme of cave lions on the hunt hold a central place in the inspiration of the artists at Chauvet; through their spectacular frescos, these artists have provided us a point of access to their symbolic vision of the world and an element of their myths.

Keywords

Paleolithic art, myth, stories, images, artistic techniques, charcoal, dating, evolution of art, Aurignacian, Gravettian.

Introduction: Art of great antiquity

Discovered in 1994, the cave of Chauvet-Pont d'Arc is a cavity of considerable dimensions and complex topography. In addition to the remains of cave bears (bones, foot-prints, claw-marks, dens), and the archeological remains on the cave floor (hearths, scatterings of charcoal, human footprints), the cavern shelters more than 420 representations of animals and graphic motifs and symbols (Clottes, 2001) (figure 1).

In 1995, the publication of the first ^{14}C dates from certain black drawings in the cave constituted a true revelation in the study of art and human prehistory, confirming for the first time the existence of parietal art of astounding virtuosity dating to the Aurignacian period (Clottes *et al.*, 1995). In the scientific world, these dates were received with enthusiasm by some and with incredulity and skepticism by others (Clottes, 1996; Züchner, 1996). The consequences of this discovery were (and remain) considerable, to say the least. It has shaken the foundations of the linear model for the evolution of art and symbolic thought among *H. sapiens* that has been developed and refined over the last century. Twenty years later, we are far from having explored all of the many new lines of research presented by this paradigm shift; certain authors (often the same individuals) remain the last obstinate defenders of a simplistic and obsolete view of Paleolithic art (Combier, Jouve, 2012; Alcolea, Balbin, 2007; Pettitt, Bahn, 2003).

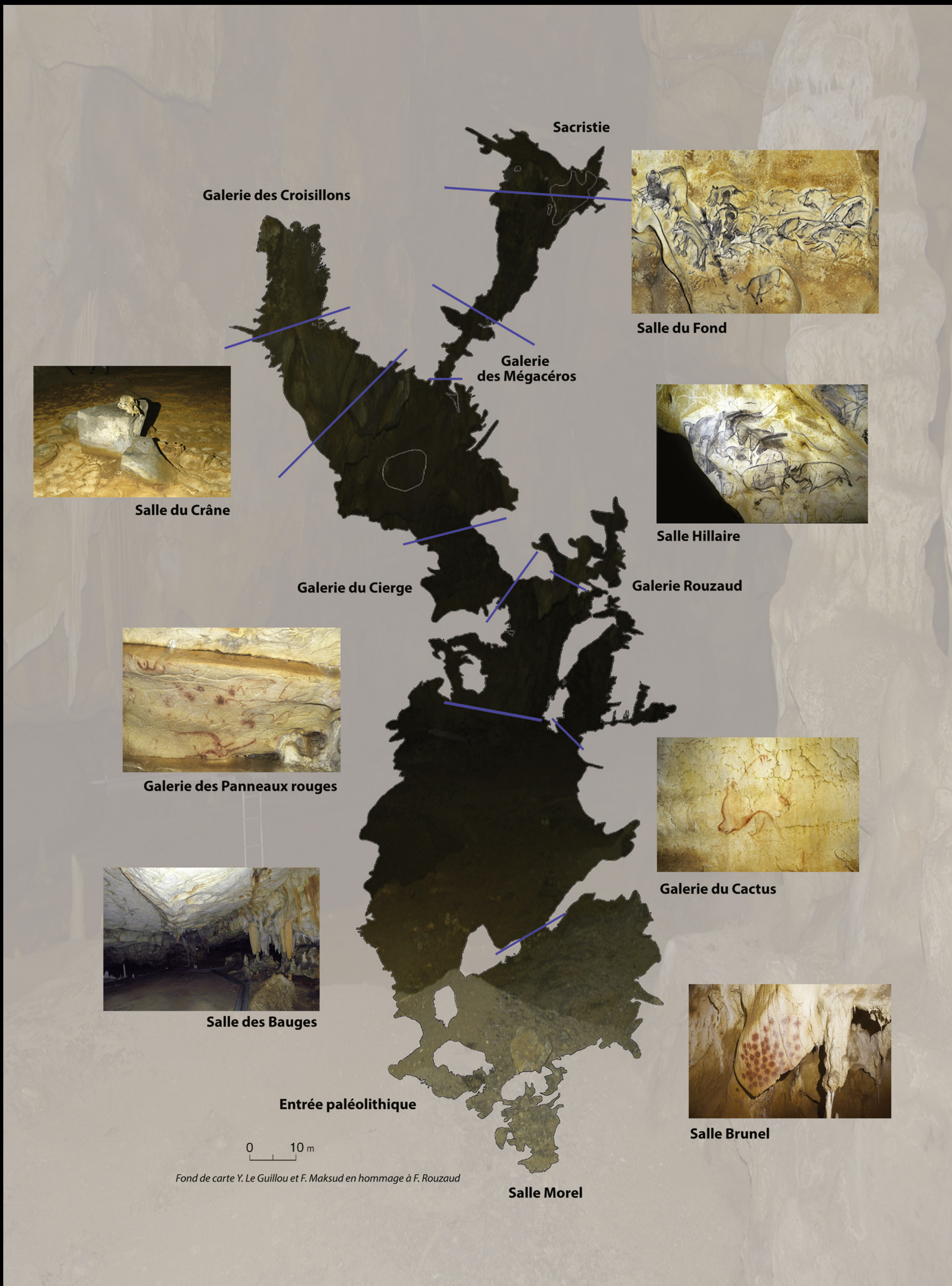


Figure 1 - Grotte Chauvet-Pont d'Arc. General plan and the location of the principle chambers and galleries (CAD: C. Fritz and G. Tosello; topographic background by Y. Le Guillou and F. Maksud dedicated to F. Rouzaud).

Radiometric dates from the cave have multiplied since 1995 (Valladas *et al.*, 2004, 2005; Cuzange *et al.*, 2007). Additional methods have established the precise chronology of the collapse and closing of the primary cave entrance and have further supported the initial results (Sadier *et al.*, 2012). As of 2014, more than 150 dates were available and even more are in the course of treatment and analysis (Quilès *et al.*, 2014). This research confirms that there were two events of human occupation / use of the cave. The first occurred between 33 000 and 39 000 cal BP and corresponds with the creation of the drawings in black (the only ones that can be directly dated), which were solely authored by Aurignacian visitors to the cave. This phase of occupation and decoration is not, however, the oldest. In the sector of the *Salle du Crâne* and the *Galerie des Mégacéros*, there are drawings in black of a distinct character and style that underlie the others but have not thus far been successfully dated (Feruglio, Baffier, 2005). In any case, the position of these figures in the relative chronology of the decorated panels indicates that they are older than the drawings in black dated directly to an average of 36 000 cal BP (Quilès *et al.*, 2014) (figures 2-3).

Figure 2 - *Galerie des Mégacéros*, left wall. Panel with two types of drawings in black, fingertip traces, rubbing-removal of clay, engravings, and claw-marks from cave bears (photo: C. Fritz).

The second and more recent phase of human visitation to the cave dates to the Gravettian (between 29 000 and 33 000 cal BP) and is evidenced by dates derived from torch-marks and charcoal fragments, but not, to date, from any of the drawings (Clottes *et al.*, 1995; Le Guillou, 2005; Cuzange *et al.*, 2007).

Could these Gravettian visits to the cave be related to the creation of works in the cave other than the drawings in black?

The paintings in red and the engraved and finger-traced images, for example, cannot be directly dated. At the entrance to the *Galerie des Mégaceros*, to the left, there is a panel that presents a relative chronology of composition in five stages, in which a finger-traced mammoth on the wall is painted over by two wooly rhinos in black with stylistic characteristics typical of the Aurignacian phase (Feruglio, Baffier, 2005) (figure 3).

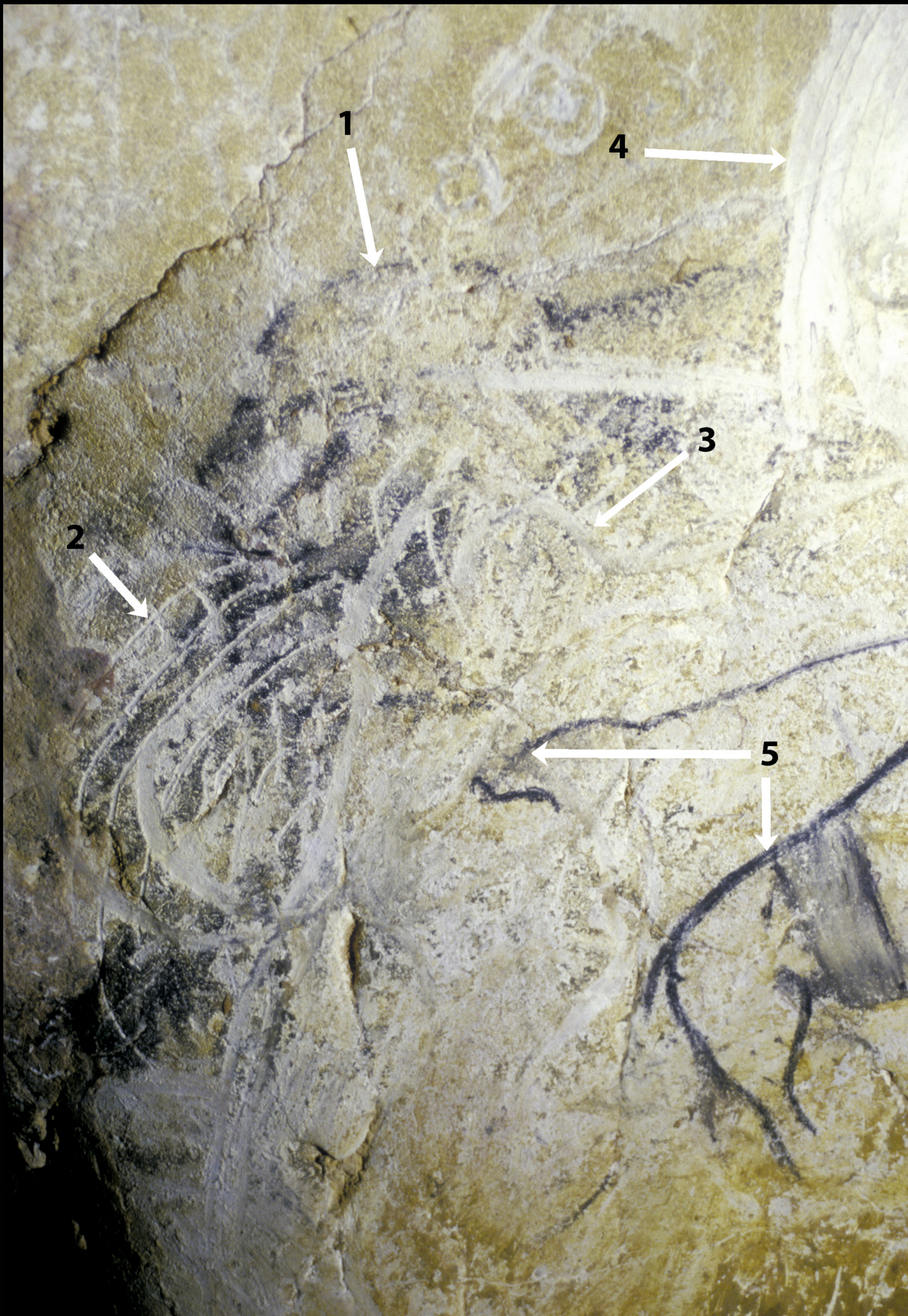


Figure 3 - *Galerie des Mégacéros*, left Wall. Detail of Figure 2. Chronology of phases in the panel: 1: black mammoth; 2: claw-marks of a bear; 3: mammoth in fingertip traces; 4: erasure or signe "en gerbe"; 5: dorsal outline of the black rhinoceroses, drawn during the last phase (chronology: D. Baffier and V. Feruglio; photo: M. Azéma).

Based on comparisons to other caves like Gargas and Pech Merle, at least some of the paintings in red at Chauvet have been attributed to the Gravettian on the basis of stylistic elements such as negative hand-prints and a comparable menagerie of animals (mammoths, bears, felids). In spite of these stylistic parallels, there are images of felids and red dots in the *Salle du Fond* that are heavily eroded and partially covered by drawings in black that date to the Aurignacian phase. These elements (the felids and red dots) are stylistically similar to palm-prints and felids known in the first sector of the cave (Clottes, Azéma, 2005) (figure 4). If the paintings in red of Chauvet date to a single period (which has not been confirmed), they are older than previously believed, because they predate the Aurignacian drawings in black.

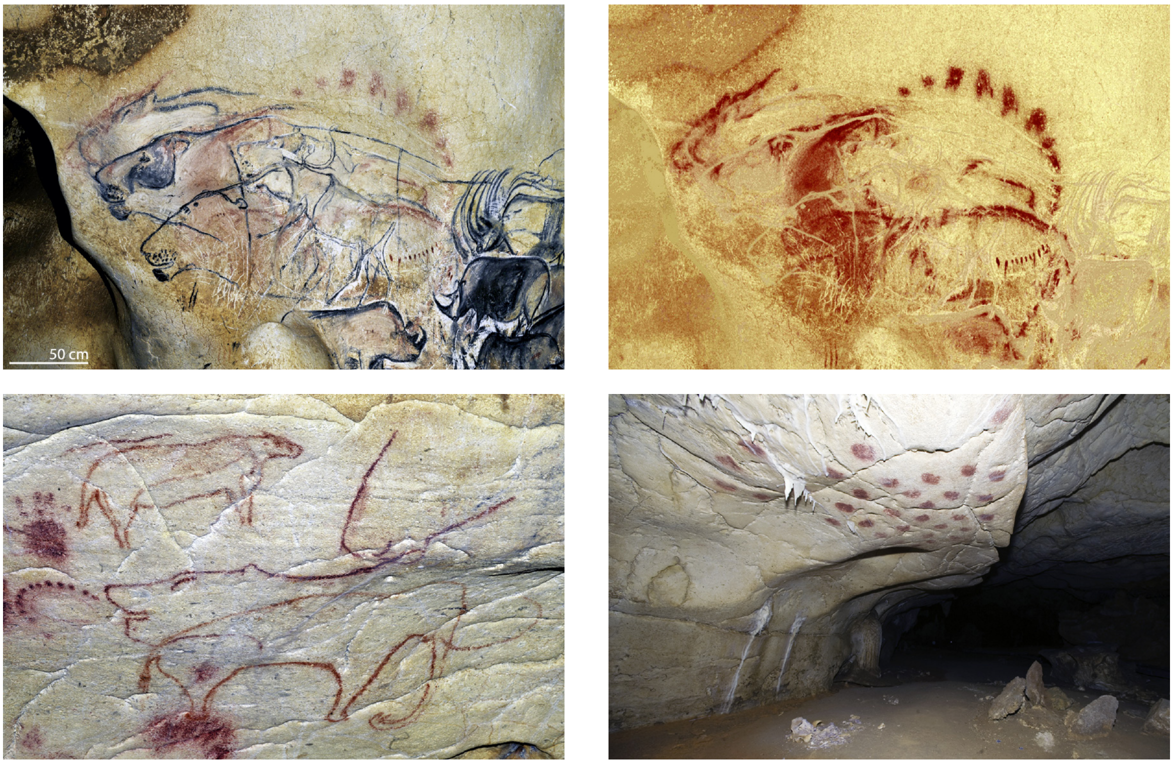


Figure 4 - 1: *Salle du Fond*, left section of the large *Panneau des Lions*. Faded vestiges of red paintings, covered over by drawings in black; 1bis: The same image after digital processing to highlight the red and remove the black. The profiles of the lions and the palm-prints are much more visible; 2-3: Galerie des Panneaux rouges. Heads of lions and zone of red palm-prints for comparison with the paintings in the *Salle du Fond* (photos: C. Fritz and G. Tosello / MCC).

Another noteworthy fact: the paintings in red in the "Salle du Fond" have been cut through by claw-marks of cave bears. The most recent dates on cave-bear remains place them at around 33 000 BP, which additionally suggests that these red images are associated with the initial, Aurignacian, phase of human visits to the cave (figure 5).

If one attempts the rather risky exercise of proposing a synthetic chronology of the site based on the parietal art, the evidence thus far supports a model much more complex than a succession of two distinct phases of human visitation suggested by the currently available dates. The "first" of these two hypothetical phases, the Aurignacian drawings in black that are dated to around 36 000 cal BP, is in fact preceded by even older works drawn in black, painted in red, and engraved. It is difficult to establish a relative chronology within this older sets of images, as there is no recurrent sequence of superposition among them (even if a technique itself can define a chronological phase, which remains to be proven). As for the "second" (Gravettian) phase, it must be pointed out that at present, no work of art can be attributed with certainty to this event of human visitation.

In summary, the chronology of Chauvet cave extends in phases of the Aurignacian that predate 36 000 cal BP; human frequentation of the cave is revealed to have occurred earlier and earlier, even if one cannot as of yet provide an exact date for its beginning.

In Europe, Chauvet cave is now a less isolated example in time and space than it appeared to be in 1995. Since that time, many additional examples of Aurignacian art have been discovered and/or dated to the period between 30 000 and 33 000 uncal BP (36 000 to 37 000 cal BP). The archeological contexts of works of mobiliary art have been dated to this period, for example the ivory figurines of the Swabian Jura at Geißenklösterle (level II, 33 500 BP), Hohle Fels (layer Va, between 31 700 and 32 300 BP) and Hohlenstein-Stadel (between 32 270 and 31 750 BP) (Conard, Floss, 2001; Conard, Bolus, 2003; Conard, 2009; Higham *et al.*, 2012). In Dordogne, the engraved blocks from Abri Castanet have been dated to around 32 600 BP (37 019 ± 480 cal BP) (White *et al.*, 2012). In the Romainian cave of Colboaia, a fragment of charcoal recovered from the floor of a gallery decorated with charcoal drawings returned a date of 31 640 BP (36 020 ± 480 cal BP) (Clottes *et al.*, 2011). In the French department of Gard, in the cave of Baume-Latrone, a fragment of burnt bone was recovered from beneath a layer of calcite sealing the entrance to a chamber of cave paintings was dated to 32 740 ± 530 BP (37 520 ± 650 cal BP) (Azéma *et al.*, 2012). It is the geological in-filling of the site of Aldène that has provided a *terminus ante quem* of 30 260 ± 220 BP for the parietal engravings, "contemporary to the first phase at Chauvet" (Ambert *et al.*, 2005).

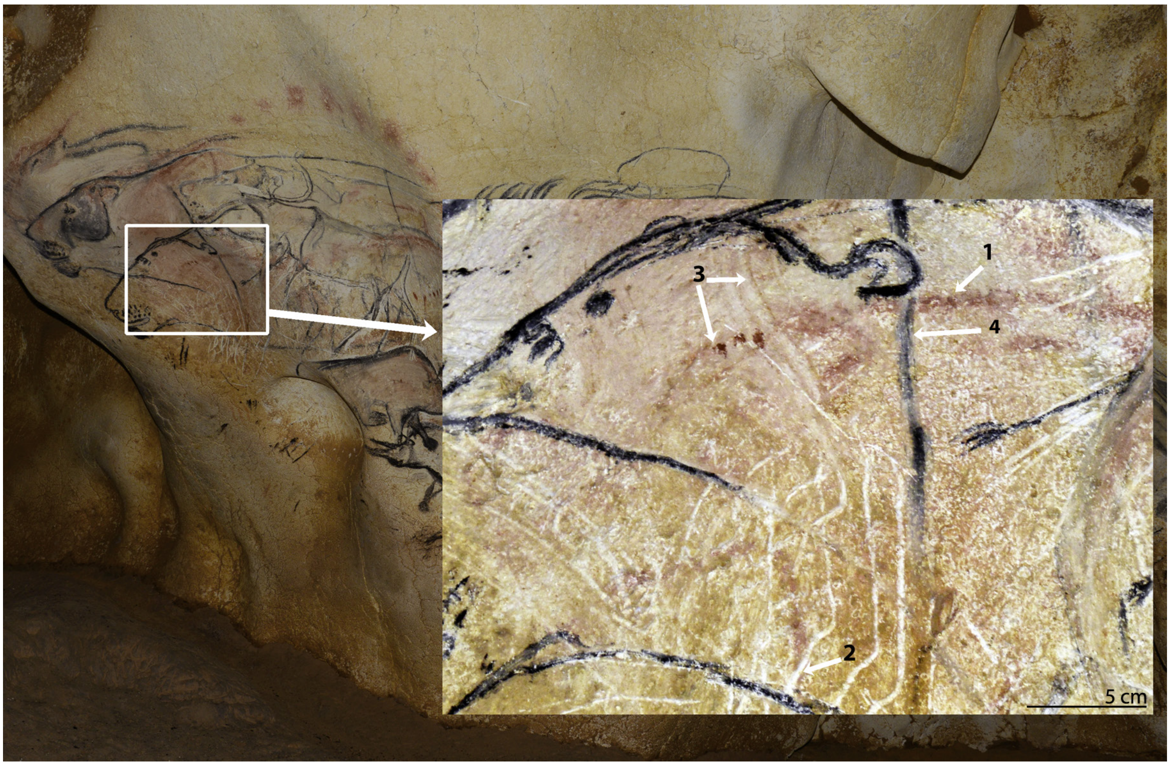


Figure 5 - *Salle du Fond*, left section of the large *Panneau des Lions*. 1: faded left profile of a red lion; 2: claw-marks of a bear cutting through the red painting; 3: fingertip traces and small red dots superimposed over the red lion (1); 4: large black heads of lions superimposed over the ensemble (photos: C. Fritz / Ministère de la Culture et de la Communication).

1 - Three colors in a single cave

As we have shown, the emblematic elements of the art at Chauvet cave are the charcoal figures achieved through sketching with a piece of charcoal and blending. In addition to these iconic images, there are numerous paintings in red and engraving that stand out in white against surfaces of the walls covered in brown clay.

A - White

In contrast to the reds and blacks, the white images in the cave are not the product of pigments applied to the cave walls; they are achieved through the removal of material from the walls. In effect, these images were created by the tracing of fingertips through clay deposits of a reddish-brown color, present on certain areas of the cave walls. Cutting into the clay layer with a fingertip, or removing it by rubbing a palm or tool-edge over it, would have revealed the contrasting white limestone surface beneath. Unlike the majority of Paleolithic decorated caves, in which time has taken its toll and obscured artistic traces with a patina or a layer of calcite, the state of preservation in this cave is so exceptional that the contrasts between clay and cave-wall have maintained their original freshness and appear to us much as they once did to the eyes of prehistoric artisans (figure 6).

Figure 6 - *Salle Hillaire, Panneau du Cheval gravé.* The horse and the two mammoths are composed with fingertip traces that stand out lighter against the ochre-colored clay background of the cave wall. These fingertip traces cut through the claw-marks left by bears (photo: C. Fritz).

As a general rule, the trace of a fingertip hardly lends much subtlety to the sketching of simple outlines with a rapid sequence of gestures, but this does not preclude a certain level of virtuosity. (figure 7). Even so, in certain figures, touchups have been made to modify the original lines, creating an effect of relief (figure 8).

Figure 7 - *Salle Hillaire*, *Panneau du Cheval gravé*. Detail of the head: the inside edge of the outline of the forehead has been softened with the fingertips (photo: C. Fritz).

Figure 8 - *Salle Hillaire*, *Panneau du Cheval gravé*. Along the inferior line of the neck, a series of short, oblique lines is cut through by long fingertip trace that is heavier on the external edge: this succession of gestures was used to create a slight relief effect (photo: C. Fritz).

At times, the artists were more intrigued by the surfaces of the cave walls, abandoning outlines in favor of zoomorphic silhouettes, rubbing away large areas of clay from the walls, as in the case of the "mammouths raclés" in the "Salle du Crâne" (figure 9) (Azéma, Gely, 2005: 49). The inspiration for this masterful composition of three mammoths, which extends over more than 3 m, may have been a vertical pillar with a rounded base projecting from the cave wall and evoking the large foot of an elephant. From this natural "foot", a large mammoth was created in a dynamic pose, hind leg lifted, through removal of the thin clay layer with large, semi-circular gestures. This large figure overlaps to other mammoths to the right that are closely connected to the first, as if the animals are facing or passing each other (figure 10).

Figure 9 - *Salle du Crâne, Panneau des Mammouths raclés*. From afar, the panel looks like a large, light-colored surface, but the mammoths are not visible (photo: C. Fritz).

There are also engravings in which the deepest points of the lines present fine striations, but the sides are steeper than those created with a fingertip (figure 11). In these cases, the tool employed was probably a fragment of wood or bone. In other cases, the engravings were made with fine, pointed tools such as burins or flakes of flint. When these fine lines are optimally preserved, they stand out in white against the brown-to-ochre background like the fingertip traces, but are less clearly visible (figure 12). These fine engravings are more abundant than was thought at the outset of research in 1998; over the course of the research seasons, their number has increased in all sectors examined, from the first decorated chambers to the last (figure 13).

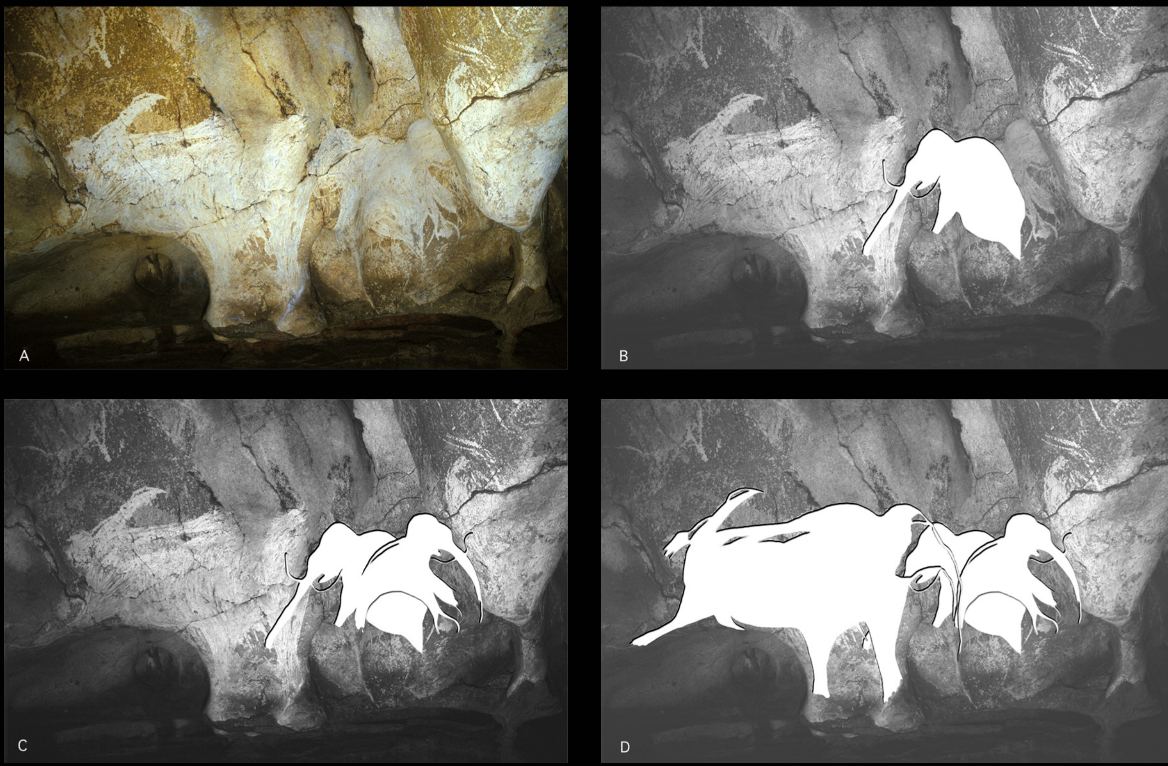


Figure 10 - *Salle du Crâne*, *Panneau des Mammouths raclés*. Schema representing a chronological reading of the panel: view of the ensemble of the finished panel (A), the first mammoth drawn to the right (B), the second mammoth to the right, drawn over the first (C), the third, to the left (D) drawn over the two others (photos and CAD: M. Azéma and B. Gély).

Figure 11 - *Salle du Crâne*, *Alcôve des Bouquetins*. The engravings of this ibex differ from the fingertip traces and show striations attributable to a tool (photo: C. Fritz).

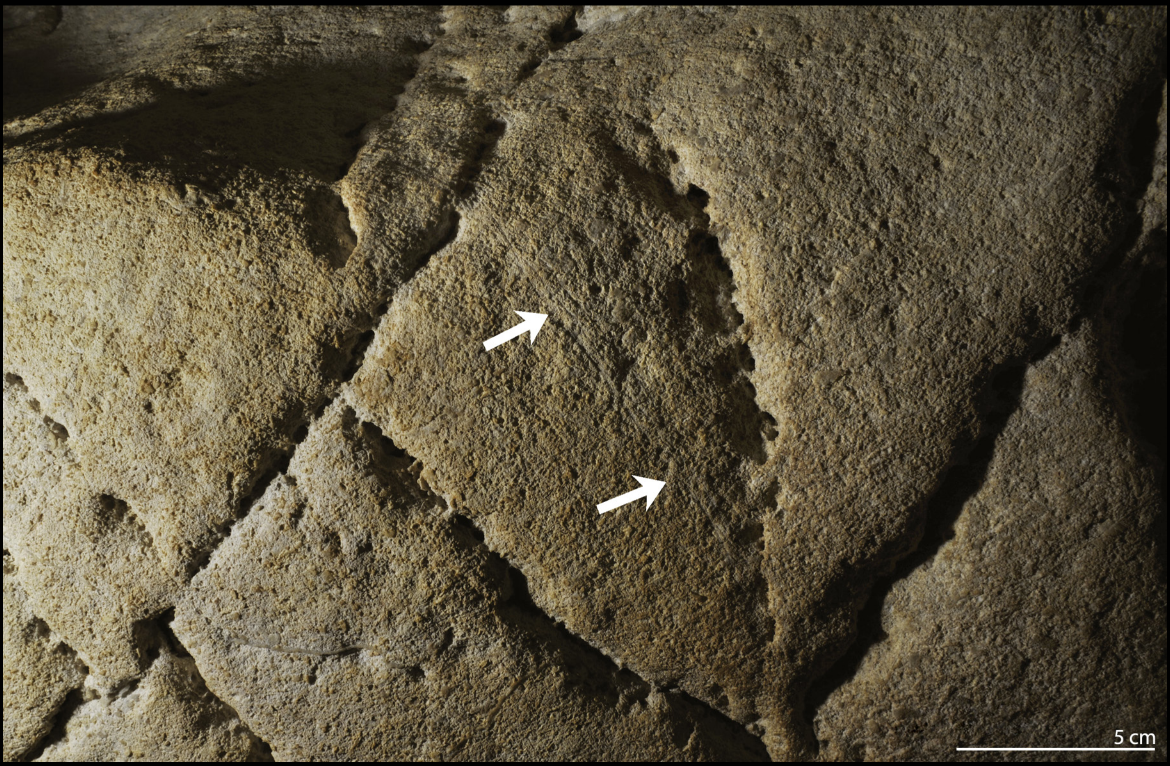


Figure 12 - *Galerie des Panneaux rouges*, *Panneaux des Mains négatives*. Detail of a large, finely engraved horse, in the upper portion of the panel (see also figure 13). The fine lines defining the lower outline of the neck (indicated in the image by arrows) are only visible by oblique light (photo: C. Fritz).

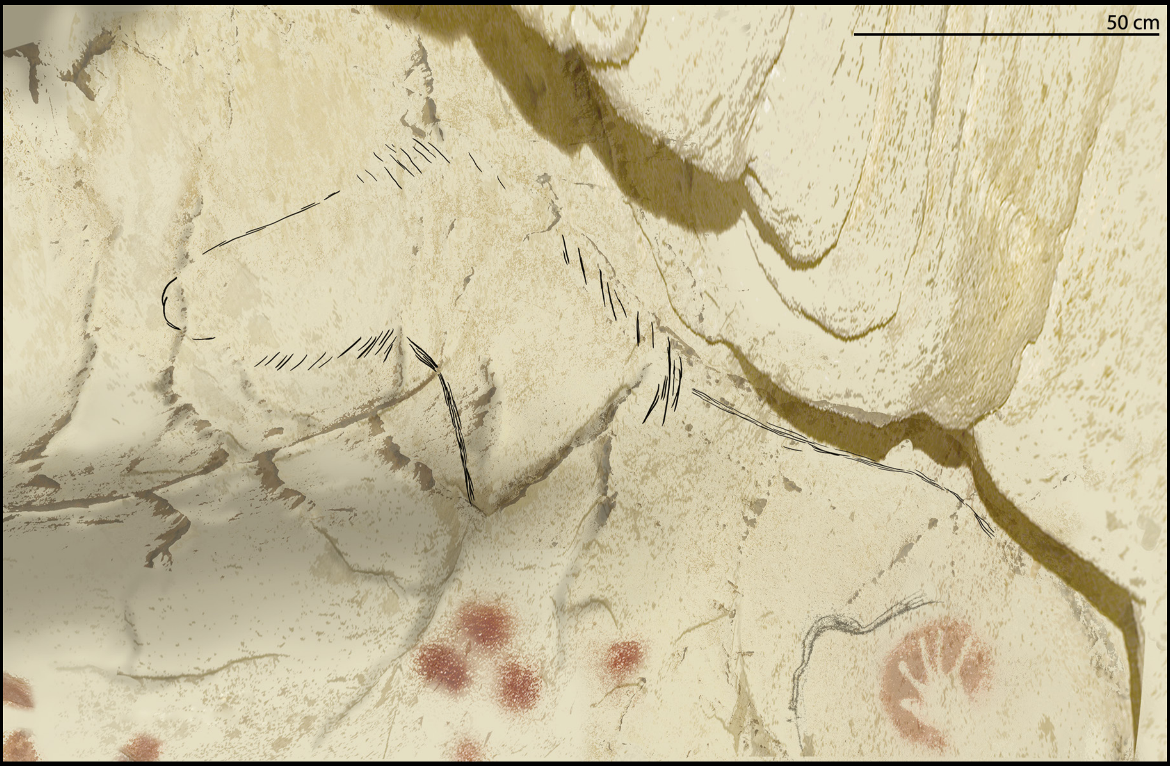


Figure 13 - *Galerie des Panneaux rouges*, *Panneaux des Mains négatives*. Rendering (relevé) of the engraved horse in the upper portion of the panel (drawing: C. Fritz and G. Tosello).

B - Red

The second color in the compositions at Chauvet Cave is the red that, among other things, is the preferred pigment for the abstract signs and symbols and handprints. There are also numerous animals in red, for the most part limited to the first half of the cave but present all the way through to the "Salle du Fond". In spite of a large and nuanced palette of tones, all of the reds pigments are composed of hematite (figure 14).

Figure 14 - *Galerie des Panneaux rouges, Panneau de la Panthère.*
Shown in its entirety, displaying the nuanced diversity of reds in the cave (photo: C. Fritz).

The rarest of these techniques is spraying of the colorant in powder form, either directly from the mouth or with the use of a tube, as exemplified in the large dots and on the panel of negative handprints and the negative handprints themselves (figure 15). This technique is identified by the morphology of the resulting spots of pigment, which are more concentrated at the center and thin out toward the edges. The effect is similar to that obtained today by using an airbrush or spray-paint. On one of the negative handprints, "spatter" is visible (pronounced spots of red that interrupt the gradation of the pigment) and indicated either that the pigment was not ground uniformly or that it was not homogenously mixed with water (figure 16).

The color red was often applied in a liquid form, though more or less thick. The simplest method is to dip the finger or hand into the pigmented mixture and apply it directly to the rock face. This was the method used to create the five positive handprints known in the cave (figure 17). The artists also employed a variation of this technique by which solely to the palm of the hand, covered with pigment, made contact with the wall. The resulting motif, the "palm-print", was in some cases repeated to form surfaces of palm-prints with zoomorphic outlines (Baffier, Feruglio, 1998). The presence of complete handprints showing "phantom" (accidental) first phalanges have lent support to the restitution of this technique (figure 18).

Figure 15 - *Galerie des Panneaux rouges*, *Panneaux des Mains négatives*.
Large red dot made by spraying pigment (photo: C. Fritz).

Figure 16 - *Galerie des Panneaux rouges*, *Panneaux des Mains négatives*. Negative handprint made by blowing pigment in a mixture of liquid and pigment that includes larger particles of pigment (indicated by arrows) (photo: C. Fritz).

Figure 17 - *Galerie des Panneaux rouges*, *Panneaux des Mains positives*.
The five positive handprints in the cave (photo: C. Fritz).

Figure 18 - *Galerie des Panneaux rouges*, *Panneaux des Mains positives*. Red dots made by pressing the palm of the hand, covered in paint, to the wall and avoiding all contact between the fingers and the wall. In certain places, the observation of accidental traces of the first phalanges confirm the reconstruction of this technique (photo: C. Fritz).

The most frequent technique employed in the creation of red animal figures is the simple outline, usually fairly broad. On one small horse figure, dripping occurred while the paint was still fresh, indicating a mixture of pigment and water that was a bit too fluid (figure 19). With the exception of this case, it seems that the pigment mixtures used were generally rather thick. Close observation shows that the densest concentration of particles of pigment are concentrated along zones of micro-relief, leaving bare zones at the millimetric scale. As a result, many of the red lines have variations in color density, and even gaps when they are perceived from a distance, as is generally the case (figure 20).

Some red lines show signs of partial rubbing with fingers. This detail is particularly visible on the bears (in the "Diverticule" and "Cactus"). The result is a strengthened outline that is also more regular, as the redistributed pigment fills in any gaps left in the initial deposition of color. On red animals, the use of a blending stump is primarily evident on the heads and forelegs (figure 21).

The question of the use of brushes arises in certain rare cases, such as that of the small rhinoceros in the "Panneau des Chevaux". The regularity of the stroke (with visible parallel striations in the curves of the line) and the presence of downstrokes and upstrokes could indicate the use of a hair or fur brush in the application of the paint (figure 22).

A recent discovery has revealed that fine engraving sometimes accompanies the red pigment, as is evidenced on a large rhinoceros whose woolly coat has been carefully illustrate with fine parallel incisions that are barely perceptible in oblique light (figure 23).

Figure 19 - *Salle Brunel, Panneau des Cheveaux jaunes*. The dripping lines visible on the head of this schematic horse indicate that the mixture of pigment was too fluid when it was applied to the wall (photo: C. Fritz).

Figure 20 - *Galerie des Panneaux rouges, Panneau du petit Ours*. The contour of this bear was smoothed out with fingertips to render the outline more regular (photo: C. Fritz).

Figure 21 - *Salle Brunel, Diverticule des Ours* (A) and the *Galerie du Cactus* (B). The comparison of these two painted bears in these distant sectors of the cave show technical similarities of technique, notable blending on the muzzle and the throat (photo: C. Fritz).

Figure 22 - *Salle Hillaire*, *Panneau des Chevaux*. This small, schematic head of a rhinoceros at the far right of the panel is one of the rare red paintings in the deepest sectors of the cave (photo: C. Fritz).

Figure 23 - *Galerie des Panneaux rouges, Panneaux des Mains positives*. Illustration of a large, red rhinoceros (1.08 m) enhanced by finely engraved lines. Top: detail of the engravings (arrows) (photo and drawing: C. Fritz and G. Tosello).

C - Black

Black pigment is almost exclusively composed of wood charcoal from the single species of Scots pine (*Pinus sylvestris L.*), selected for its lighting properties in caves (Théry-Parisot, Thiébault, 2005). The charcoal found in the cave derives either from torches or from hearths lit on the cave floor in the deeper areas of the cave (figure 24). The execution of figures in black reflects what one might call an opportunistic state of mind on the part of the artist or, if one prefers, a keen sense of adaptation to the state and form of the cave walls. The technical principles employed are simple, but their use in combination and/or succession can result in complex gestural sequences. The term "figures in black" encompasses a great diversity of works.

There are some drawings traced directly on limestone surfaces free of clay deposits. The outline is sometimes retraced with the fingers, which crushes the charcoal grains and increases the density of the black. This is the first stage of blending (figure 25).

The operational sequence becomes more complicated in places where the cave wall is covered with a thin layer of brown clay. Drawing with a stick of charcoal is difficult or even impossible because the charcoal mixes with the damp clay as it is deposited, which results in lines that are faint, diffused, and difficult to see. In these cases, the artists at Chauvet began with a wiping or scraping procedure aimed at removing the fine layer of clay and revealing the white limestone beneath (figure 26). This process presents a two-fold advantage: it allows for smooth application of the charcoal and also reveals a white background that was not apparent before. The drawings in black benefit from an increased contrast that intensifies their visibility and expressive power (figure 27).

Another result of this procedure is that once scraped clean, the more resistant white limestone can be finely engraved with pointed tools in hard materials, such as flint flakes or burins (figure 28).

In numerous cases, the artists left thin zones of brown clay on the surface, which mixed with and diffused the charcoal. The result is a nuanced palette of colors that ranges from light gray to beige or dark brown, depending on the dominance of the clay (brown) or charcoal (black). Macro photographs show granules of charcoal mixed with particles of clay and the white of the wall (figure 29).

Drawings achieved with this mixed technique (preparation by scraping, drawing with charcoal, blending, mixture of pigments on the wall, and engraving) are the most representative of the site. They are often assembled in monumental frescoes, such as that on the *Panneau des Chevaux* (figure 30).

Studies of the "Panneau des Cheveaux" have revealed a composition by species (rhinoceros, aurochs, horse). The group of horses, at the center of the composition, were executed at the final stage and their position was reserved for them in earlier stages (figure 31). These studies also revealed an "anomaly" in the sequence of composition: with his/her final gestures, the artist retouched the horn of a certain rhinoceros, one of the first figures completed in the lower portion of the panel, causing it to overlap the final plane of the image, as if it were slipping under the belly of the fourth horse. This graphic modification reveals a conceptual link between the unit of the two rhinoceroses and the four horses (figure 32). In the "Alcove des Lions", located just to the right of the "Panneau des Chevaux", the interweaving of figures is even more elaborate (figure 33). In fact, the outline of the body of one large lion is broken at three points to leave space for two horses, creating successive visual planes. Remarkably, the head of a third horse emerges from the belly of the lion, its muzzle passing outside the outline of the lion, as if it is trying to escape the grasp of the beast. This lion is superimposed or underlying another horse, depending on which lines one examines, which at first blush seems paradoxical (figure 34).

A final example of a "contradictory" chronology within the compositions occurs in the *Salle du Fond*. On the left section of the large "Panneau des Lions", a reindeer with multiple hooves was painted and engraved over a group of four lions. Assessment of the arrangement of the lines in this composition show that the antler of the reindeer overlaps the back of one lion; on the other hand, the hind feet of the deer are crosscut by the line of the same lion's belly (figure 35).

Figure 24 - *Galerie des Mégacéros*. At the foot of the wall decorated with a horse (engraved and drawn in charcoal), the ground is covered in a scatter of charcoal and rubified fragments of stone (photo: C. Fritz).

Figure 25 - *Salle Hillaire, Panneau des Rennes*. Red deer drawn in charcoal and partially blended (chest, fetlock) on a bare limestone wall, not coated with clay (photo: C. Fritz).

Figure 26 - *Salle du Fond, Grand Panneau des Lions*. More than 2 m above the floor, these lion heads were drawn in charcoal on surfaces that were first scraped by hand to remove the clay that covered them (photo: C. Fritz).

Figure 27 - *Salle Hillaire, Secteur des Chevaux*. The white, scraped surfaces accentuate the contrasts between the drawings in black and make them more expressive, especially when seen from a distance (photo: C. Fritz).

Figure 28 - *Salle Hillaire, Panneau des Chevaux*. The head of a horse drawn in charcoal and then blended has been entirely traced in fine engravings to define the outline (photo: C. Fritz).

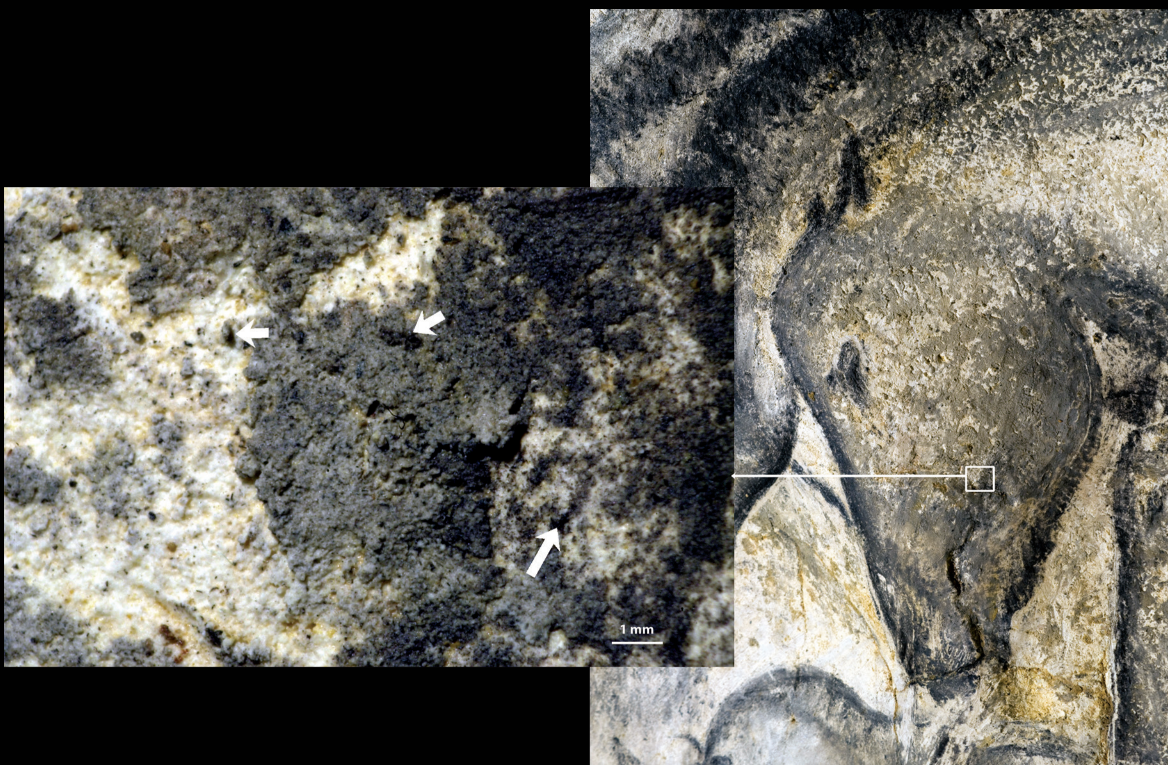


Figure 29 - *Salle Hillaire, Panneau des Chevaux*. Cheek of a second horse. Macrophotography (12×) shows a mixture of charcoal fragments and clay from the wall that produced the shades of gray, as with the mixing of paint. Micro-charcoal (arrows) are still visible (photo: C. Fritz).

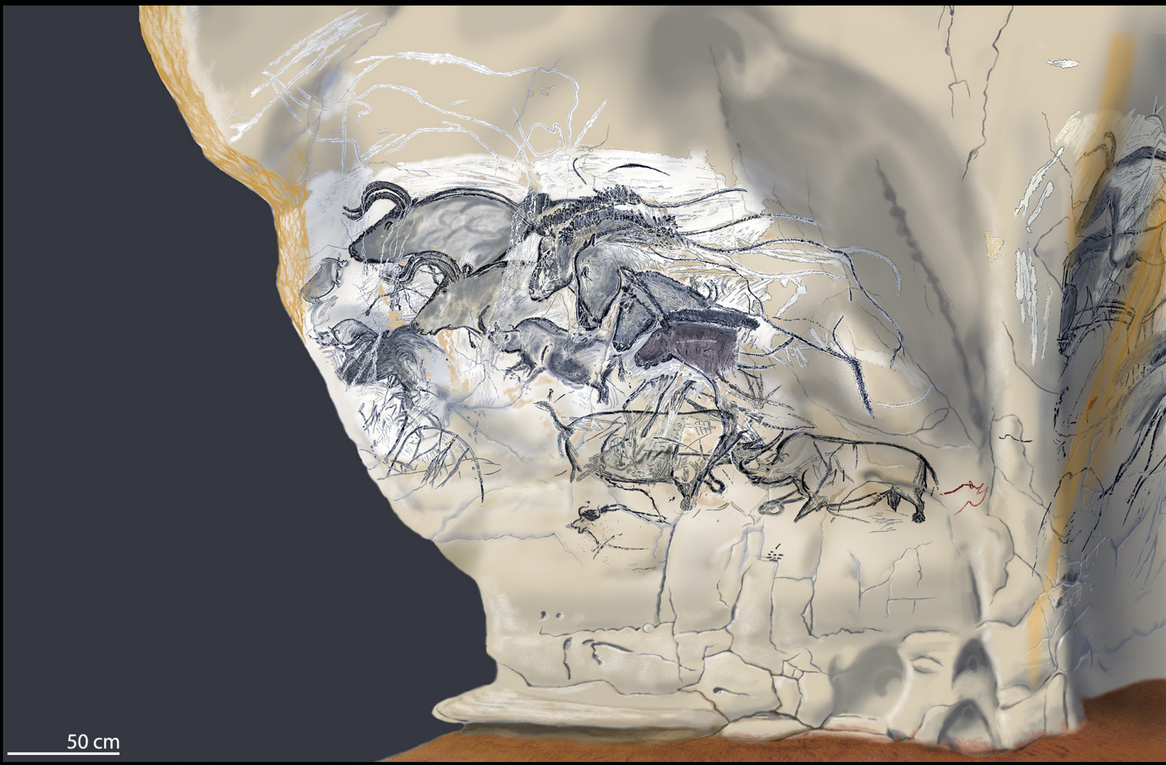


Figure 30 - *Salle Hillaire, Panneau des Chevaux*. Rendering (relevé) of the panel in its entirety (drawing: C. Fritz and G. Tosello).

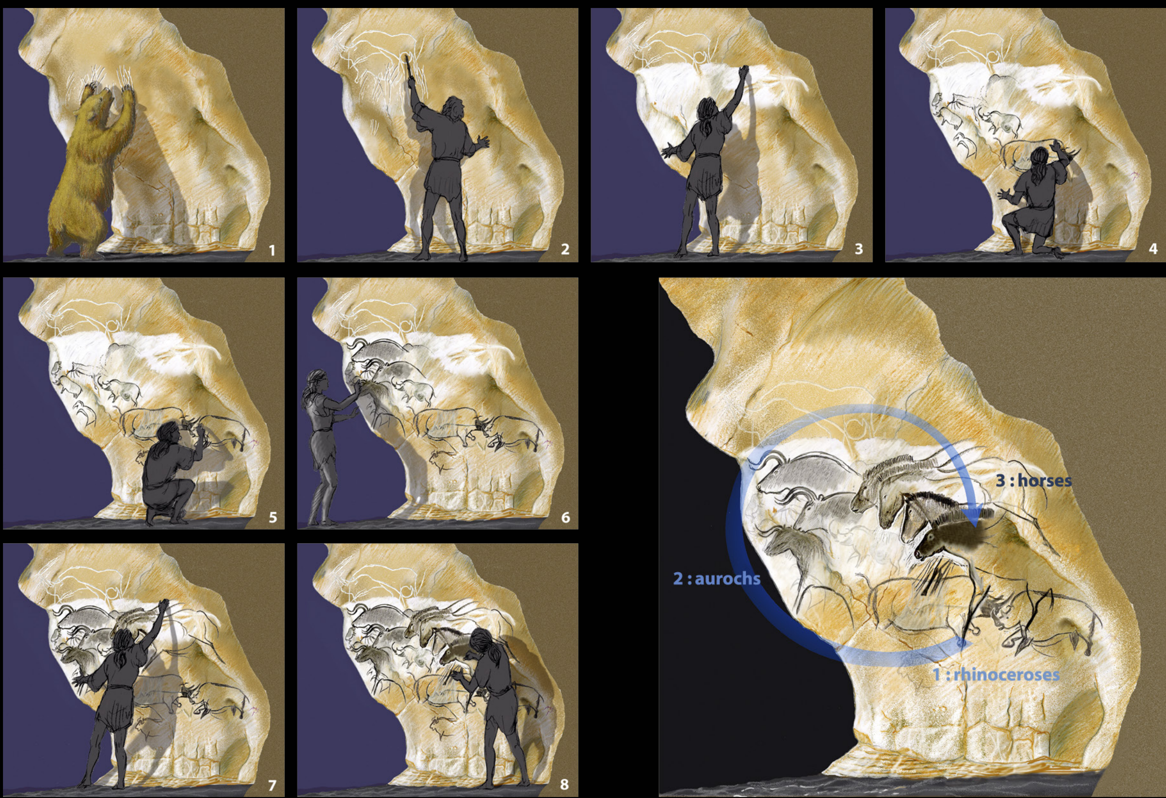


Figure 31 - *Salle Hillaire, Panneau des Chevaux*. Chronology of the primary stages of creating the panel. 1: initial state of the wall; 2: engravings on the upper section; 3: scraping of the surface in the central area; 4-5: the opposing rhinoceroses; 6: the aurochs; 7-8: the horses. The chronology of the panel reveals a composition of the figures organized by species, in a clock-wise sense (drawings: C. Fritz and G. Tosello).

Figure 32 - *Salle Hillaire, Panneau des Chevaux*. Detail showing the superposition of the horn of one of the opposing rhinoceroses on the belly of the last horse to be drawn. This superposition (which goes against the chronological sequence of the composition as a whole) can be interpreted as a final touch by the artist, a detail that supports the argument for a single hand in the creation of the composition (photo: C. Fritz).

Figure 33 - *Salle Hillaire, Alcôve des Lions*. Partial view of the left wall (photo: C. Fritz).

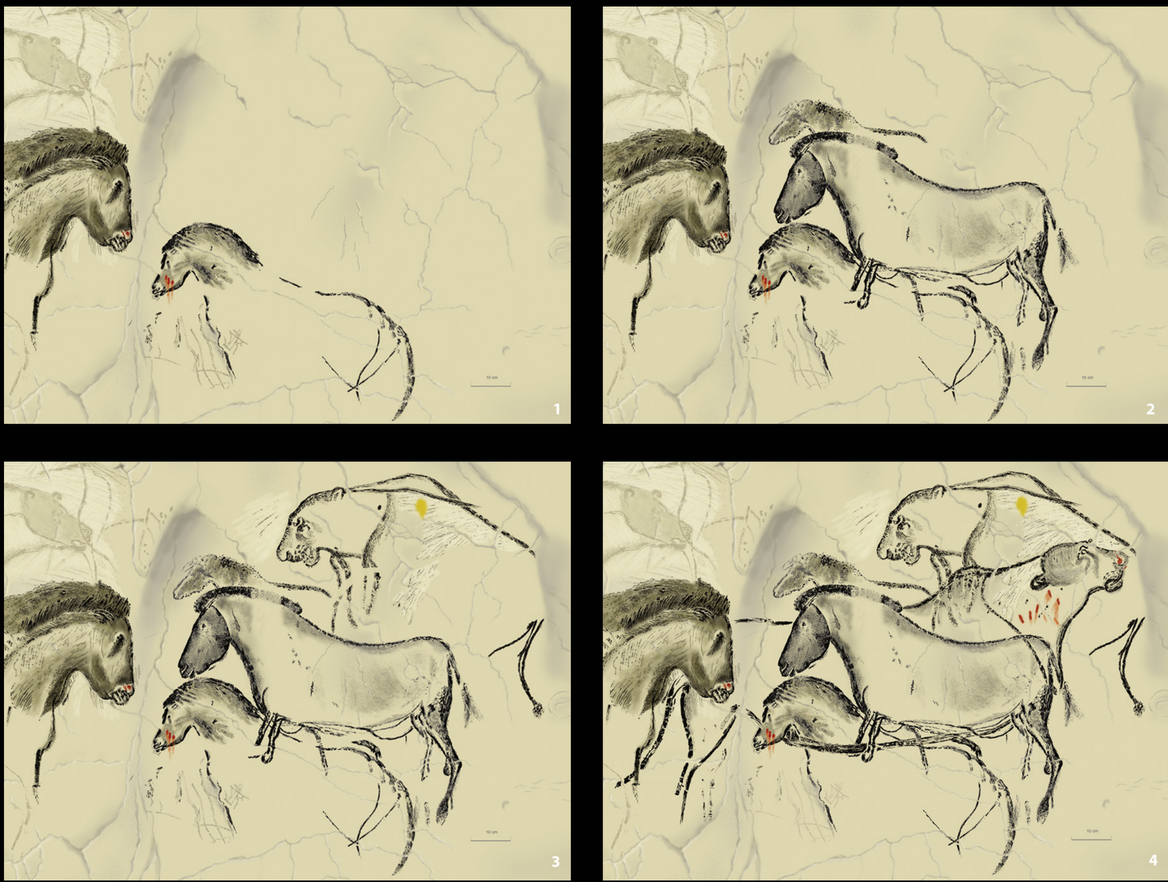


Figure 34 - *Salle Hillaire, Alcôve des Lions*. The left section of the right wall. Four stages in the chronology of the composition of two lions and four horses. The large male feline appears to be the last figure drawn, but the outline of his body lies over those of the horses in some places, and is cut through by them in others (drawings: C. Fritz and G. Tosello).

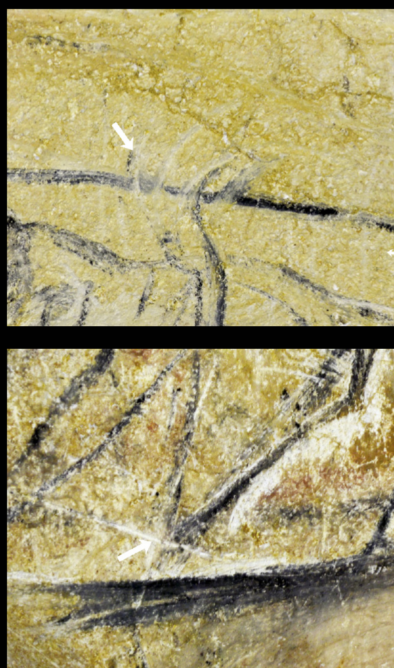


Figure 35 - *Salle du Fond, Grand Panneau des Lions*, left section. The reindeer with multiple feet at times superimposed on (antlers) and at times underlies (hind foot) one of the lions (photo: C. Fritz).

These apparent contradictions are resolved if one considers each of these compositions as an autonomous ensemble. Through these final alterations, the artist disturbed the order of succession of the figures, as if she wanted to bring a story to a close by reinforcing the graphic ties between the characters.

2 - Codified images in the service of a story

A survey of the different techniques and colors in the Chauvet paintings demonstrates the diversity of the parietal art in the cave. Nonetheless, there are similarities in these works that reveal closely-related processes and concepts. For example, spreading the red paint with the fingertips and crushing the pigment so that it penetrates cracks in the limestone is an approach very similar to the blending of charcoal in the drawings in black, in terms of both the gestures and the results obtained.

As already mentioned, the animals display stylistic similarities and graphic conventions that transcend the techniques of their execution (Clottes, 2001; Tosello, Fritz, 2005). Thus the rhinoceroses, whether engraved, red, or black, have ears represented by a double-curve motif, a line on the cheek, and a distinct band at the center of the body (figure 36). The aurochs all have sinuous and parallel horns that project forward, whereas the horns of the bison are symmetrically positioned to either side of a central, circular “chignon”. Finally, the lions, in spite of their individualization, present numerous points of commonality: squared muzzles drawn in triple-curved motifs; small, round ears; tear-ducts...

Figure 36 - Beyond the inevitable idiosyncrasies, the rhinoceroses of Chauvet possess stylistic similarities, graphic conventions that transcend the diversity of techniques (drawings: C. Fritz and G. Tosello).

This "family resemblance" is also evident in the themes and the compositional processes of the more complex panels.

In the "Salle du Fond", the center of the "Panneau de Lions" displays a composition of some thirty animals primarily represented by the heads and forelegs. Nearly all of these animals face the left (figure 37). The lions grouped on the right stalk a herd of bison, regarding them with intensity. The bison flee; four of them are seen face-on as if they are turning toward the viewer. This panel can be interpreted as a hunting scene, with the entrance of the predators on the right and the flight of prey to the left (Azéma, 2011) (figure 38).

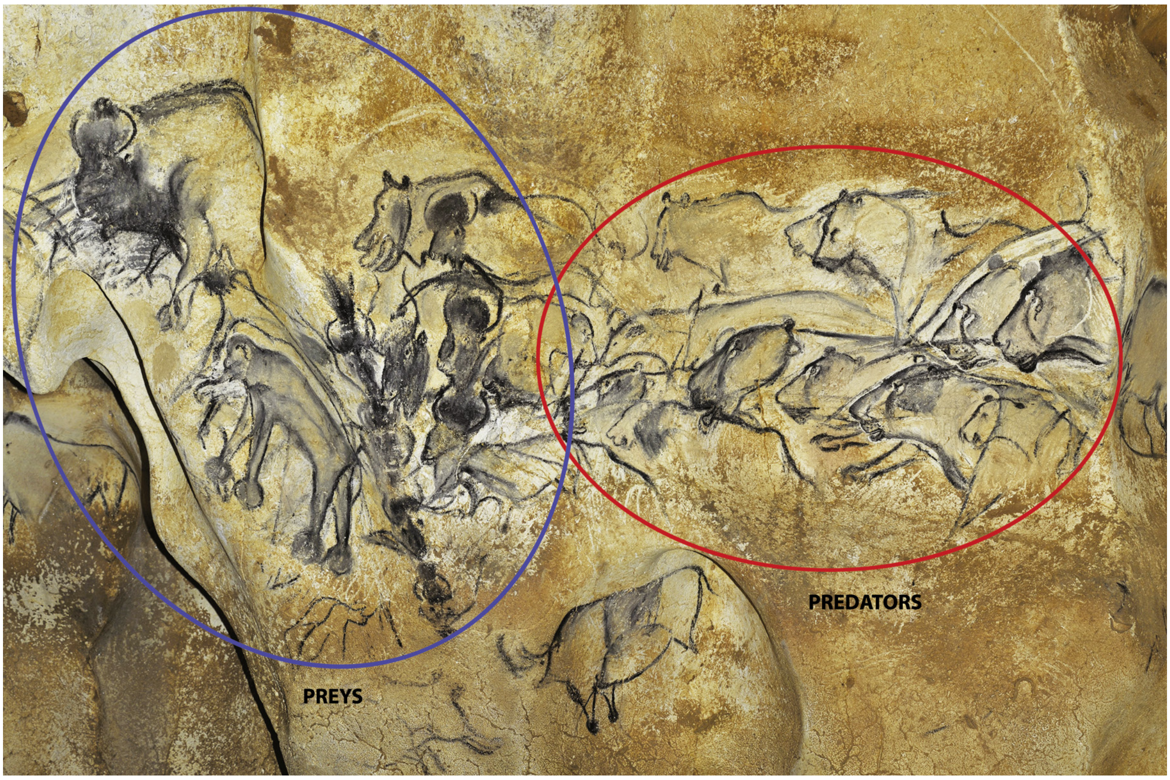


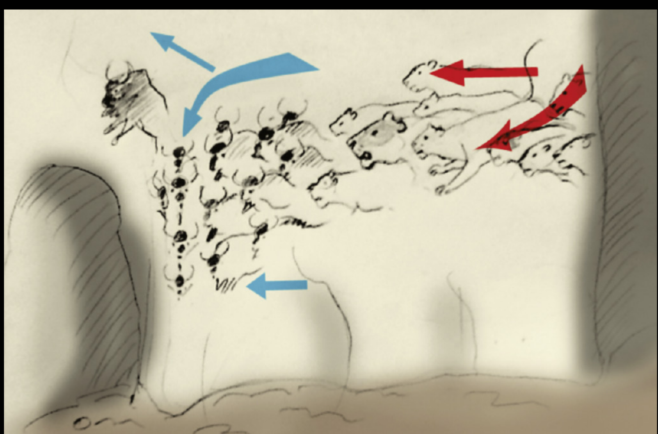
Figure 37 - *Salle du Fond, Grand Panneau des Lions*, central section.
Hunting scene: big cats track a herd of bison fleeing toward the left (photo: C. Fritz).

In another sector of the cave, the "Galerie des Panneaux rouges", the red paintings are situated in the upper sector of the large panel (more than 7 m long in all) sharply inclined above the cave floor (figure 39). The presence of archeological vestiges and cave-bear bones at the foot of the wall prevents approach and the view from the walkway presents significant distortions. The reconstitution of the decorated section on a textured 3-D model allowed for a better understanding and interpretation of this the relationships between the representations of the animals and the different species. The scene is read from left to right, as in the "Salle du Fond". Seven felids appear to stalk a herd of rhinoceroses fleeing in two groups, in two opposing directions (figure 40). The red felines, mostly represented by the heads, lack detail; they are distinctly less expressive than their counterparts drawn in black.

1 - The lions leap into pursuit of the bison

2 - Sketch of the position of the predators and prey

3 - Among the bison fleeing to the left, four of them are seen head-on as if they are turning toward the viewer



4 - The lions leap into the scene, gazes fixed on their prey

Figure 38 - *Salle du Fond, Grand Panneau des Lions*, central section (drawings: C. Fritz and G. Tosello).

Figure 39 - *Galerie des Panneaux rouges, Panneaux des Mains positives*.
Global view of the central portion of the panel (photo: C. Fritz).

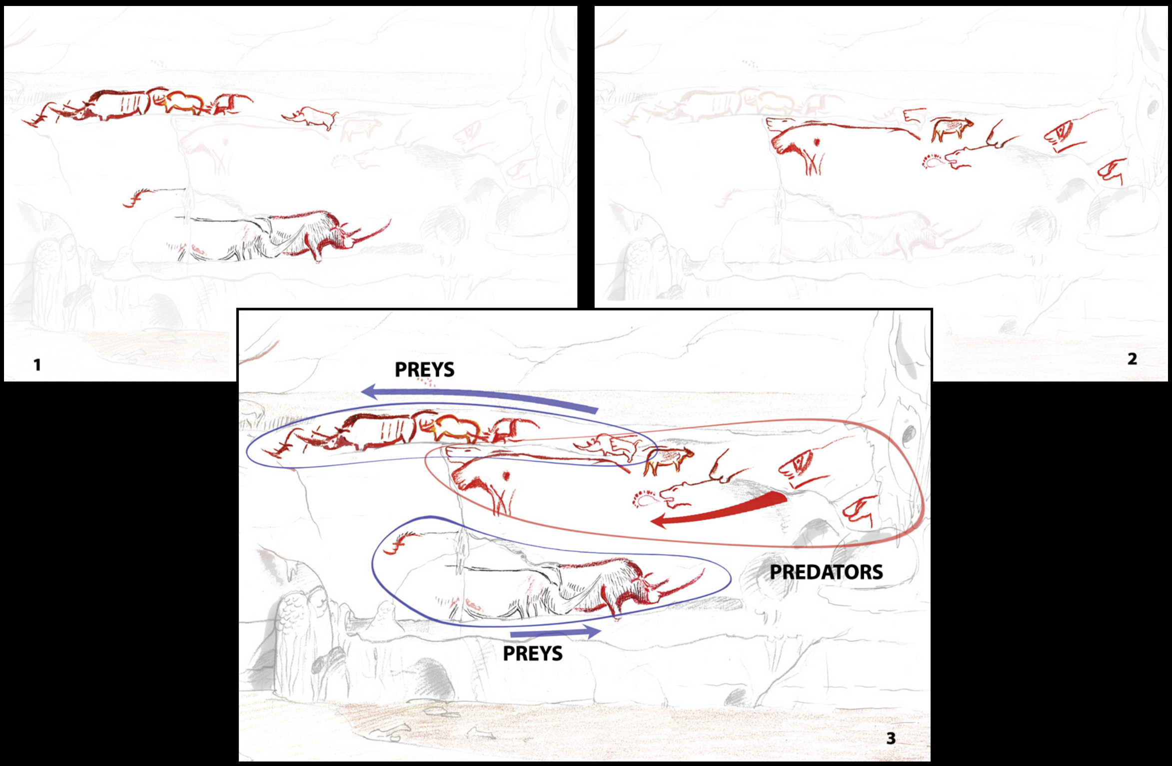


Figure 40 - *Galerie des Panneaux rouges, Panneaux des Mains positives*. Hunting scene. 1: sketch of the location of the rhinoceroses; 2: sketch of the location of the lions; 3: structure of the composition and interpretation. The lions have divided the rhinoceros herd into two groups that flee in opposite directions (drawings: C. Fritz and G. Tosello).

At the entrance to the "Salle du Crâne", opposite the "Panneau des Chevaux", a herd of ibex engraved with fingertip traces and deeper engravings coexist with an animal whose squared muzzle, elongated body, and long tail suggest a felid (figure 41). The ensemble of figures is represented in a summary manner: only two of the ibex are represented with bodies, while the rest are suggested only by the horns. If one analyses this composition, it appears to be yet another hunting scene, even more schematic in its representation than the red panel (figure 42).

Conclusion: shared myths?

In terms of chronology, the study of parietal art since 1998 has considerably enriched our overall view of the subject. What one can call the Aurignacian phase, dated to around 36 000 cal BP, has been revealed to be longer and more diverse than the ^{14}C dates, based solely on the figures in black, allowed us to perceive. This phase undoubtedly consists of a succession of overlapping parietal compositions, grouped into distinct or common spaces in the cave, possibly associating panels of several techniques and colors. This long time span is corroborated by the early disappearance of cave bears and further supported by the analysis of motifs and figures that share common stylistic conventions, themes, and modus operandi. In this varied but coherent ensemble, the place of the "second" phase as revealed by the ^{14}C dates has proven difficult to discern, even though is highly improbable that the Gravettian visitors would have left no traces in the cave aside from the torch-marks that yielded the relevant dates; they must logically have been the authors of some (minor?) part of the panels, even if we cannot isolate definitive formal or thematic indications. It is rather the opposite that emerges in our analyses. In anticipation of new radiometric dates, are we to imagine that the groups of people related to these distinct phases shared similar techniques, graphic conventions, even the same conceptual universe?

One of the most striking aspects of the parietal art in Chauvet cave is unquestionably the organization of individual figures in complex compositions, conceived as narrative elements tied to ethology (scraped mammoths, rhinos in confrontation) or carrying some enigmatic significance through the association of different interwoven and overlapping species (*Panneaux des Cheveaux*). This complex elaboration leads us to hypotheses involving encoded spatial relations or symbolic complementarities (Leroi-Gourhan 1958a-c, 1971; Sauvet *et al.*, 1977; Sauvet, Sauvet, 1979). Chauvet-Pont d'Arc presents a more distinct legibility than is encountered in the majority of decorated caves, and, above all, a unique thematic aspect.

The hunt, by predatory animals, was the central preoccupation of the artists. The most clearly intelligible is the large panel of Lions. In fact, this scene provides the interpretive keys for other, less explicit, compositions following the same theme, such as the hunt of horses (black), of rhinoceroses (red) or of ibex (engraved). In passing, one notes that the three colors and the diverse techniques and animal species of the cave are all represented. Even if the black panels display a more elaborate *mise-en-scène*, it is no less the case that a comparable narrative structure can be proposed in the other cases.

If we believe the parietal depictions, cave lions, the largest predator of the epoch, practiced coordinated hunts (as do African lions today) and attacked large prey such as steppe bison and even wooly rhinoceroses. This beast of prey must have been simultaneously feared and admired by the humans who shared their territories. It is conceivable that this combination of fear and admiration (awe) inspired in these artists, themselves hunters, a certain fascination and that they symbolically staged themselves in these scenes, in the form of these big cats. The scenes in their entirety though, are limited neither to the hunt, nor to impending slaughter.

Figure 41 - *Salle du Crâne, Alcôve des Bouquetins*. Global view of the panel of engravings and fingertip traces (photo: C. Fritz).

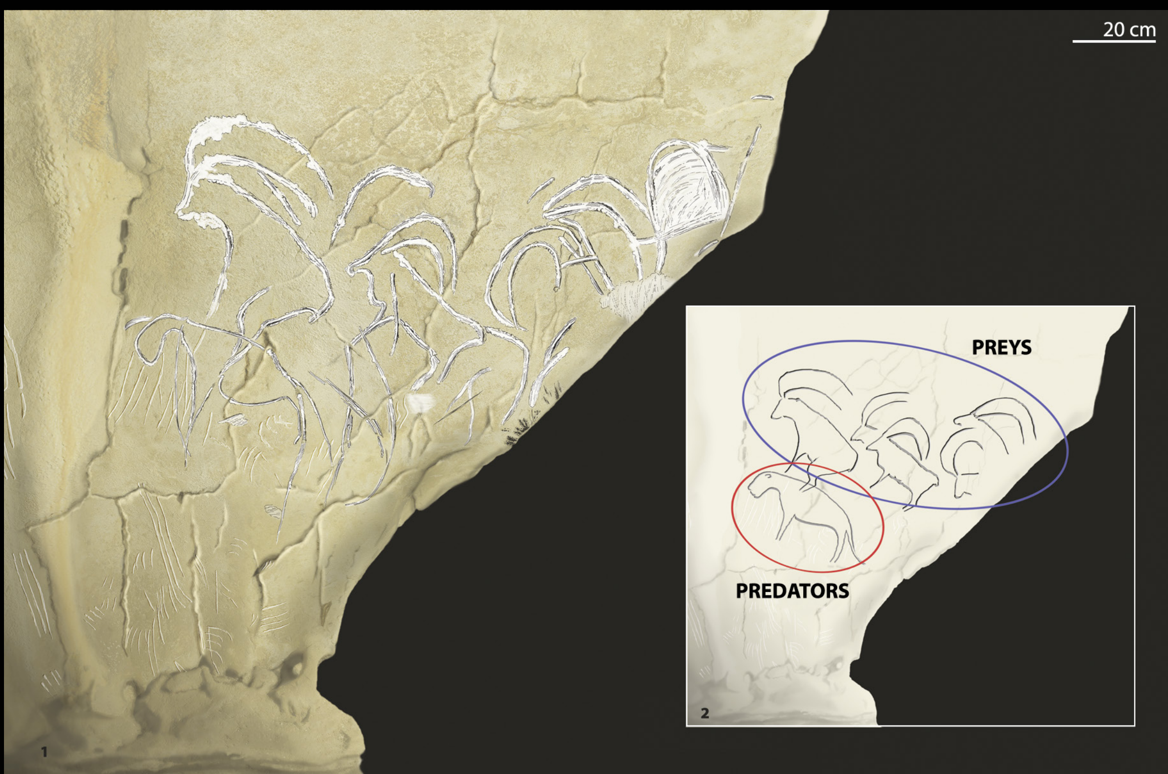


Figure 42 - *Salle du Crâne, Alcôve des Bouquetins*. 1: Rendering (relevé) of the entire panel of engravings and fingertip traces; 2: sketch of the position of the lion and the ibex. Interpretation of the panel as a hunting scene (drawings: C. Fritz and G. Tosello).

On the "Pendant de la Vénus", to the right of the fresco of Lions, the artists positioned a female image, centered on the sexual and procreative function (figure 43). Accordingly, the two fundamental principles of the human condition, imminent death and life to come, are found assembled in one place, in one action, like the phases of an eternal cycle (Godelier, 2013). Such an oppositional life / death structure leads us back to a representational discourse whose final function is the mediation of these two extremes, whose component parts and variations could correspond to the sociological and economic existential conditions of these hunting groups, the actors in these images.

Beyond just a story in pictures, the Aurignacians have left us a vision of their world in Chauvet-Pont d'Arc, a repeated story that attains the status of myth.

Figure 43 - *Salle du Fond*. To the right of the fresco of Lions, a limestone stalactite decorated with the pelvis and legs of a woman drawn in black (photo: C. Fritz).

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THE OLDEST PORTABLE ART:

the Aurignacian Ivory Figurines from the Swabian Jura (Southwest Germany)

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the Aurignacian Ivory Figurines from the Swabian Jura (Southwest Germany)

Harald FLOSS

Abstract

Four cave sites in the Swabian Jura have yielded a spectacular array of portable art: Hohle Fels, Geißenklösterle, Vogelherd, and Hohlenstein-Stadel. Some of these ivory figurines are well known, and others less so. In all, about fifty such objects or fragments of objects are known from the region. They occur in the same archeological levels where have been found musical instruments (flutes) and early examples of painting. Drawing on recent research as well as archival records from earlier excavations, this contribution chose a simple question-and-answer format in order to revisit issues of the interpretation of Aurignacian portable art objects, which constitute some of the earliest known representational artifacts in Europe, and perhaps the world. Subjects addressed include informations about raw materials, iconography, dating, context and the possible social foundations underlying the production and use of these objects.

Keywords

Aurignacian, ivory figurines, Swabian jura.

Introduction

Since the first discovery of Aurignacian ivory figurines by Gustav Riek at Vogelherd cave in 1931, there had been a lot said and written about these marvelous tiny sculptures. Since Gustav Riek (1934), many researchers have been or are still involved in the recovery, the study, and the enhancement of these objects, such as Karl Dietrich Adam, Reiner Blumentritt, Michael Bolus, Gerhard Bosinski, Nicholas J. Conard, Harald Floss, Joachim Hahn, Wulf Hein, Claus-Joachim Kind, Stefanie Kölbl, Maria Malina, Sam Mallin, Hansjürgen Müller-Beck, Martin Porr, Anne Scheer, Elisabeth Schmid, Otto Völzing, Eberhard Wagner, Kurt Wehrberger and Robert Wetzel (listing not imperatively exhaustive).

Studies by these and other researchers have produced a considerable body of data. Here, we have chosen a simplified question-and-answer format to present the basics of this subject and the current state of our knowledge about these remarkable objects to an international public.

1 - How many sites are involved?

There are four cave sites of the Swabian Jura yielding Aurignacian ivory figurines. These caves are situated in valleys of tributaries of the Danube crossing the Jurassic plateau: The Lone valley with Vogelherd cave and Hohlenstein-Stadel and the Ach valley with Geißenklösterle cave and Hohle Fels near Schelklingen (figure 1). But beware! These four sites are by far not the only caves in the region yielding Aurignacian levels. And – in a region dominated by caves, some have been recently discovered for the first time. Surveys and excavations are also being undertaken at two presumed Aurignacian open air sites, Königsbach-Stein near the city of Pforzheim (Floss, Poenicke, 2006) and Börslingen, on the Alb plateau near the Lone valley (Floss *et al.*, 2012).

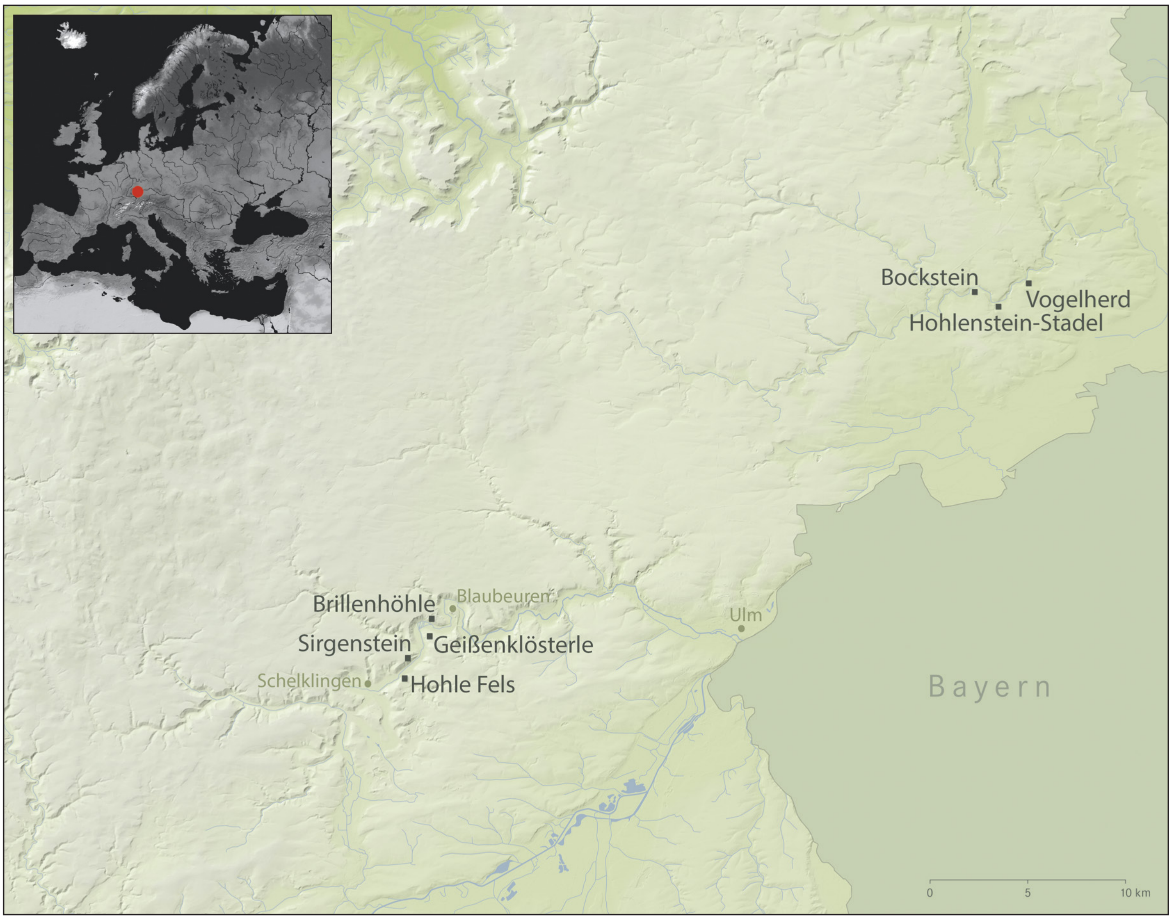

Figure 1 - The Ach and the Lone valley (Swabian Jura) and their important Palaeolithic cave sites (CAD: Landesausstellung Baden-Württemberg, Bordon, modified).

2 - How many sculptures have been found?

In recent years, ongoing investigations have increased the number of figurines (Conard, 2003, 2009; Conard, Floss, 2013; Conard *et al.*, 2009; Floss, 2007, 2009; Floss, Conard 2010; Floss, Rouquerol, 2007). Today, about 50 objects, including figurine fragments, are known. But it is not always certain if these fragments belong to new or to already-known figurines. In at least two cases, spectacular refits of fragments have proved that they belong to the torso of an animal. This is the case for an animal without a head found by Gustav Riek in 1931, which had been interpreted as a bear or a young rhino (Hahn, 1986). The stunning refit of a head, recently discovered in the course of field operations directed by Nicholas J. Conard, shows that this animal might be a bear or even a lion (figure 2). Still, by far the majority of the figurines come from Vogelherd, followed by Geißenklösterle and Hohle Fels (with four figurines each) and finally Hohlenstein-Stadel with its recently newly refitted and completed lion man (figure 3; Ulmer Museum, 2013).

Figure 2 - The newly refitted ivory figurine of a torso of an animal (found by Gustav Riek in 1931 in Vogelherd cave) and its newly discovered head by investigations directed by Nicholas, J. Conard (photo: Hilde Jensen, University of Tübingen)

Figure 3 - The Lion-man from Hohlenstein-Stadel in his newly refitted shape (photo: Y. Mühleis © Landesamt für Denkmalpflege im RP Stuttgart).

1 cm

3 - What is depicted?

Animals, humans and hybrid beings! The topics of Aurignacian art differ from those of the evolved Upper Paleolithic. The taxonomically assignable Swabian animal figurines represent mostly mammoth and lion (figure 4) and also horse (figure 5), bison, and maybe rhino. This observation led to the hypothesis "Kraft und Aggression" by Joachim Hahn (1986) according to which powerful and aggressive animals are the commanding topics. Nevertheless, the Aurignacian animals of the Swabian Jura are mostly represented in a static and not really aggressive manner (Serangeli, 2004). Furthermore, depictions of small and peaceful animals, such as waterfowl (figure 6), fish and small mammals have recently been discovered, which to some extent modify the traditional view. The most fascinating theme of the Swabian Aurignacian is that of therianthropes, mixed beings, half man, half beast. By far the most renowned example is the lion-man from Hohlenstein-Stadel (figure 3), which at 30 cm tall is much bigger than the other figurines (Wehrberger, 1994). Additionally, there is a miniature version of the lion-man from Hohle Fels cave and the so-called worshipper from Geißenklösterle, a human relief with raised arms and a strange long appendix between the legs, which resembles more a draped hide with a tail than a male sexual organ. Finally, there is an anthropomorphic figurine from Vogelherd which has some formal similarities with a figurine from Trou Magrite (Belgium) and a phallus sculpture from Abri Blanchard (Dordogne) and, of course, the fabulous "Venus" figurine from Hohle Fels cave (figure 7; Conard, 2009).

4 - Which raw materials?

Commonly, the Swabian depictions are called "ivory figurines". Ivory working, for the production of tools (Hahn, 1988), personal ornaments (Wolf, 2013) and mobile art (Hahn, 1986), is an essential factor of the Swabian Aurignacian technology. The mammoth ivory originates partly from hunted animals but predominantly from tusks and fragments which had been collected by the Aurignacian hunter-gatherers (Niven, 2006). Beyond ivory, other materials were also used for portable art. A mammoth relief from Vogelherd cave is carved on a bone pendant (figure 8), and another admittedly questionable mammoth depiction from the same site is made of sandstone (Floss, 2007).

5 - How old are the figurines?

The Aurignacian figurines from the Swabian Jura were faced for a long time with the same unjustified criticism of their antiquity leveled against Grotte Chauvet-Pont d'Arc today. Our discipline has for too long been influenced by ideas that art production is bound by a strict and linear evolution in which only simple and archaic achievements could possibly be Aurignacian (Leroi-Gourhan, 1965). The Vogelherd discoveries might have been considered to be supposedly biased by the old excavations of the 1930s, but the precise excavation techniques of Joachim Hahn at Geißenklösterle cave (Hahn, 1988), supported by a detailed radiocarbon record, proved the early Aurignacian age of the Swabian figurines. Nevertheless, we are astonished to find in some recent papers, particularly by certain Neanderthal enthusiasts, claims that the Swabian art production did not start before the evolved Aurignacian. This view is wrong. The new female figurine from Hohle Fels has been discovered in the lowermost Aurignacian level (Conard, 2009). In Geißenklösterle, too, some of the art objects originate from the lowest Aurignacian level. The radiocarbon record (Higham *et al.*, 2012) leaves nothing to be desired and indicates that the Swabian early Aurignacian has an age around 42 000 cal BP (figure 9), older, by the way, than some Châtelperronian and Protoaurignacian sites of Southwestern Europe.

4

5

6

7

8

1 cm
(1/1)

Figure 4 - Ivory figurine of a lion, Vogelherd cave, excavations Riek 1931.

Figure 5 - The Vogelherd horse, excavations Riek 1931.

Figure 6 - Water fowl ivory figurine. Hohle Fels near Schelklingen, excavations Nicholas J. Conard.

Figure 7 - The Hohle Fels Venus, excavations Nicholas J. Conard.

Figure 8 - Relief of a mammoth on a bone pendant, excavations Riek 1931.

(photos: Hilde Jensen, University of Tübingen; figure 7 after Conard, 2009).

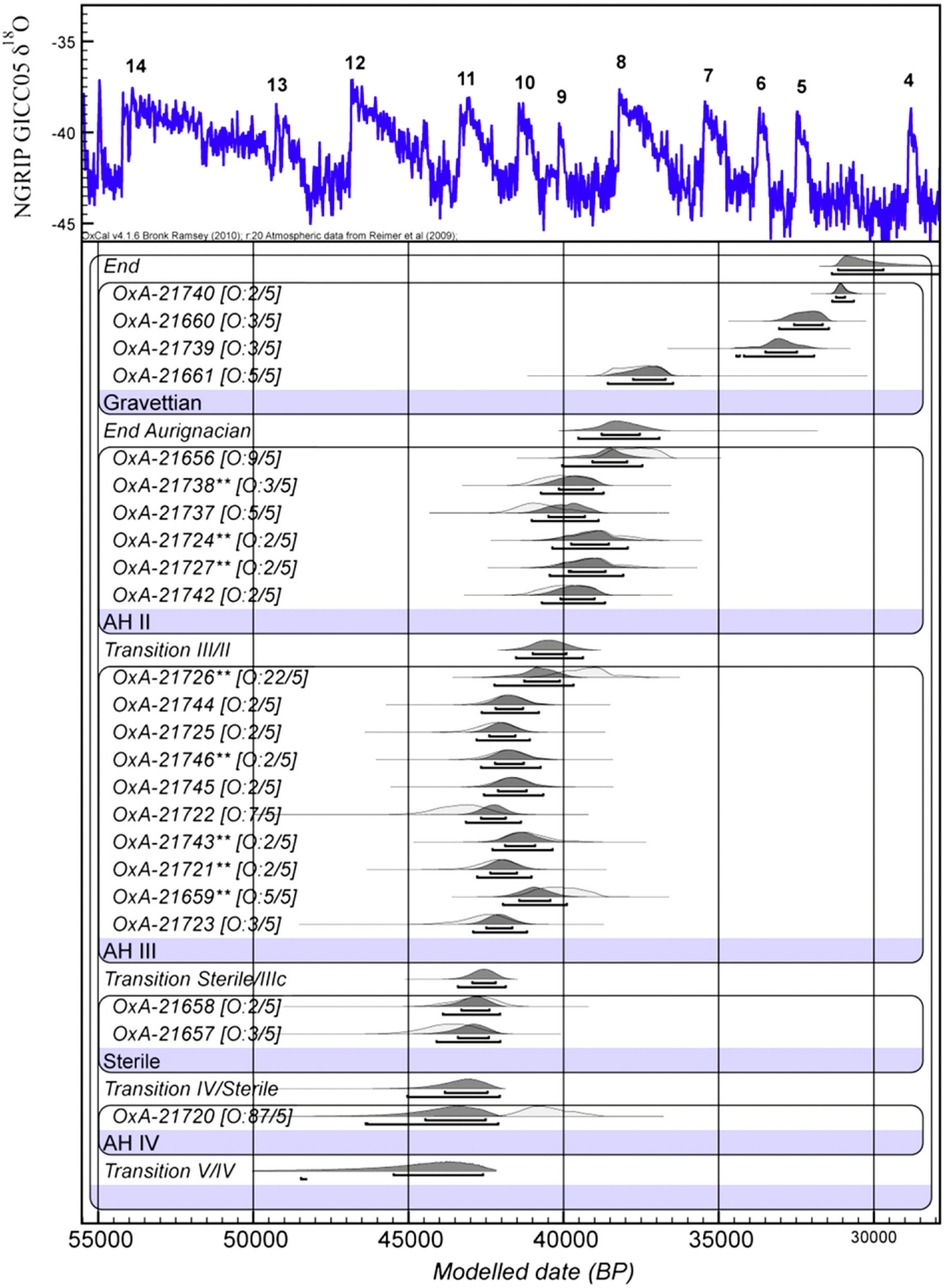

Figure 9 - Bayesian model for the Geißenklösterle 14C-sequence using OxCal 4.1 (after Higham *et al.*, 2012: figure 5).

I would like to make here a supplementary statement for those scholars who might take issue with the Aurignacian age of the Vogelherd figurines due to the fact that they come from the old Riek excavations or from recent excavations of backdirt, and therefore might be Gravettian (due to similarities with Moravia) or even not datable at all: There is no doubt that the age of the Vogelherd figurines is Aurignacian. First of all, the stratigraphic observations of the 1930s excavations are quite convincing (Riek, 1934). Furthermore, the lithic and bone technology as well as the radiocarbon record of objects belonging to the Aurignacian levels is unambiguous. And finally, I would like to give a very important new argument: In his excavations, Gustav Riek didn't pay much attention to small objects. In the new excavations of his backdirt, due to careful water-screening of the sediments, several hundreds of elements of personal ornamentation, such as beads and pendants have been found. The meticulous study of these very reliable cultural and chronological markers (Wolf, 2013) showed that these items (particularly the double perforated beads) match perfectly with stratified Aurignacian objects from the region (such as Hohle Fels), whereas Gravettian or other types of beads are totally lacking.

6 - Why is the Swabian Jura a paleolithic melting pot?

In historical times and even into the present day, the Swabian Jura is one of the most isolated areas of Central Europe. Until the 19th century, the region was characterized by one of the highest rates of infant mortality in Europe. The harsh climatic conditions and poverty affiliated with religious piety made the indigenous people of the “Alb” suspicious and bitter. Nevertheless, once you won their confidence, you'd find great friends. And - likely no other part of central Europe is characterized by such an accumulation of enterprises with international reputation that make Swabia one of the most innovative regions of the world.

In Paleolithic times the situation was similar, but of course due to completely different reasons. The Paleolithic hunter-gatherers found everything they could need in this open highland, crossed by copious valleys. The Swabian Jura was visibly rich in game, shelter and diverse raw materials, particularly Jurassic chert for stone tool production. It may be, though, that the most decisive factor was the proximity of the Danube, which certainly played a major role as an orientation axis for animal and human migrations. It may even be that the dispersal of anatomically modern humans took place along these major river systems.

7 - Beyond the ivory sculptures, are there other indications of a Swabian Aurignacian genius?

Yes, indeed. The Swabian Aurignacian yields several musical instruments. Three sites, Geißenklösterle, Vogelherd and Hohle Fels, provide at least eight examples of flutes that were made of bird bones (swan and vulture) (figure 10) and, particularly astonishing, of ivory (Conard *et al.*, 2009). Furthermore, there is one example of painting. At Geißenklösterle, a small limestone block bears a series of painted stripes, from black to red and light ochre back to red and black (Floss, Conard, 2001, 2009) (figure 11). This stone indicates the knowledge of pigment processing and painting in the Swabian Jura. As the small block is painted all around, it's not an example of parietal art, but of early Aurignacian portable art. Finally, the Swabian Jura yields an amazing record of very rich and various objects of personal ornaments (Wolf, 2013) which were obviously an integral part of the Aurignacian society.

Figure 10 - Flute from a vulture bone. Hohle Fels cave,
excavations Nicholas J. Conard (photo: H. Jensen, University of Tübingen).

Figure 11 - Painted stone from an Aurignacian level from Geißenklösterle cave, excavations J. Hahn (photo: University of Tübingen, Floss, Conard, 2001).

8 - What makes the Swabian figurines so unique?

Beyond their great antiquity, the Swabian figurines are fascinating for several reasons. First, yes, they are beautiful. The carvings have harmonious and rounded shapes and smooth surfaces, providing not only a visual appeal, but a tactile interest as well (figure 5) (Floss, 2000, 2007). The figurines have a very individual character, as if they belonged to and/or had been created by distinct persons. Furthermore, some of the figurines were pendants (figures 8, 12). Most of them were small and could be carried around in everyday life. That is to say, mobile objects in a mobile world. Finally, the figurines are covered with marks and engravings, dots, lines, hooks, criss-crossed motifs, etc. (figure 13). The message behind these signs remains mysterious. The figurines depict animals from every possible living sphere: earth, water and air. And even more: The hybrid beings evidence mythological beliefs.

Figure 12 - Mammoth figurine from Vogelherd cave, shot from below, excavations Riek 1931 (photo: H. Jensen, University of Tübingen).

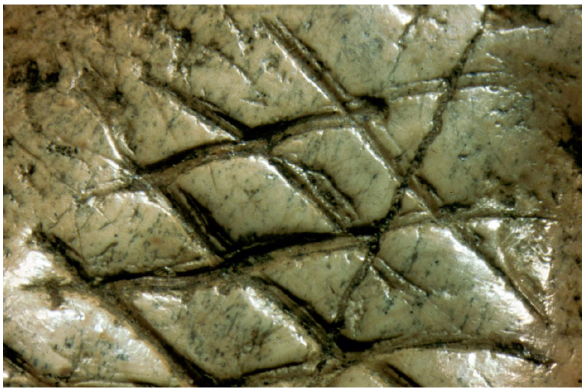

Figure 13 - Criss-crossed engravings on a lion figurine, excavations Riek 1931 (photo: H. Jensen, University of Tübingen).

9 - What about the contextual information of the figurines?

At Vogelherd, Gustav Riek in course of his 1931 excavations paid more attention to stratigraphy and unfortunately much contextual information is lacking. Vogelherd has a y-shaped floor plan with three galleries meeting in the centre. There, at the central point of the cave, at least some of the objects have been recorded (Riek, 1934) (figure 14). In Geißenklösterle cave, the sculptures were discovered in the midst of ordinary lithic and faunal waste (Hahn, 1988). In contrast, at Hohlenstein-Stadel, the circumstances of recovery are particularly interesting. The ivory fragments that were refit much later to the lion-man figurine, were found deep in the cave, where ordinary lithic and osseous remains became scarce, and near a niche in the cave wall, as if the lion-man

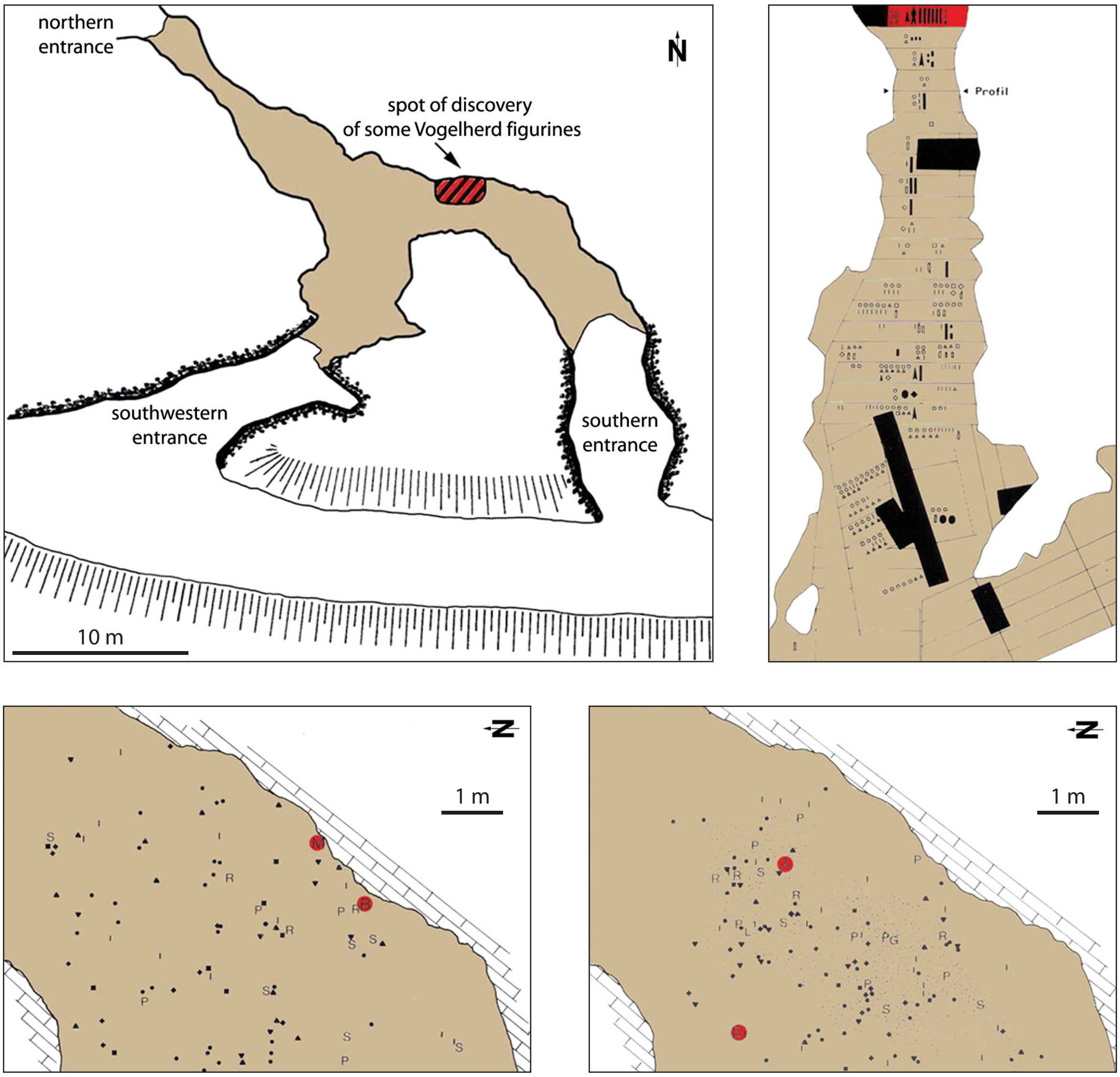

Figure 14 - Contextual informations of the Swabian ivory figurines. Top left finding spot of some of the Vogelherd figurines, excavation Riek1931, top right finding position of the ivory fragments later refitted to the lion-man figurines from excavation Wetzel in 1939; bottom left and right. Position of the ivory figurines in Geißenklöstele cave, levels II and III, excavations Hahn, after Riek 1934, Hahn 1988, Floss 2007.

had been placed or deposited in a special place (Ulmer Museum, 2013). Finally, Hohle Fels also demonstrates unique contexts of deposition of the most outstanding objects. Even if it's true that the ivory figurines have been recorded in the middle of the ordinary occupation debris, the female figurine and the vulture-bone flute were found in the same sub-layer only a few centimeters from each other (Conard, 2009). This observation could indicate that these two outstanding objects had been involved in the same (possibly ritual) use.

10 - Aurignacian art in Europe

A second centre with Aurignacian art is located in the Dordogne, southwestern France (Delluc, Delluc, 1991). It comprises at least seven rock shelters which yield engraved and painted proto-typical limestone blocks, forming the so-called archaic art of the Périgord: La Ferrassie, Abri Blanchard, Abri Castanet, Abri Cellier, Abri Pataud, Abri Belcayre and Fongal. It is probable that in Aurignacian times some of these rock shelters were completely decorated. Others have only single decorated blocks. It is also very probable that some caves of the region were already decorated at that time (Les Bernous; La Cavaille; Pair-non-Pair; La Croze à Gontran; Les Fieux, Lot).

All in all, we consider the original vibrancy and the role of Aurignacian art in the Dordogne to have been much more significant than their appearance nowadays suggests, for they have been heavily affected by erosion, premature excavations and the dispersal of decorated artifacts into numerous collections. This vision of an "artified" Aurignacian landscape, in the centre of the Dordogne, underlines, in our view, the artistic take-off which took place at that time; it replies to some recent approaches which tend to minimize the significance of Aurignacian art (Combier, Jouve, 2012). Furthermore, new series of radiocarbon dates confirm its old age. In Castanet, recently discovered paintings and engravings belong to deposits dated to at least 37 000 years BP (Mensan *et al.*, 2012).

Grotte Aldène (Hérault), La Baume-Latrone (Gard) and, of course, Grotte Chauvet at Vallon-Pont d'Arc (Ardèche, France) (see different contributions in this volume) yield further evidence for Aurignacian cave art. South of the Alps, the very important cave site of Fumane, located in Northern Italy near to the city of Verona, yields at least six fragments and blocks of limestone painted with red colour (Broglio *et al.*, 2007). They represent enigmatic animals, symbols and particularly a bull headed creature which reminiscent of the hybrid beings at other Aurignacian sites, e.g. Grotte Chauvet and Hohlenstein-Stadel.

Finally, we want to stress a very important discovery which had recently been conducted in Rumania. Peştera Coliboaia is a cave in Transylvania, located in the Bihor area (Western Carpathian Mountains). In this partly flooded cave were recorded paintings of animals (rhino, etc.) which show stylistically striking similarities to depictions of Grotte Chauvet and which recently have been dated to about 32 000 BP (Clottes *et al.*, 2011).

All in all, at least 30 European places, caves, rock shelters and open air sites, yield early Upper Paleolithic and in particular Aurignacian art. From the Iberian Peninsula in the west to Rumania and the Russian plains in the east, from Belgium (Trou Magrite) in the north to Austria (Stratzing) and Italy in the south, Aurignacian art was present all over the European continent. If we take into account that only parts of the former reality are preserved and part of the archeological heritage, it is evident that the production and use of mobile and parietal art were common features of the early upper Paleolithic cultures and societies.

11 - What about the role of the Swabian figurines for the history of mankind?

This new awareness of a generalized presence of a multifaceted Aurignacian art all over the continent initializes a withdrawal from outdated beliefs by which art production supposed to be bound by a strict and linear evolution in which only simple and archaic realizations "had the right" to be Aurignacian. The ivory sculptures from the Swabian Jura support in an impressive way the claim of "Aurignacian genius" such as it has been defined for our common project, especially in terms of symbolic behavior. Never before in the prehistory of mankind, neither in the Neanderthal world, nor in the African MSA, has an archeological record been observed that could compete in variety and excellence with that of the Aurignacian. Its numerous innovations (figurative and complex parietal art, musical instruments, mythical imagery, sculpted personal ornaments etc.) could be linked with a new social order or at least with new religious or social customs. There are arguments that these new elements are linked with the first anatomically modern humans emerging in Eurasia. Neanderthals did neither paint Grotte Chauvet, nor carve the Swabian figurines. They were not inferior, but certainly different!

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PERSONAL ORNAMENTS OF THE SWABIAN AURIGNACIAN

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PERSONAL ORNAMENTS OF THE SWABIAN AURIGNACIAN

Sibylle WOLF, Nicholas J. CONARD

Abstract

In the caves of the Swabian Jura (Southwest Germany) excavators found numerous mammoth ivory remains, which date to the Aurignacian. Among them were at least 600 beads. These beads come from the well stratified layers of Hohle Fels cave in the Ach Valley, while others derive from the backdirt in front of the Vogelherd cave in the Lone Valley, which was completely emptied during the excavation 1931. We give an overview about the variety of forms of the personal ornaments, although the double perforated bead dominates the inventories. This special bead form gives evidence of identity formation of the Aurignacian people.

Keywords

Swabian Aurignacian, mammoth ivory, bead, personal ornaments.

Introduction

The Swabian Jura in Southwest Germany is famous for its numerous cave sites, which yielded Aurignacian deposits (e.g. Conard, Bolus, 2003). The sites Hohle Fels and Geißenklösterle in the Ach Valley between Schelklingen and Blaubeuren as well as Vogelherd and Hohlenstein-Stadel in the Lone Valley near the towns Niederstotzingen and Asselfingen are of special interest (figure 1). These sites delivered extraordinary mammoth ivory assemblages (Wolf, 2015). The paleolithic people who frequented the Swabian cave sites used ivory to fabricate tools, figurines, musical

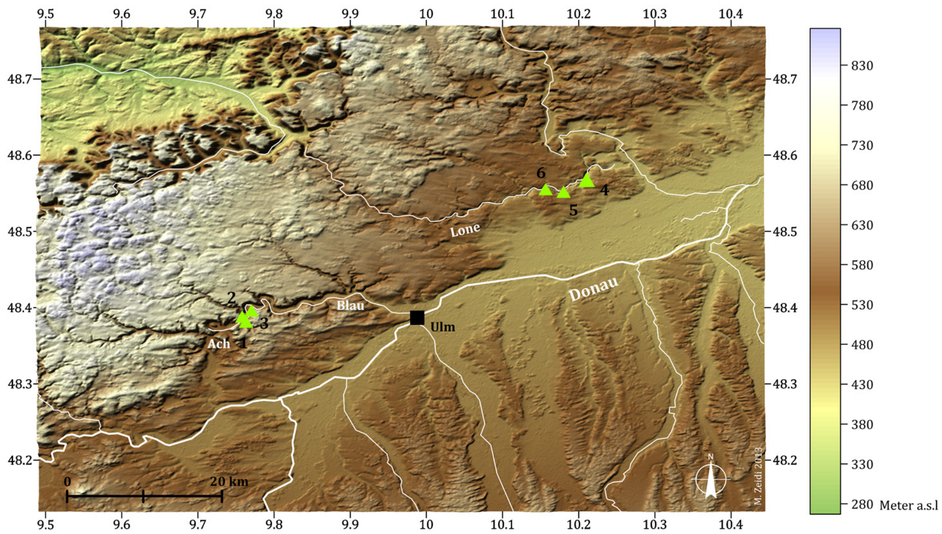

Figure 1 - Map of caves with Aurignacian deposits of the eastern Swabian Jura (Southwest Germany). 1: Hohle Fels, 2: Sirgenstein, 3: Geißenklösterle, 4: Vogelherd, 5: Hohlenstein, 6: Bockstein (CAD: M. Zeidi).

instruments and personal ornaments (Schmidt, 1912; Riek, 1934; Hahn, 1986, 1988; Conard, 2003, 2009; Wolf, 2015). The current state of research indicates that these archeological remains were made by the anatomically modern humans (e.g. Conard *et al.*, 2006). The inventories of all of these sites are outstanding and unrivaled so far. Aurignacian figurative art made of ivory is unique in the caves of the Swabian Jura (e.g. Floss, 2007). Concerning personal ornaments, the double perforated ivory beads are typical. That is why the Swabian Aurignacian has its own character, which is not directly comparable with other European regions (Conard, Bolus, 2003; Conard *et al.*, 2006; Wolf, 2015). The aim of this article is to give a general overview about the ivory assemblages particularly of Hohle Fels cave as well as Vogelherd cave with the focus on the personal ornaments and the types of the different Swabian bead forms.

1 - Research History

Oscar Fraas first excavated the Hohle Fels 1870/1871. Field work is still going on in yearly campaigns under the direction of Nicholas Conard, University of Tübingen (Conard, 2002; e.g. Conard, Malina, 2012). The Aurignacian levels IId to Vb date back to 36 000 years BP uncalibrated (Conard, Bolus, 2008; Conard, 2009). Until today the excavators recovered more than 10 000 ivory remains in these layers (Wolf, 2015). Among the numerous waste of daily life, the most famous find is a female figurine which was excavated in 2008 (Conard, 2009).

Joachim Hahn mainly conducted the excavations in the Geißenklösterle cave (Hahn, 1988). The Aurignacian layers are II and III. The dates of the latter are with the oldest data for an Aurignacian so far with an age of at least 38 000 years BP uncalibrated (Higham *et al.*, 2012; Nigst *et al.*, 2014). Here the most elaborated find was a flute made of ivory (Conard *et al.*, 2004) among four figurines (Hahn, 1986). Hahn found several personal ornaments made of mammoth ivory and animal teeth (Hahn, 1988; Conard, 2003; Wolf, 2015). Robert R. Schmidt excavated Sirgenstein cave (Schmidt, 1912). Here, he describes one damaged double perforated bead, which probably derives from the Aurignacian layer IV; it was found during sorting the soil samples and not *in situ* (Schmidt, 1912: 27).

Gustav Riek led the excavations in Vogelherd cave (Riek, 1934). In 1931, within three months, he and his crew emptied the whole cave with an area of 125 sq.m² and sediments up to five meter high. They put the backdirt in front of the two entrances of the cave. The main layers were the Aurignacian levels IV and V, with dates between 31 000 and 36 000 years BP uncalibrated (Conard, Bolus, 2003). Vogelherd became world famous because of eleven figurines, which mainly depict Ice Age animals; Riek discovered them in both Aurignacian layers (Riek, 1934). Between 2005 and 2012 excavation teams of the University of Tübingen re-excavated the backdirt in order to recover all the small finds, that Riek had overlooked (e.g. Conard, Malina, 2006). This led to the discoveries of additional ivory figurines. The most known is the perfectly carved mammoth excavated in 2006 (Conard *et al.*, 2007). Riek found no ivory beads during his excavation, but so far more than 300 small beads have been recovered (Wolf, 2015) due to the careful methods used in the re-excavation. All of these pieces could only be determined in having an Aurignacian age by studying them in tandem with the finds from the Ach Valley caves. The latter come from secured stratigraphies.

Oscar Fraas examined the Hohlenstein complex in the 1860s, while Robert Wetzel led excavations there in the 1930s and between 1956 and 1961 (Wetzel, 1961; Beck, 1999). In 1939 the workers discovered many worked ivory fragments, which were later refitted to a hybrid, the famous lion-man. This figurine is the tallest Ice Age statuette known so far (Schmid 1989). Together with the fragments of the figurine, two ivory beads and six fox teeth pendants were discovered (Reinhardt, Wehrberger 2005). Between 2009 and 2013 Claus-Joachim Kind of the State Office for cultural heritage led excavations in the Stadel cave (Beutelspacher, Kind, 2012; Kind *et al.*, 2014).

The current date of the Aurignacian layer is 35 000 years BP uncalibrated (Kind, Beutelspacher, 2010). Kind found the original location of the lion-man and he recovered hundreds of new ivory fragments, which belonged to this special figurine as well as additional personal ornaments. In 2012/2013 restorers reconstructed the lion-man using these new fragments as well as fragments which could not be refitted during the first professional restoration in 1988 (Wehrberger, 2013). Many new observations were made, that are presented below.

2 - Material, Technology and Production sequence

In the sites of the Swabian Aurignacian only wooly mammoth was identified when analyzing the proboscidean remains (Münzel, Conard, 2004; Niven, 2006). The ivory inventories are homogenous in color and appearance and there are no indications for the usage of e.g. ivory of the forest elephant (Hiller, 2002; Wolf, 2015). For the Swabian Aurignacian the evidence indicates the systematic collection of tusks of perished animals in the open steppe, instead of active hunting of adult mammoths (Niven, 2006; Wolf, 2015). Tusks are composed of a pulp cavity with dentine in the inner and a sheathing cementum (e.g. White, 1995; Wolf, 2015). We are interested in the life history of the artifacts made of mammoth ivory. The whole production sequence from the acquiring of the material to the discarding was explained several times (e.g. Semenov, 1957; White, 1995; Christensen, 1999; Liolios, 1999; Khlopachev, 2006; Khlopachev, Girya 2010; Wolf, 2015). After the initial break-down of ivory, people extracted long and slender rods as raw forms for the further working. The manufacturers chopped, scraped, ground, and smoothed these unfinished objects until they reached the intended size and shape. In this context it is important to define the term bead and the different stages of bead production. A bead or a pendant is a small object, which people could apply to a substratum (e.g. clothes, bags, accessories etc.). The bead possesses a suspension – this could be an eyelet or a grooving. People also could have worn these pieces as a necklace for example. There is no absolute need to sew a bead on a substratum; it could also be used separately and in different varieties of patterns.

A differentiation of six different stages of bead- and pendant production took place (figure 2):
- raw form: a discernible base form for a special object is recognizable;
- half product: the special form is nearly complete;
- finished product: the special object is finalized, but it does not show traces of usage;
- used product: the special form is finalized and it shows clear traces of usage;
- damaged product: the half,- or finished,- or used product is damaged and broken;
- recycled product: the broken or unintentional product was fashioned for a different usage.

3 - Hohle Fels

Hohle Fels excavation teams recovered more than 10 000 ivory pieces in the Aurignacian layers IId to Vb so far (Wolf, 2015). Most of the pieces derive from layer IV, which is the thickest Aurignacian archeological horizon (AH) beside AH Va. The ivory finds range from thick smashed pieces to hundreds of small splinters and shavings. The splinters are the result of the intensive scraping and ivory working inside the cave. In all excavated square meters the excavators found ivory artifacts. The numerous rods are the raw forms for many other finalized forms like points. This form also proofs the ivory-working at the site. Typical are flakes, which are the results of controlled knapping (Heckel, Wolf, 2014). Often they were also used as tools e.g. as wedges.

Figure 2 - Examples of the production sequences of typical Swabian Aurignacian double perforated beads; from rods to broken beads (photos: S. Wolf; montage: G. Häussler).

The Aurignacian people also fabricated massive chisels and percussors of ivory debris. Furthermore, points with solid bases have been found in all layers, except the oldest layer Vb. One broken raw form for a flute is known and many pieces show traces of aesthetic expressions, like cross patterns or personal markings. Altogether the team found 217 beads so far (figure 3). The pieces vary in size and shape, but the double perforated bead dominates the assemblage with 124 pieces: 18 raw forms, 13 half products, 22 finished products, 46 used products and 25 damaged pieces were excavated. The overwhelming majority of double perforated beads (98 pieces) derive from the layers IV and Va. The average length of complete pieces is 7.4 mm, the average width is 4.5 mm and the average thickness is 3.6 mm. Other types are the single perforated bead, the double perforated bead with wedge-shaped appendix, the non-perforated, constricted bead, the Swabian basket-shaped bead, the ring-shaped bead, the eight-shaped bead and the discoid bead. Some unique forms exist, which find no similar pieces in other Aurignacian regions. Bands are another interesting type of adornment made of ivory. These objects could have been sewn on clothes or they could have been worn in different ways (Didon, 1911; Peyrony, 1927, 1935; Castets, 2008). Such pieces come from the layers IIIb and Va. We also see trends in the manufacturing and use of the beads: during the younger Aurignacian phase (layers IId-IIIb) the people preferred the basket-shaped bead and the non-perforated, constricted bead, which are not known in the older horizons.

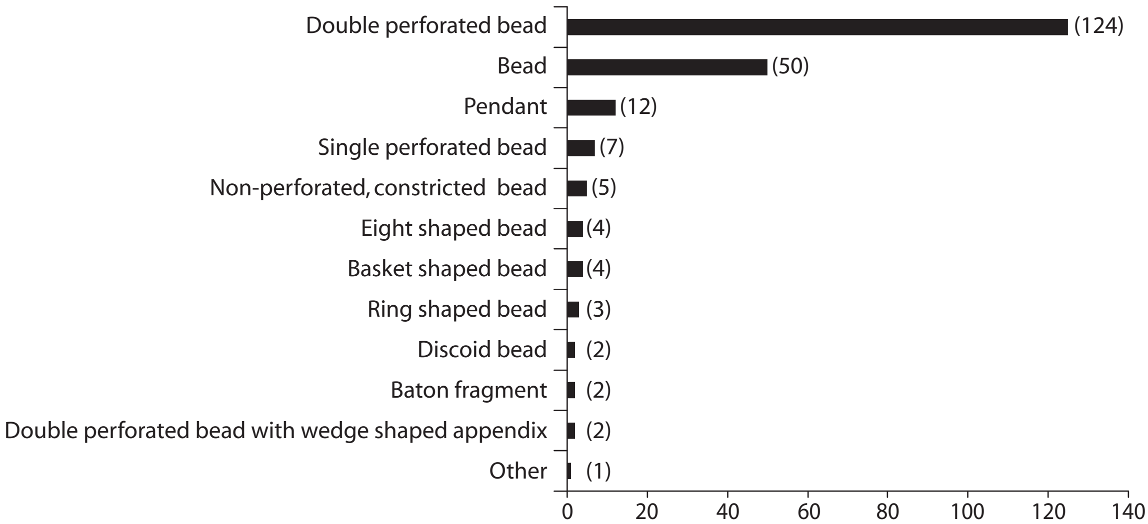

Figure 3 - Hohle Fels cave different types of Aurignacian personal ornaments and the number of these items (diagram: S. Wolf).

4 - Vogelherd

During the excavations 1931 the workers found the big ivory pieces (figure 4). At the southern entrance of the cave the team discovered segmented ivory tusks. These pieces had a length of 50 cm each (Riek, 1934). In addition, the excavators found many ivory plaques placed on top of each other there. In the southwestern entrance a bone pile was discovered and here also the excavators found large tusk-fragments. Riek describes a working area for ivory in the southwestern entrance; he recognized ivory dust on one stone and interpreted this as a proof of grinding this material (Riek, 1934). Interestingly a few pieces were found, which Riek called “ambos”. This could be supported by recent analysis which declares them as anvils, retouchers and underlays for daily work (Wolf, 2015). Most of the large pieces are naturally broken tusk pieces and they are not smashed pieces or flakes. Some of them were used as tools like smoothers, but not intensively.

Figure 4 - Vogelherd cave, mammoth tusks during the excavation 1931 (photo: Ulmer Museum).

The most famous finds are eleven, small figurines. Ten are made of ivory. Each piece is designed individually. They mostly depict Ice Age animals, but one anthropomorphic figurine exists, too (Riek, 1934; Floss, 2007). Remarkably, some of the figurines possess a double function, because they also served as pendants (see in detail e.g. Hahn, 1986; Floss, 2007). The nearly complete mammoth possesses perforations between its forelegs and its hind legs (figure 5). In addition the oval bone piece, which shows a mammoth relief, displays a broken perforation at one end. This is the proof that this find formerly was a pendant, too. This reflects the mobile character of these pieces: they are "mobile objects in a mobile society" (Floss, 2007: 308).

Riek did no water screening and sorting during his excavation. That is why he did not find any splinters, which would indicate ivory working on site. Furthermore he did not discover any beads made of ivory. As adornment he mentions only one pierced cervid canine, which was decorated by notches and one pierced brown bear canine. One ivory object, which is drawn-in at the top, could be interpreted as jewelry (Riek, 1934; Wolf *et al.*, 2013).

Figure 5 - Vogelherd cave, mammoth figurine - and pendant.
Length: 5 cm (photo: H. Jensen, copyright University of Tübingen).

During the excavations of the backdirt and the sorting between 2005 and 2012, 345 beads in all stages of production have been found and are analyzed so far (figure 6). At present, about two thirds of the water screened sediments from the excavations have been sorted, so future work at Vogelherd will produce additional finds. Most of the beads have forms also known in the caves of the Ach Valley. That is why we are sure to date them to the Aurignacian. There are 219 double perforated beads and four double perforated beads with wedge-shaped appendix, 43 beads,

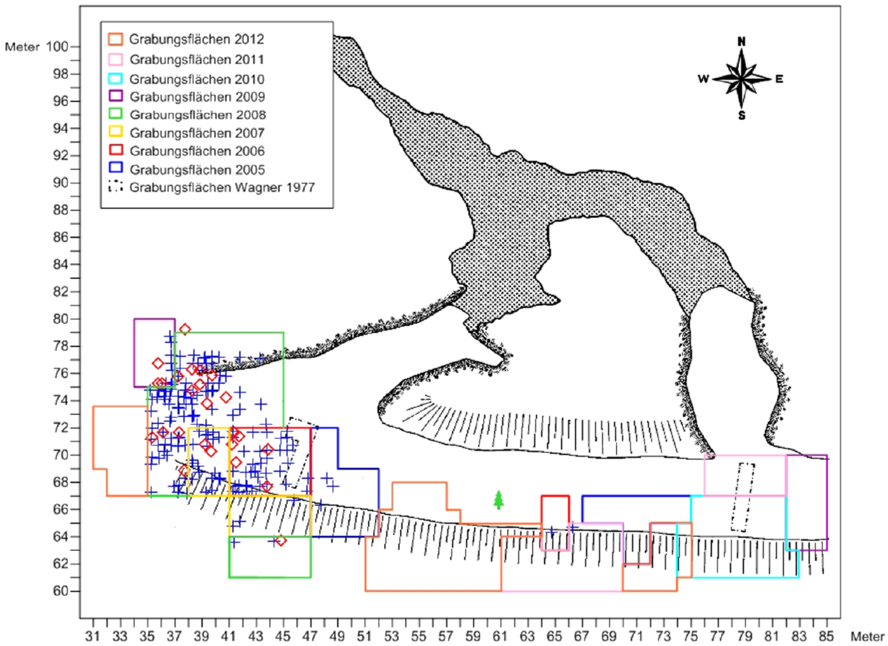

Figure 6 - Vogelherd cave, plot of all double perforated (blue) and single perforated (red) beads in the backdirt in front of the southwestern entrance.

35 pendants, 34 single perforated beads, four Swabian basket-shaped beads, two complete cone-shaped beads, a broken eight-shaped bead, a fragment of a non-perforated, constricted bead, and three pieces which clearly belong to jewelry, but their exact allocation cannot be resolved. The double-perforated beads are divided into 23 raw forms, three half products, 16 finished products, 73 used products and 104 damaged pieces. The average length of all the complete pieces is 8.7 mm, the width is 5.5 mm and the thickness is 3.6 mm. All these beads are double perforated beads, and each piece shows individual characteristics.

The narrowest width of the double perforated bead is 3.5 mm. The width of this bead type could be up to 11 mm. About 80% of the 364 rod fragments (293) are classified in the area between 3.5 mm and 11 mm width. The conclusion is that the rod fragments were the main raw form for the serial production of beads. Additionally, excavators recovered 37 decorated pieces. They mainly show cross patterns and they often belonged to rods. Some are fragments of figurative art. E. Dutkiewicz currently examines these decorations in her Ph.D. project at the University of Tübingen.

The beads from Vogelherd come exclusively from the backdirt in front of the southwestern entrance of the cave. The sediments were dumped near the respective excavation area during the excavation in 1931. Therefore, we suggest that Aurignacian people sat and worked in the south-western entrance of the cave while the ivory stock was stored in the area of the southern entrance. The pieces in all stages of the manufacturing processes show that these objects were produced locally at the site. The large amount of other finds speaks for an intensive use of the cave. The jewelry items ended up together with the other objects in the everyday waste.

5 - Hohlenstein-Stadel

Recently the lion-man was restored in the State Office for cultural heritage in Esslingen. Currently more than two thirds of the figurine are preserved, because the restoration team added more than 60 new pieces. After the restoration the lion-man changed his appearance (figure 7).

Figure 7 - Hohlenstein-Stadel cave, right view of the lion-man after the restoration 2013. Length: 31,1 cm (photo: Y. Mühleis, State Office for cultural heritage Baden-Württemberg).

2 cm

The figurine gained more volume and the proportions are different than before. The right arm could be refitted, lamellae of the mouth were found as well as many new layers in between the body as well as both scapulae. During the work it became clear that we are dealing with a male statuette, because the platelet between the legs is completely worked and discharged and therefore indicates a penis. The whole refitting work was extremely complex (for all details see Ebinger-Rist, Wolf, 2013; Wehrberger, 2013). Apart from its meaning, the piece is of interest concerning prehistoric ivory working: The figurine was carved of a complete mammoth tusk. The head is oriented to the tip of the tusk, while the crotch of the figurine is at the end of the pulp cavity. The hands and parts of the back show the cementum layer while the rest is manufactured of the pure and softer dentine. The Aurignacian carver knew exactly the composition of a mammoth tusk and he saved labor, by creating the figurine this way.

During the excavation 1939 in the Hohlenstein-Stadel two extraordinary ivory beads and six pierced fox-canines were excavated together with the lion-man (Hahn, 1977; Reinhardt, Wehrberger, 2005; Wolf, 2015). This figurine lay in isolation in the rear chamber of Stadel cave, only accompanied by these special personal ornaments. The first bead is a huge, polished basket-shaped form with two broken eyelets at both sides (figure 8). The second piece is a nearly globular bead, but the eyelet is not preserved, too. The recent excavation in 2010 yielded nine pierced animal teeth as well as another globular pendant. Both ivory bead forms do not show any similarities with other forms of the Aurignacian sites so far (Wolf *et al.*, 2013).

Figure 8 - Hohlenstein-Stadel cave, extraordinary basket-shaped bead with broken eyelets, excavated 1939. Length: 2,1 cm (photo: Ulmer Museum).

6 - Discussion

The meaning of jewelry is mostly a symbolic one (e.g. Vanhaeren, d'Errico, 2006). A piece of jewelry can be a small decorative item or a mean to beautify the bearer. In general jewelry represents a social status (Hahn, 1992; Haidle, 2003). People use jewelry primarily to increase the attractiveness or the value of themselves within a society or a group. Any kind of jewelry like hairstyles, body painting, scarification, embroidery, chains, rings, applications on clothing and other is perceived by other people, read and evaluated. Adornment creates identity and foremost it is a means of communication. Once a form in the artifact inventory of a site recurs, it was preferred within a group over a longer period of time. The unification of jewelry for long periods of time indicates an identification of groups with this particular form (Haidle, 2003). This testifies to a stylistic and traditional craftsmanship (see also Wiessner, 1983).

The personal ornaments of Hohle Fels derive from all layers. The double perforated bead form occurs in the layer Vb, which is the oldest Aurignacian deposit. People carved this form for millennia until the end of the Aurignacian. Nevertheless we see trends in the bead forms, namely the unique forms appear in the older layers, while people developed the basket-shaped form as well as the non-perforated, constricted bead later.

The beads from Vogelherd come exclusively from the backdirt at the southwestern entrance of the cave, along with thousands of stone artifacts and bone fragments of the prey. As mentioned above, we think that the excavators put the backdirt close to the excavation area. Therefore, we can assume that during the Aurignacian people sat and worked at the southwestern entrance of the cave. The beads are represented in all stages of the manufacturing, use and discard. That shows that the objects were produced locally. People wore them and they also lost beads or discarded them. The large quantity of other finds proves the intensive usage of the cave. The jewelry ended along with the other artifacts in the everyday waste. The double perforated beads as well as the single perforated beads from the backdirt show striking resemblance to the objects of jewelry from the Ach Valley caves. The wealth and the variety of pieces from Hohle Fels and Vogelherd testify to the high mental and manual skills of the Aurignacian people. Carvers produced the beads in series, but each piece was manufactured individually and therefore represents the work of an individual.

For millennia Aurignacian people sought out the Ach – and the Lone Valley. During this long time period, they favored the same style of beads. Since especially the double perforated beads exclusively occur in the Swabian Jura and here in large numbers, we assume that they reflect a specific group membership and group identity. Many Aurignacian sites yielded personal ornaments (e.g. Otte, 1979; White, 1995; Vanhaeren, d'Errico, 2006; Wolf *et al*., 2013). Few personal ornaments of for example the Belgian sites show similarities with pieces of the Swabian Aurignacian like a half preserved basket-shaped bead from Spy (Otte, 1979, 1995; Wolf *et al*., 2013). But in general the numerous Swabian personal ornaments possess their own special character.

Aurignacian hunter-gatherers used the caves in both valleys. Perhaps different small groups occupied the Ach- and the Lone Valley at the same time. This would mean that they shared the same material culture; hence they knew each other and exchanged ideas and objects. In this case the people maintained similar beliefs and they created a common culture in the valleys of the Swabian Jura. However the temporal depth could not be recorded in detail to make definitive statements; it also would be possible that one valley was settled temporary while the other valley was not visited. In any case it is evident that the Aurignacian people in this region retained the desire for certain bead forms over eras. This is true at least for the stratified pieces of Hohle Fels. The specimens from backdirt of the Vogelherd sediments could also derive from one or a few visits and thus they could be the result of intensive carving. However, there are numerous pieces and the Aurignacian layers were the thickest in the cave. These are rather arguments for an accumulation over a long period of time. The apparent deposition of the strikingly large lion-man and the special pendants in the small cave chamber suggest that this was a place, which was visited for special occasions in comparison with the neighboring Vogelherd. The lion-man provides potential clues to the beliefs of the first modern humans in southwestern Germany. The situation changes abruptly during the Gravettian, when the Swabian Gravettian people only manufactured and used the tear-dropped-shaped beads (e.g. Scheer, 1985; Wolf *et al.*, in press).

The extraordinary rich Aurignacian ivory items and especially the beads occur in a huge variety of forms and an impressive quantity. This allows many insights into the innovative material culture of the Swabian Aurignacians. But we have to bear in mind, that these are the results of 150 years of intensive and detailed research in this region. The excavations and the research of the following decades will provide additional informations about this key region of Central Europe.

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