

# Aurignacian ethno-linguistic geography of Europe revealed by personal ornaments

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## Abstract

Our knowledge of the migration routes of the first anatomically modern populations colonising the European territory at the beginning of the Upper Palaeolithic, of their degree of biological, linguistic, and cultural diversity, and of the nature of their contacts with local Neanderthals, is still vague. Ethnographic studies indicate that of the different components of the material culture that survive in the archaeological record, personal ornaments are among those that best reflect the ethno-linguistic diversity of human groups. The ethnic dimension of beadwork is conveyed through the use of distinct bead types as well as by particular combinations and arrangements on the body of bead types shared with one or more neighbouring groups. One would expect these variants to leave detectable traces in the archaeological record. To explore the potential of this approach, we recorded the occurrence of 157 bead types at 98 European Aurignacian sites. Seriation, correspondence, and GIS analyses of this database identify a definite cline sweeping counter-clockwise from the Northern Plains to the Eastern Alps via Western and Southern Europe through fourteen geographically cohesive sets of sites. The sets most distant from each other include Aurignacian sites from the Rhône valley, Italy, Greece and Austria on the one hand, and sites from Northern Europe, on the other. These two macro-sets do not share any bead types. Both are characterised by particular bead types and share personal ornaments with the intermediate macro-set, composed of sites from Western France, Spain, and Southern France. We argue that this pattern, which is not explained by chronological differences between sites or by differences in raw material availability, reflects the ethno-linguistic diversity of the earliest Upper Palaeolithic populations of Europe.

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## 1. Introduction

In spite of the considerable effort displayed in the last decades by geneticists, palaeoanthropologists, linguists, and

archaeologists, our knowledge of the degree of biological, linguistic, and cultural diversity of the first anatomically modern populations colonising the European territory at the beginning of the Upper Palaeolithic is still vague. Were these first colonisers, traditionally identified with the Aurignacian, a culturally, linguistically, and genetically homogeneous population? Did they penetrate the European territory in one wave or in successive waves, and follow a single path or multiple paths? Can any discipline determine regional trends reflecting the ethno-linguistic and genetic diversity of these populations?

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Current Europeans are African immigrants [12,38,92,169] and their gene diversity reflects demographic phenomena that occurred in Europe after 40,000 BP. The mtDNA sequences determined so far in nine Neanderthal specimens lie outside the range of variation of modern European sequences [105,108,128,150,152], suggesting that Neanderthals did not significantly contribute to the present mtDNA gene pool. However, although these results do not exclude the possibility of a genetic Neanderthal input to the gene pool of early modern colonisers that was later rubbed out by intervening bottlenecks and replacements [70], a recent modelling of potential admixture between the two populations excludes an interbreeding rate higher than 0.1% [47]. The recent genetic analysis of seven Upper Palaeolithic individuals [35,152] also seems to exclude any large genetic contribution by Neanderthals to early modern humans.

For the time being, recorded genetic differences between Neanderthals and Moderns can be used to support placing the former in either the same or different species [77,164]. Considering that there are similarities in behaviour between Neanderthals and modern humans, even if Neanderthals belonged to a different species, as suggested both by recent analysis of morphological differences among Neanderthals, modern humans, and 12 species of extant primates [81] and by differences in dental growth [135], this would not necessarily have precluded cultural [49,53,203] and perhaps biological interactions between them [177,204].

Identifying geographical patterns of genetic diversity among the early modern colonisers seems, for the moment, a largely unexplored field of population genetics, a discipline that, so far, has been more concerned with interpreting the current gene pool as a legacy of past populations' migrations. Clines in genetic markers coalescing before the Holocene have been interpreted as reflecting either successive migrations into Europe or autochthonous re-colonisations from southern refugia post-dating the Last Glacial Maximum (LGM). From a Y-chromosome perspective [37,142,151,188], the M173 lineage is considered an ancient marker that was brought by or arose in Aurignacian moderns colonising Europe about 40,000–35,000 years ago. M170 and haplogroup I would have instead originated in Europe about 22,000 years ago among Gravettian populations descendant of men who arrived from the Middle East a few thousand years earlier. A similar conclusion is reached by calculating the probable age and studying the frequency of mtDNA haplogroup H [139,174,175]. Of more recent origin, the haplogroup V is thought by the same authors to represent the genetic marker of an Upper Magdalenian expansion from a Pyrenean refugium into southern Iberia and northern Europe some 13,000 years ago.

It is plausible, considering positive correlation between linguistic and genetic data [11,13,132,155,156], that demographic scenarios suggested by genetic markers may reflect, to some extent, language spreads and related cultural contacts. To date, however, genetic studies have not identified geographic patterns that may be representative of Palaeolithic ethno-linguistic entities.

Historical linguists, for their part, are sceptical that any language or linguistic geography from the Upper Palaeolithic could be reconstructed. Even the more convinced proponents of the Nostratic hypothesis and of a monogenetic theory for language origin [26,63,75,137,143,144] admit that they have little to contribute about the languages spoken in Europe before 12,000 years ago.

The contribution of human palaeontology to advancing the understanding of the Early Upper Palaeolithic (EUP) human geography is also limited. Although accepted for the late Aurignacian, the attribution to the moderns of the early manifestations of this culture remains tentative ([41,164,203,204], but see [117]). A number of human remains traditionally attributed to the Aurignacian have recently yielded radiocarbon dates incompatible with this attribution [45,167,171]. The  $27,680 \pm 270$  date (Beta-157439) for a shell bead from the Cro-Magnon site [87] suggests a similar post-Aurignacian age for the type-specimen of Early Upper Palaeolithic AMH.

Amongst the five morphologically diagnostic early modern humans considered older than 28,000 years—Mladec, Rois, La Quina, Kent's Cavern, and Oase 1—only the last two are directly dated. Four come from old excavations, and the more recently discovered one, the Oase 1 mandible, lacks for the moment a cultural attribution [177]. On the basis of this evidence, it is challenging to evaluate the potential role of local Neanderthals in the morphological evolution of incoming modern populations and to identify regional trends that may reflect related cultural processes. This is the more so given the uncertainties about the biological affiliation of the authors of the other EUP cultural traditions. Widely accepted for the Chatelperronian, the only tradition associated with Neanderthal human remains [91,114], the Neanderthal authorship of EUP technocomplexes, even if plausible considering technological and geographic continuity with preceding local Mousterian industries, is still undemonstrated, and it has been proposed that some of them such as the Bachokirian or the Bohunucian may have been produced by moderns [127,165,167].

The elaboration of testable scenarios is further complicated by the limitation of radiometric dating for this time span (see [202,203] for discussion). The hypothesis that the earliest Aurignacian predated the emergence of the Chatelperronian and other EUP cultural traditions has been used to support the view that the Neanderthals and moderns lived side by side for a long time, during which the latter went through a process of gradual acculturation [17,91,104,117]. This would have triggered the adoption of a new lithic technology, ornaments, and bone tools by some Neanderthals groups. According to a recent variant of this scenario, designated the *Kulturepumpe* model, the Aurignacians would have reached the Swabian Jura precociously (ca 40,000 BP), from which they would have spread their civilisation into the remainder of Western Europe [44]. Instead, reappraisal of the radiometric and stratigraphic evidence supports the view that the earliest diagnostic occurrences of the Aurignacian are not older than ca 36,500 BP and postdate the emergence of the other EUP cultural traditions [1,202,203]. This

has been used to suggest an autonomous evolution of local Neanderthal Mousterian traditions toward behavioural modernity before the arrival of Aurignacian moderns [53]. Such a model does not rule out the possibility that subsequent cultural contacts took place between Aurignacians and other EUP populations and played a role in shaping their respective cultures. The nature and extent of these contacts, however, as well as their impact on both populations, remains largely a matter of speculation.

To address this question, it would be helpful to reach a better understanding both of what the Aurignacian is and of the extent to which this broad archaeological entity can correctly be assimilated to a culturally and ethno-linguistically homogeneous population. The question of the regional variation in the material culture of the Aurignacian has been addressed by a number of authors (e.g. [30,32,57,62,79,103,160,203]). Recent analysis of early Aurignacian stone tool assemblages seems to confirm the presence in Western Europe of two different techno-typological traditions: the Archaic or Proto Aurignacian, mostly found at Mediterranean sites, and the Ancient Aurignacian, common in south-western France and Germany [27,172]. However, only a few assemblages are securely attributed to one of these two traditions and no agreement exists on whether these should be considered expressions of different cultural entities or about their possible contemporaneity. The fact is that Palaeolithic archaeologists have no obvious means by which to infer ethno-linguistic diversity from the more commonly studied components of the archaeological record [115,137]. Although constantly recurring associations of artefact types and manufacturing techniques are interpreted as signatures of Palaeolithic populations sharing some degree of cultural similarity [42,112,113], it has been repeatedly stressed that this assumption does not rely on any robust analogy [153]. In the last three decades cultural anthropologists [95] have gradually changed their view on the nature of ethnic groups and shifted from “objectivist” definitions (based on cultural practices independent from the perceptions of individuals) to a conception of ethnic groups as “self-defining systems” (based on the adhesion by the individual to a shared sense of distinctiveness). While traditional definitions of ethnic groups tended to conceive these as isolated and, to some extent, unhistorical entities, current approaches focus on the dynamic nature of ethnic affiliation, constantly subject to re-definition and re-negotiation. No consensus exists on what features or association of features of the material culture could more reliably identify such dynamic past entities in the archaeological record. Symbolic behaviours such as artistic activities, mortuary practices, and decorations on utilitarian and non-utilitarian objects, which need to be transmitted from generation to generation through language, are probably among the more informative elements for tracking down ethno-linguistic entities [10,23,90,96,110,153,197,199,200]. Artefact types and manufacturing techniques might hold information similar to that contained in symbolic behaviours (e.g. [112,113]). These links, however, are neither warranted nor univocal and must be supported, for each of the above cultural traits, by explicit analogies.

## 2. Personal ornaments as a proxy for ethno-linguistic diversity

We argue that personal ornaments are the trump card for addressing this issue. Archaeologically, personal ornaments offer four advantages which are not met together in other artefact categories: (1) Their function is exclusively symbolic; (2) they have been used by a large number of ethnographically well-documented traditional societies, which allows, in perspective, the creation of an informed analogy linking beads to ethnicity, language, and genetic/biological diversity; (3) they are common at Upper Palaeolithic sites; and (4) they occur during this period in many distinct types.

Ethnographic studies [84,89,100,176,198,199] have shown that beadwork, like body painting, scarification, tattooing, garment, and headdress [34,138,173] is perceived by the members of traditional societies as a powerful indicator of their ethno-linguistic identity, enhancing within-group cohesion and fixing boundaries with neighbouring groups. Ethnographic studies also indicate that the ethnic dimension of beadwork is conveyed through the use of distinct bead types and/or by particular combinations and arrangements on the body of bead types shared with one or more neighbouring groups [64,65,89,163]. Since the other functions of personal ornaments—i.e., markers of gender, age, class, wealth, social status, and use as exchange media, etc. [178,179]—are governed by rules shared by the members of a community, beadwork used in these ways also contributes, even if unintentionally, to differentiate a society from a neighbouring one. As a consequence, we may expect that ethno-linguistic entities will be identified archaeologically by geographically coherent clusters of sites yielding particular ornament types as well as by characteristic proportions and associations of types found over larger areas.

In this respect, the potential of personal ornaments has remained largely unexplored. The pioneer study by Newell et al. [124] on Mesolithic ornaments has gained no followers. A number of authors have analysed Upper Palaeolithic personal ornaments found at habitation sites to characterise their technique of manufacture [16,51,72,126,168,180–184,192,195] and their economic significance [106,162], and to identify exchange networks [3,4,9,51,168,185] and the earliest occurrences of beadmaking and use [7,54,88,107]. Others have analysed beads associated with burials in search of information on social stratification [180–184,194]. No attempt has been made so far to create and make available a comprehensive database of Upper Palaeolithic personal ornaments, and analyse it with adapted statistical tools. Here we present results on the geographical distribution and association of Aurignacian bead types, and explore their potential to identify patterns of ethno-linguistic diversity and population dynamics.

## 3. Methodology

Using ArcView GIS software, we have created a geospatial database of bead types found at Aurignacian sites. Data were

obtained from the literature, direct analysis of published and unpublished archaeological collections. In a few cases, unpublished information was kindly provided by colleagues (Table 1).

Our typology of Aurignacian personal ornament takes into account cross-cultural studies on classification of beads [20,64,65,69,82,98,99,133,189] and, in a more general way, studies of the categorisation of the natural world [59] by traditional societies, as well as current debate on criteria used to classify archaeological artefacts [2,189,196]. Discrete bead types were created by reference to raw material, morphology, mode of suspension (e.g., perforation, groove), dimension, and, when applicable, to species (Figs. 1–3). In the case of animal teeth, we also considered the tooth type. In the case of fully shaped objects, mutually exclusive types were created by considering the raw material and comparing on a one-to-one basis the objects' morphology and size.

The taxonomy of shells has changed considerably since the first publications of Palaeolithic shell beads [109,141] and still varies today according to research traditions and specialists. To prevent having different taxa correspond to the same shell, taxonomic identifications given in the literature were updated and standardised using CLEMAM, the Check List of the European Marine Mollusca ([www.somali.asso.fr/clemam/index.clemam.html](http://www.somali.asso.fr/clemam/index.clemam.html)). Shell bead types refer to species when the latter can be visually discriminated; otherwise they refer to genus.

Taphonomic [52] and cross-cultural studies [40] indicate that not all objects with a perforation or a gouge are personal ornaments. We have excluded from our database objects bearing no compelling traces of human involvement and, in general, included objects small enough to be worn as personal ornaments, and showing clear anthropogenic suspension devices.

Seriation and correspondence analyses of this database were performed using *BASP* software ([www.uni-koeln.de/~I001/basp.html](http://www.uni-koeln.de/~I001/basp.html)). Multiple seriation runs were performed experimenting with all sites and bead types, eliminating types occurring at just one site, and associating spatially close sites when such association increased the incidence matrix correlation coefficient. Sites that have not yielded at least two types and types not present in at least two sites were excluded from the correspondence analysis. Contour maps were created by applying the non-zero weight coordinates attributed to sites by each component of the correspondence analysis in Surfer7, Golden Software, Inc. Triangulation with linear interpolation and kriging methods were used to create maps. The former uses an algorithm that creates triangles by drawing lines between data points and is, among the available methods, the one that honours the data most closely. The latter is the most popular method, effective with almost any type of data set.

Although arguably meaningful, the proportion of the different ornament types at each site was not considered in our analysis. The low amount of ornaments yielded by excavations during which sediment was not systematically sieved with small mesh grid suggests that tiny or fragile ornaments are under-represented in most collections, and recorded proportions cannot be considered representative of the

importance given to different ornaments types in Aurignacian beadworks.

#### 4. Ornament types

Personal ornaments of 157 distinct types (Table 1, Figs. 1–3) are recorded at 98 Aurignacian sites in Europe and the Near East (Fig. 4). Of these types, 62 represent ornaments made of shells, 31 of teeth, 30 of ivory, 11 of stone, 11 of bone, 7 of deer antler, and one each of belemnite, nummulite, ammonite, sea urchin, and amber. Shell beads (Fig. 1) comprise 16 types corresponding to species restricted to the Mediterranean Sea, 5 to the Atlantic Ocean, and 12 to fossil outcrops. The remaining 23 shell bead types represent marine species found in both Mediterranean and Atlantic waters and, in one case, in fossil outcrops or fluvial environments. With the exception of *Dentalium* and *Vermetus*, which bear natural apertures, the shells were transformed into pendants by making one or, occasionally, two perforations.

To make pendants of teeth (Fig. 2), Aurignacians used the incisors, canines, premolars, and molars of 20 different mammals, including humans and, in one case, a shark. The use of deciduous horse or hyena teeth is recorded at three sites. With the exception of mammoth tusks, which were used as raw material for the manufacture of ivory beads and pendants, teeth from the other species were transformed into ornaments by making a perforation into or a circular groove around the root.

Twenty-one manufactured bead and pendant types (Fig. 3), made in a variety of raw materials, are found at Aurignacian sites, along with ivory and stone rings, possible diadems and labrets made of ivory, bone, or antler, as well as imitations in bone and antler of horse incisors and red deer canines. To this category of manufactured beads and pendants also belongs a single occurrence of an antler split-base point transformed into a pendant. Manufactured ornaments show single or double perforations, or grooves made to facilitate suspension.

Five ornament types consist of unmodified bones bearing an anthropogenic perforation (the fox metapodial and humerus, the reindeer phalange and vestigial metapodial, fish vertebra, and the mammal femur head).

#### 5. Seriation analysis

The seriation of bead-type associations (Fig. 5) shows a good compactness along the diagonal of the incidence matrix. It also identifies fifteen *sets*, defined as clusters of three or more spatially cohesive sites sharing similar bead type associations. Set 1 groups ten sites from Germany. Set 2 groups five sites from Belgium. Sets 3, 6, 7, and 10 consist of a total of 27 sites from the southwest of France. Set 4 assembles seven sites from northern Iberia. Set 5 groups three sites from the northwestern Pyrenees. Set 8 groups five sites from the northeastern Pyrenees. Sets 9 and 13 comprise nine sites located in the southeast of France. Set 11 brings together seven

Table 1  
Aurignacian Bead Database

Site	Ornament type	References
<i>Austria</i>		
Krems-Hundsteig	Clanculus, Columbella, Cyclope, Dentalium, Melanopsis	[71,78]
Langmannersdorf	Dentalium	[78,79]
Senftenberg	Dentalium, Turritella	[78,79]
Krems	Dentalium, PAnthropSt	[123]
Willendorf	Dentalium	[103]
<i>Belgium</i>		
Goyet	CBear, CFox, CDeer, IDeer, IHorse, IDcHorse, IWolf, Lip-plugIv, BEloIv, PEloIv, PDropIv, PEloAnt, ImIHorseBone	[60,111,126], Germonpré, pers. comm.
Prince	IDeer, POGivalIv	[60,111,126]
Princesse	CDeer, RIv, PTrapNotchIv, PTrapNotchAnt	[60,111,126]
Spy	CFox, CDeer, IWolf, IBoar, RIv, Lip-plugIv, BEloIv, B8Iv, PDropIv, BEllFlatNotchIv, BDiskIv, BDiskBISt, BTubIv, BTubBone	[60,111,126]
Trou Magrite	CFox, CDeer, IDeer, Crommium, RIv, B8Iv	[60,111,126]
<i>Croatia</i>		
Sandalja	CBadger, CDeer, IDeer	[97]
<i>Czech Republic</i>		
Mladec	CWolf, CBear, DiademBone, IBeaver, IHorse, IMoose, VstMtpReindeer	[78,125,166]
<i>France</i>		
Abri Peyrony	CDeer, CFox, Dentalium, Turritella, Pecten	[118,119]
Balauziere	Acanthocardia, CDeer, L obtusata, Natica, Osilinus, Phalium, Tapes, Turritella, Venus	[14,71]
Blanchard	Ancillaria, Aporrhais, Belemnite, Columbella, Conus, Cypraea, Dentalium, Homalopoma, L littorea, L obtusata, L saxatilis, N corniculus, N gibbosulus, N mutabilis, N reticulatus, Natica, Nucella, Urchin, Potamides, Theodoxus, Turritella, BBasketIv, DiademIv, DiademBone, PForkIv	[61,121,131,168]
Caminade Est	Dentalium	[121,168]
Canecaude	CBear	[145]
Castanet	CHyena, CFox, IBovid, IDeer, IFox, Ancillaria, Aporrhais, Charonia, Cypraea, Dentalium, Homalopoma, L obtusata, L saxatilis, N gibbosulus, N incrassatus, N mutabilis, N reticulatus, Natica, Nucella, Phalium, Potamides, Surcula, Turritella, DiademBone, DiademIv, BGIv, BBasketIv, BBasketSt	[131,168]
Cellier	CWolf, Dentalium, Turritella, L obtusata, N reticulatus, DiademIv, PPointedNotchGIV	[131,168,191,195]
Chevre	Nucella, Potamides, BTubBone	[121,168]
Combe	Arca, CDeer, IFallowdeer, THuman, L littorea, L obtusata, Natica, N reticulatus, Nucella, Turritella	[86,121,168]
Combe Capelle	Urchin	[168]
Combette	Cypraea, Thais	[14]
Ferrassie	Ammonite, Architectonica, Turritella, CDeer, DiademIv, IBovid, Nucella, Urchin, BTubBone, PPointedAnt	[120,130,168]
Festons	Ammonite, Cardium, Urchin, Pecten	[168]
Figuier	Glycymeris	[168]
Flageolet I	CFox, Cardium, CDeer, L littorea, BRectanFlatIv	[140,168]
Gatzarria	CFox, CDeer, Iibex, IDeer, IHorse, IFox, BBasketAnt, BBasketIv, BBasketSt, DiademAnt, DiademBone, RSt, BTubBone, PEloAmber, PTrianguloidIv, FishVertebra	[5,146]
Grotte des Fours	BTubBone	[121]
Grotte des Hyenes	CLion, CWolf, CFox, CDeer, THuman, DiademIv, Natica, Nucella, BBasketIv, BBasketSt	[27,86]
Isturitz	CHorse, CHyena, CWolf, CBear, CFox, CDeer, IBovid, IDeer, IHorse, IWolf, Thuman, L obtusata, Turritella, VstMtpReindeer, PEllIv, BBasketIv, BBasketSt, DiademBone, PEloAmber, PFlatSt, PRectangIv	[86,147,191]
La Quina	CHyena, CFox, Colus, IBovid, IHorse, IDcHorse, IWolf, IFox, MolWolf, PremolHorse, L littorea, L obtusata, Turritella	[66,67,74,85]
Laouza	Cypraea, Dentalium, N gibbosulus, N mutabilis, N reticulatus, Natica, Trivia	[71]
Lartet	Glycymeris, N gibbosulus	[121,168]
Le Piage	CFox, TShark, Iibex, IBovid, IDeer	[39]
Pages	CWolf, CFox	[121]
Pasquet	L obtusata, N gibbosulus, N mutabilis, Nucella, Turritella	[121,168]
Patary	CBear	[121]
Pataud	FemurIbex, CLion, CFox, CDeer, DiademBone, HumFox, IBovid, IWolf, L littorea, MtpFox, VstMtpReindeer, Pecten, BBasketIv, PhalFox, PhalReindeer, PRectangIv, Rhynchonella	[33,168,186]
Pecheurs	CDeer, Cyclope, Dentalium, Homalopoma, N mutabilis, N reticulatus, Natica, Ringicula, Trivia	[14]
Poisson	L saxatilis, N reticulatus, Natica, Theodoxus, Trivia	[168]

(continued on next page)

Table 1 (continued)

Site	Ornament type	References
Pont-Neuf	Pecten	[121]
Régismont	Acanthocardia, Glycymeris, Phalium	[71]
Renne	RProtrusionIv, Crommium, IBear, PEloIv	[195]
Roc de Combe	CLynx, CFox, IBovid, FishVertebra	[161]
Rochette	CLion, CFox, Dentalium, BTubBone	[121]
Rois	CHyena, CWolf, CFox, CREindeer, CDeer, THuman, DiademAnt, IBovid, IHorse, IReindeer, GastMould, Urchin, BBasketIv, BTubBone, PPointedAnt	[120]
Rothschild	Ammonite, Aporrhais, Cardium, Columbella, CDeer, Cyclope, Cypraea, Dentalium, Glycymeris, L littorea, L obtusata, Mitra, N gibbosulus, N mutabilis, N reticulatus, Natica, Nucella, Ocinebrina, Patella, Pecten, BBasketSt, Phalium, Potamides, Theodoxus, Trivia, Turritella	[14,71,168]
Saint-Cesaire	CDeer, IBovid, Turritella	Morin, pers. comm.
Salpetriere	Cardium, Cypraea, Dentalium, N gibbosulus, N mutabilis, Natica, Pecten, Phalium, Potamides	[14,71,168]
Solutre	BBasketIv, BDiskIv	Connet, pers. comm.
Souquette	Ammonite, CHyena, CFox, CDeer, IBovid, L littorea, L obtusata, L saxatilis, N gibbosulus, N mutabilis, N reticulatus, Natica, Nucella, Urchin, BBasketIv, BTubBone, Potamides, PPointedDecIv, PSplitAnt, Trivia	[13,19,27,56,168,195]
Sous-le-Roc	L obtusata, N reticulatus, Turritella	[121]
Sous-les-vignes	Cdeer, Cfox, Homalopoma, Trivia	[134]
Tournal	Acanthocardia, CBear, CDeer, Cyclope, Dentalium, L obtusata, Natica	[71,145,168]
Trou Mere Clochette	IBearG, BRectanFlatIv, PZoomorphicIv	[58], Monnier, pers. comm.
Tuc d'Audoubert	BBasketAnt	Pastors, pers. comm.
Tuto de Camalhot	Buccinum, CFox, CDeer, Dentalium, DiademAnt, DiademIv, IBovid, L littorea, L obtusata, L saxatilis, N gibbosulus, N mutabilis, Pecten, BBasketIv, BBasketSt, BTubBone, PVoidDecIv, PPointedIv, Turritella	[27,168,187]
Vachons	CWolf, CFox, Colus, CDeer, Dentalium, IDEer, IWolf, Natica, Nucella, Ostrea, Pecten	[31,168]
<i>Germany</i>		
Bockstein Torle	IBovid, RNotchSt, PDropIv, PVoidSt	[78,101]
Bockstein Hohle	CBear	[101]
Breitenbach	CFox	[78]
Geissenklosterle	CFox, DiademAnt, DiademIv, BEloIv, BBulgElldpIv, BBilobateIv, PDropIv, PPyramidalIv, BTubBone, PZoomorphicIv	[44,101]
Hohle Fels	CDeer, IBex, Lip-plugIv, BBulgElldpIv, BBilobateIv, B8Iv, BDiskIv, BTubIv, PZoomorphicIv	[44,101]
Hohlenstein Stadel	CFox, PDropIv	[101]
Lommersum	PDropIv, PConIv	[80]
Sirgenstein	BBulgElldpIv	[101]
Vogelherd	CDeer, BTubBone, PTrapNotchIv, PZoomorphicIv	[43,101]
Wildscheuer	CWolf, IHorse, PVoidSt	[170]
<i>Greece</i>		
Klisura	Clanculus, Columbella, Cyclope, N reticulatus, Natica, Ocinebrina, Potamides, Theodoxus, Trochus	[102]
<i>Hungary</i>		
Istallosko	ImCDeerAnt, BEloIv, GRoot	[78]
<i>Italy</i>		
Bombrini	Aporrhais, Clanculus, Cyclope, Gibbula, Homalopoma, N gibbosulus, N reticulatus, Ocinebrina, Osilinus, Trivia, Turritella	[71,76]
Cala	Astraea, Cantharus, Clanculus, Columbella, Conus, Cyclope, Dentalium, Gibbula, Glycymeris, Haliotis, Homalopoma, Jujubinus, Mitra, N gibbosulus, N incrassatus, N mutabilis, N reticulatus, Natica, Osilinus, Pecten, Phalium, Potamides, Tricolia, Trivia	[71,76]
Castelcivita	Homalopoma	[71,76]
Cavallo	Aporrhais, Cardium, Columbella, Cyclope, Dentalium, Glycymeris, Mytilus, N gibbosulus, Natica, Patella, Pecten, Potamides, Trochus, Turritella, Venus, Vermetus	[129]
Fanciulli	Acanthocardia, Aporrhais, Arca, Cyclope, Cypraea, Dentalium, Glycymeris, N mutabilis, N reticulatus, Nucella, Pecten, Potamides, Cdeer	[14,71]
Fossellone	CFox, CDeer, BEloSt	[24]
Fumane	Aporrhais, Cantharus, Clanculus, Cyclope, Cypraea, Dentalium, Epitonium, Gibbula, Glycymeris, Homalopoma, Jujubinus, L obtusata, L saxatilis, Mangelia, Mitra, Mytilus, N gibbosulus, N incrassatus, N mutabilis, N reticulatus, Natica, Ocinebrina, Osilinus, Patella, Potamides, Rissoa, Theodoxus, Trochus, Trivia, IDEerG	[71,76]
Mochi	Acanthocardia, Aporrhais, Arca, Astraea, Callista, Charonia, Clanculus, Conus, Cyclope, Cypraea, Dentalium, Epitonium, Fusus, Gibbula, Glycymeris, Haliotis, Homalopoma, Jujubinus, L obtusata, L saxatilis, Mitra, Mytilus, N gibbosulus, N incrassatus, N mutabilis, N reticulatus, Natica, Nucella, Nummulite, Ocinebrina, Osilinus, Ostrea, Patella, Pecten, Potamides, Strombus, Trivia, Turritella, BBasketBone, BBasketSt	[14,162]

Table 1 (continued)

Site	Ornament type	References
<i>Near East</i>		
Hayonim	CWolf, CFox, CDeer, Dentalium, IDeer, IHorse	[22]
KsarAkil	Columbella, Dentalium, N gibbosulus	[93]
Sefunim	Columbella, Conus, Cyclope, N gibbosulus	[17]
Yabrud	Dentalium, N gibbosulus, Theodoxus	[17,136]
<i>Romania</i>		
Cioclovina	CBear	[21]
Ohaba-Ponor	CFox	[21]
<i>Russia</i>		
Kostienki 1	CFox, Cyclope, N reticulatus, BWedgeIv, Potamides, Theodoxus	[6,78,103,154]
Muralovka	CFox	[78]
<i>Spain</i>		
Beneito	CLynx, Dentalium, Theodoxus	[94,159]
Cobalejos	CFox, CDeerG, IDeer, L obtusata, PPointedAnt	[148]
Cueva Morin	CDeer	[46]
Foradada	Buccinum, CLynx, Columbella, Glycymeris, Mytilus, Pecten, Theodoxus, Turritella	[36]
Garma	BBasketSt, BTubBone	[8]
L'Arbreda	Dentalium, Homalopoma, Pecten, Potamides, Trivia	[116]
Mollet	IDeer	[116]
Otero	CFox, CDeer, Ibex, IDeer	[46]
Pendo	CDeer, BAsyEloSt, BEloSteatite PEloSt, BBasketSt, BRectanFlatIv	[46]
Reclau Viver	CDeer, Femurlbex	[157,158]
<i>Ukraine</i>		
Siouren	Aporrhais, CDeer, IBeaver, Theodoxus	[6,103]

Abbreviations of ornament types (see Figs. 1–3) combine information on size (B, bead; P, pendant), tooth type (C, canine; Dc, decidual; I, incisor; Premol, premolar; Mol, molar; T, tooth), bone type (Phal, phalange; Hum, humerus; Vst, vestigial; Mtp, metapodial; Epi, epiphysis), shell type (Gast, gastropod), species (D, red deer; Lit, *Littorina*; N, *Nassarius*), raw material (Ant, antler; Iv, ivory; St, stone), morphology (Im, imitation; Con, conical; Elo, elongated; Bulg, bulged; Ell, elliptical; D, drop-shaped; R, ring; Disk, disk-shaped; 8, figure-eight-shaped; Ovoid, ovoidal; Trap, trapezoidal; Tub, tubular; Rectan, rectangular; Asym, asymmetrical; Split, split based point; Wedge, wedge-shaped) and other features (G, grooved; Dp, double-perforated; Notch, notched; Dec, decorated; Bl, black).

sites from Italy and Greece. Set 12 groups three sites from the Mediterranean coast of Iberia. Set 14 includes five sites from Austria. Finally, Set 15 comprises three sites from the Near East, attributed to the Levantine Aurignacian. The 12 remaining sites scatter between these 15 sets and correspond almost exclusively to geographically isolated occurrences.

The histograms composing Fig. 6 visually present the number of ornament types that each set shares with the other sets, as well as the number of types peculiar to each set and found therein at single or multiple sites. Five of the 15 sets (1, 2, 5, 7, 11) reveal particular ornament types occurring at more than one site within each set. Noteworthy, Sets 1, 2, and 3 have no ornament types in common with Sets 10 through 15 although both share a number of types with intermediate Sets 4 through 9.

These three clusters of sets are called hereafter *Macro-sets A* (Sets 1–3), *B* (Sets 4–9), and *C* (Sets 10–15).

### 5.1. Discrete ornament types

Macro-set A differs from B and C by its proportionally higher number of discrete bead types. Types specific to this macro-set and found therein in at least two constituent sets, consist of a repertoire of ivory beads (elongated, figure-

eight-shaped, drop-shaped, disk-shaped), ivory pendants (zoo-morphic, trapezoidal), and ivory lip-plugs.

Discrete types found in more than one set of the intermediate Macro-set B comprise perforated teeth (wolf premolar, fox incisor, hyena and lion canines, human tooth), shaped ornaments (rectangular ivory and pointed antler pendants, bilobate notched ivory beads, antler basket beads), perforated bones (femur heads, vestigial reindeer metapodials, fish vertebrae), and Atlantic shell beads (*Colus*, *Littorina littorea*). Only two ornament types, the Mediterranean *Clanculus* shell and the *Mytilus* shell bead common in both the Mediterranean and the Atlantic, are specific to Macro-set C and found therein in more than one constituent set.

Four sets (1, 2, 5, 7) within Macro-sets A and B, and one (Set 11) within Macro-set C yielded ornament types specific to each of the five and found within each set at more than one site. Bulged elliptical double-perforated and bilobate ivory beads, ovoidal stone beads only occur in Set 1. Ivory rings occur in Set 2, amber pendants in Set 5, and fossil *Ancillaria* shell beads at sites from Set 7. Nine marine shell beads made either from species restricted to the Mediterranean (*Clanculus*, *Tricolia*, *Trochus*, *Gibbula*, *Jujubinus*, *Cantharus*) or from both the Mediterranean and the Atlantic (*Epitonium*, *Haliotis*, *Astraea*) are only found at sites in Set 11.





With the exception of Sets 10, 12, and 15, all the sets comprise types only found at a single site. In Set 1 these are the conical ivory pendant, the pyramidal ivory bead and the notched stone ring. In Set 2 these are the elliptical flat notched ivory beads, the ogival ivory pendant, the disk-shaped black stone bead, the elongated antler pendant, the wild boar incisor, and the imitation horse incisor made of bone. The grooved shark tooth occurs at only one site in Set 3.

Types unique to single sites from Set 4 are the elongated steatite bead, asymmetrical elongated stone bead, and the grooved red deer canine. The five ornament types unique to Set 5 are the elliptical ivory bead, the trianguloid ivory pendant, the flat stone pendant, the stone ring, and the perforated horse canine.

Twelve unique bead types occur in sites from Set 6: perforated animal bones (the reindeer phalange, the fox phalange, metapode, and humerus); the fossil *Rhynchonella* and *Architectonatica* shell bead; the perforated gastropod mould; the perforated reindeer canine and incisor; the horse premolar, the wolf molar, and the pointed bone pendant.

Sites from Set 7 have seven unique types: the pointed ivory bead decorated with punctures; the pendant made of an antler split-base point; the grooved and notched ivory pointed pendant; the perforated forked ivory pendant; the fossil *Surcula* bead; the perforated fallow deer incisor; the belemnite bead, and the *Nassarius corniculus* bead. The decorated ovoid ivory pendant was found at a single site from Set 8. Two shell beads, one Mediterranean (*Ringicula*) and one common in the Mediterranean and the Atlantic (*Tapes*) are specific to single sites from Set 9.

Specific types found at single sites from Set 11 are the bone basket bead, the grooved red deer incisor, and marine shell beads made from species occurring in both the Atlantic and the Mediterranean (*Callista*, *Vermetus*, *Mangelia*, *Rissoa*), as well as beads made from the fossil *Strombus* shell, nummulite, and *Fusus*, a typical Mediterranean shell. The *Thais* seashell has been exclusively found at one site from Set 13, and two types, the anthropomorphic stone pendant and the fossil *Melanopsis* shell bead, occur at single sites from Set 14.

Other discrete ornament types individualise geographically scattered sites that occur in between the identified sets. One

type, the perforated beaver incisor, is exclusively found at two such sites (Mladec, Czech Republic, and Siuren, Crimea). A grooved tooth root and an imitation in antler of a perforated red deer canine are found solely at Istallosko in Hungary. A perforated wolf incisor and ivory rings with a protuberance are found at the Grotte du Renne in northern France, a perforated badger canine at Sandalja in Croatia, a perforated moose incisor at Mladec, and a wedge-shaped ivory bead at Kostienki 1 in Russia.

## 5.2. Shared ornament types

Macro-sets B and C have in common a much higher proportion of shared ornament types than that observed between A and B. Fourteen ornament types are shared by Macro-sets A and B, which assemble sites from the north of Europe, France, and the north of Spain. Thirty-seven types, absent in Macro-set A, are shared by B and C, the latter of which includes sites from southern Europe, Austria, and the Near East. Among shared ornament types some are more widely diffused than others.

The most popular types shared by the first two macro-sets are found at eight of nine constituent sets. They consist of perforated fox canines and tubular bone beads, found in Sets 1 through 8, and perforated red deer canines, present in Sets 1 and 2 and Sets 4 through 9. It is noteworthy that this last type is the only one that Set 9 (in the southeast of France), shares with the sites from Macro-set A.

Less trendy ornament types occurring in Macro-sets A and B are perforated bovid incisors, occurring in seven out of nine constituent sets and absent in Sets 4 and 9. Ivory diadems, perforated red deer incisors, and bear and wolf canines occur in five sets each. Antler diadems and perforated ibex, wolf, and horse incisors occur in four sets. Tubular ivory beads occur in three sets, and deciduous horse incisors in two sets.

The most widespread type common to the second and third macro-sets, the *Turritella* shell, is found in nine of 12 constituent sets and is only absent in northern Spain (Set 4), in one of the two sets from southeastern France (Set 13), and in the Near East (Set 15). Found in eight sets, *Littorina obtusata* and *Dentalium* shells are the second most frequently shared types. The

Fig. 1. Major shaped ornament types. 1, elongated steatite bead (Pendo); 2, asymmetric elongated stone bead (Pendo); 3, conical ivory pendant (Lommersum); 4, elongated ivory bead (Geissenklösterle); 5, bulged elliptical double-perforated ivory bead (Hohle Fels); 6, drop-shaped ivory pendant (Hohle Fels); 7, elliptical ivory pendant (Isturitz); 8, ovoid stone pendant (Wildscheuer); 9, bilobate ivory bead (Hohle Fels); 10, ivory lip-plug (Spy); 11, trianguloid ivory pendant (Gatzarria); 12, disk-shaped black stone bead (Spy); 13, disk-shaped ivory bead (Solutré); 14, ivory basket bead (Solutré); 15, stone basket bead (Garma); 16, bone basket bead (Mochi); 17, ivory ring (Spy); 18, ivory ring with protrusion (Renne); 19, stone ring (Gatzarria); 20, notched stone ring (Bockstein Torle); 21, tubular ivory bead (Spy); 22, tubular bone bead (Geissenklösterle); 23, rectangular flat ivory bead (Pendo); 24, elliptical flat notched ivory bead (Spy); 25, ogival ivory pendant (Prince); 26, pyramidal ivory pendant (Geissenklösterle); 27, figure-eight-shaped ivory bead (Spy); 28, pointed ivory pendant (Tuto de Camalot); 29, decorated pointed ivory pendant (Souquette); 30, wedge-shaped ivory bead (Kostienki 1); 31, ivory diadem (Ferrassie); 32, antler diadem (Geissenklösterle); 33, notched trapezoidal flat ivory pendant (Vogelherd); 34, rectangular ivory pendant (Isturitz); 35, pointed antler pendant (Rois); 36, elongated stone pendant (Pendo); 37, elongated amber pendant (Isturitz); 38, pointed notched ivory pendant with suspension groove (Tuto de Camalhot); 39, antler pendant on a split based point (Cellier); 40, forked ivory pendant (Blanchard); 41, zoomorphic ivory pendant (Vogelherd); 42, anthropomorphic schist pendant (Galgenberg); 43, flat stone pendant (Isturitz); 44, imitation in bone of a perforated horse incisor (Goyet); 45, imitation in antler of a perforated red deer canine (Istallosko); 46, elongated ivory pendant (Goyet); 47, elongated antler pendant (Goyet); 48, decorated ovoid ivory pendant (Tuto de Camalhot). 1–2, 23, 36: after Corchon, 1986 [46]; 3, 8: after Hahn, 1977 [79]; 4–6, 9, 20, 22, 26, 32–33, 41: after Kölbl and Conard, 2003 [101]; 7, 34, 37, 43: after de Saint Perrier and de Saint Perrier, 1952 [147]; 10, 12, 17, 21, 24–25, 27, 46: after Lejeune, 1987 [111]; 11, 19: after Saenz de Buruaga, 1991 [146]; 15: after Arias Cabal and Ontañón Peredo, 2004 [8]; 16: after Stiner, 1999 [162]; 18: after White, 2001 [195]; 28, 38, 48: after Bon, 2002 [27,28]; 29: after White, 1996 [193]; 30, 45: after Hahn, 1972 [78]; 31: after Peyrony, 1934 [130]; 39: after White, 1989 [190]; 40: after White, 1989, 1993 [190,191]; 42: after Neugebauer-Maresch, 1999 [123].



Fig. 2. Teeth used as personal ornaments in the Aurignacian. 1, badger canine; 2, bear canine; 3, bear incisor; 4, fox canine; 5, bovid incisor; 6, fox incisor; 7, reindeer incisor; 8, reindeer canine; 9, beaver incisor; 10, horse canine; 11, horse incisor; 12, fallow deer incisor; 13, red deer canine; 14, red deer incisor; 15, hyena incisor; 16, hyena canine; 17, horse decidual incisor; 18, lion incisor; 19, wolf canine; 20, ibex incisor; 21, lion canine; 22, shark tooth; 23, human tooth; 24, wolf molar; 25, wolf incisor; 26, moose incisor; 27, lynx canine; 28, wild boar incisor.



Fig. 3. Shells used as personal ornaments in the Aurignacian. 1, *Acanthocardia* sp.; 2, Ammonite; 3, *Ancillaria* sp.; 4, *Aporrhais* sp.; 5, *Arca* sp.; 6, *Architectonica* sp.; 7, *Astraea* sp.; 8, Belemnite sp.; 9, *Buccinum* sp.; 10, *Callista* sp.; 11, *Cantharus* sp.; 12, *Cardium* sp.; 13, *Charonia* sp.; 14, *Clanculus* sp.; 15, *Columbella* sp.; 16, *Colus* sp.; 17, *Conus* sp.; 18, *Crommium* sp.; 19, *Cyclope* sp.; 20, *Cypraea* sp.; 21, *Dentalium* sp.; 22, *Epitonius* sp.; 23, *Fusus* sp.; 24, Gasteropod mould; 25, *Gibbula* sp.; 26, *Glycymeris* sp.; 27, *Haliotis* sp.; 28, *Homalopoma sanguineum*; 29, *Jujubinus* sp.; 30, *Littorina littorea*; 31, *Littorina obtusata*; 32, *Littorina saxatilis*; 33, *Mangelia* sp.; 34, *Melanopsis* sp.; 35, *Mitra* sp.; 36, *Mytilus* sp.; 37, *Nassarius corniculum*; 38, *Nassarius gibbosulus*; 39, *Nassarius incrassatus*; 40, *Nassarius mutabilis*; 41, *Nassarius reticulatus*; 42, *Natica* sp.; 43, *Nucella lapillus*; 44, Nummulite; 45, *Ocenebrina* sp.; 46, *Osilinus* sp.; 47, *Ostrea* sp.; 48, *Patella* sp.; 49, *Pecten* sp.; 50, *Phalium* sp.; 51, *Potamides* sp.; 52, *Rynchonella* sp.; 53, *Ringicula* sp.; 54, *Rissoa* sp.; 55, *Strombus* sp.; 56, *Surcula* sp.; 57, *Tapes* sp.; 58, *Thais* sp.; 59, *Theodoxus* sp.; 60, *Tricolia* sp.; 61, *Trivia* sp.; 62, *Trochus* sp.; 63, *Turritella* sp.; 64, urchin; 65, *Venus* sp.; 66, *Vermetus* sp.

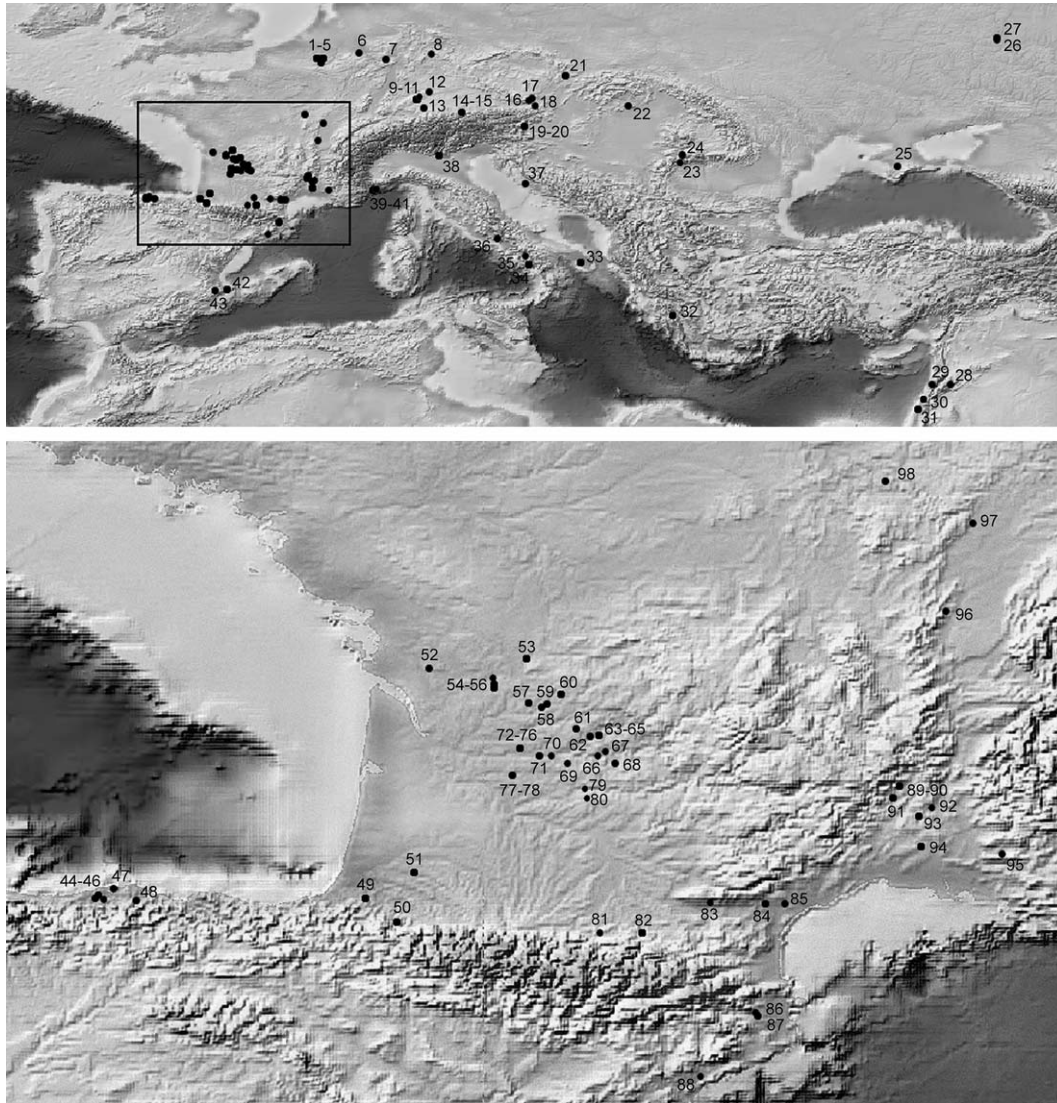


Fig. 4. Geographical distribution of the Aurignacian sites that yielded personal ornaments. 1, Spy; 2, Prince; 3, Princesse; 4, Goyet; 5, Trou Magrite; 6, Lommer-sum; 7, Wildscheuer; 8, Breitenbach; 9, Hohle Fels; 10, Sirgenstein; 11, Geissenklösterle; 12, Hohlenstein Stadel; 13, Vogelherd; 14, Bockstein Torle; 15, Bockstein Hohle; 16, Willendorf; 17, Senftenberg; 18, Langmannersdorf; 19, Krems-Hundsteig; 20, Krems; 21, Mladec; 22, Istallosko; 23, Ohaba-Ponor; 24, Cioclovina; 25, Siouren; 26, Kostienki 1; 27, Muralovka; 28, Yabrud; 29, KsarAkil; 30, Hayonim; 31, Sefunim; 32, Klisura; 33, Cavallo; 34, Cala; 35, Castelcivita; 36, Fossellone; 37, Sandalja; 38, Fumane; 39, Mochi; 40, Bombrini; 41, Fanciulli; 42, Foradada; 43, Beneito; 44, Pendo; 45, Garma; 46, Cobalejos; 47, Cueva Morin; 48, Otero; 49, Isturitz; 50, Gatzarria; 51, Grotte des Hyenes; 52, Saint-Cesaire; 53, La Quina; 54, Pont-Neuf; 55, Rois; 56, Vachons; 57, Cellier; 58, Chevre; 59, Festons; 60, Ferrassie; 61, Le Piage; 62, Rochette; 63, Blanchard; 64, Castanet; 65, Souquette; 66, Grotte des Fours; 67, Caminade Est; 68, Roc de Combe; 69, Combe Capelle; 70, Patary; 71, Flageolet I; 72, Combe; 73, Lartet; 74, Pasquet; 75, Pataud; 76, Poisson; 77, Pages; 78, Sous-le-Roc; 79, Abri Peyrony; 80, Sous-les-vignes; 81, Tuc d'Audoubert; 82, Tuto de Camalhot; 83, Canecaude; 84, Tournal; 85, Régismont; 86, Reclau Viver; 87, L'Arbreda; 88, Mollet; 89, Balauziere; 90, Laouza; 91, Pecheurs; 92, Figuier; 93, Salpetriere; 94, Rothschild; 95, Combette; 96, Solutre; 97, Trou Mere Clochette; 98, Renne.

former is only absent in Sets 13, 14, and 15, the latter in Sets 4, 5, and 6. *Nassarius gibbosulus*' distribution resembles that of *Dentalium*, except for its absence in Set 14 (Austria). *Natica*, also present in seven sets, is absent in Sets 4, 6, 12, and 14 through 15. Six types (stone basket bead, *Nucella lapillus*, *Pecten*, *Nassarius mutabilis*, *Theodoxus*, *Trivia*) are found in six sets. Nine types (*Nassarius reticulatus*, *Cardium*, *Acanthocardia*, *Aporrhais*, *Phalium*, *Potamides*, *Cyclope*, *Columbella*, *Glycymeris*) are found in five sets. Five types are found in four sets (*Littorina littorea*, ammonite, *Littorina saxatilis*, *Cyprea*, *Homalopoma*), and three types are found in three sets (urchin *Arca*, *Conus*). Eleven types are found in just two sets (*Ostrea*,

*Charonia*, *Venus*, *Nassarius incrassatus*, *Patella*, lynx canine, *Osilinus*, *Mitra*, *Ocinebrina*, *Clanculus*, *Mytilus*).

## 6. Correspondence analysis

The plane created by the first two axes shows a parabolic crescent pattern (Fig. 7a). The first axis ranks sites in an order that closely follows the one identified by the seriation. The second axis identifies a similar trend with the exception of sites from Sets 1–2, which are found on either extremes of the range. This depends on the fact that the sites with the



lowest values (Trou Magrite, Geissenklösterle, Spy, Vogelherd, Princesse, Hohle Fels) have in common a number of bead types absent in the other sites of their sets and a proportionally higher number of types shared with sites from sets 3–9. However, all sites from sets 1–2 join when the first three axes of the correspondence analysis are rotated under a certain orientation (Fig. 7b). This setting confirms the pattern identified by the seriation: sites from the same set plot together and sets are ranked according to their geographic proximity. The only notable exception to this trend is the site of Hayonim from the Near East, which plots with the sites of southwestern France instead of clustering near those from Southern Europe and Austria, as is the case with the other sites from the Levant (Set 15). This is due to the presence at Hayonim of five bead types (red deer, fox and wolf canines, horse and deer incisors) that are common at sites from Macro-sets A and B (Fig. 5) but absent at sites from Macro-set C. The presence of these bead types at Hayonim does not seem to be due to percolation of Natufian beads into Aurignacian layers since three of these types (wolf canine, horse and deer incisors) have never been found in Natufian contexts [18,19,22].

## 7. Geographic mapping

The maps obtained by plotting individual bead type occurrences (Fig. 8) and by gridding the values provided for each site by the first component of the correspondence analysis visualise the geographical differences in bead type associations (Fig. 9). Both kriging and triangulation methods identify a South-North decreasing gradient. The steepness that characterises this gradient in the Eastern Alps materialises the clear-cut difference in bead type association between German (Set 1) and Austrian (Set 14) sites. The gradient dissipates east and westward but shows a promontory-like feature in the South West of France. This is mostly determined by the arrival at sites from this region of Mediterranean shell beads that do not reach sites located in the North fringe of Western France and the Cantabrian coast. A single site (Hayonim) is responsible for the “bull’s-eye” pattern created in the Levant by the kriging method.

## 8. Discussion

Seriation and correspondence analysis of Aurignacian ornaments identifies a geographic cline in ornament type association sweeping counter-clockwise from the northern plains to the Eastern Alps through western France, northern Spain, the Pyrenees and Mediterranean Europe. A clear contrast is observed between the extremes of this cline—Germany and Austria—which, in spite of their geographic proximity have no ornament types in common. Three explanations may account for this pattern: (1) it reflects changes over time in personal ornament preference; (2) it is determined by availability of raw material used for bead-making; (3) it mirrors long-lasting cultural differences between the human groups that have lived in these areas.

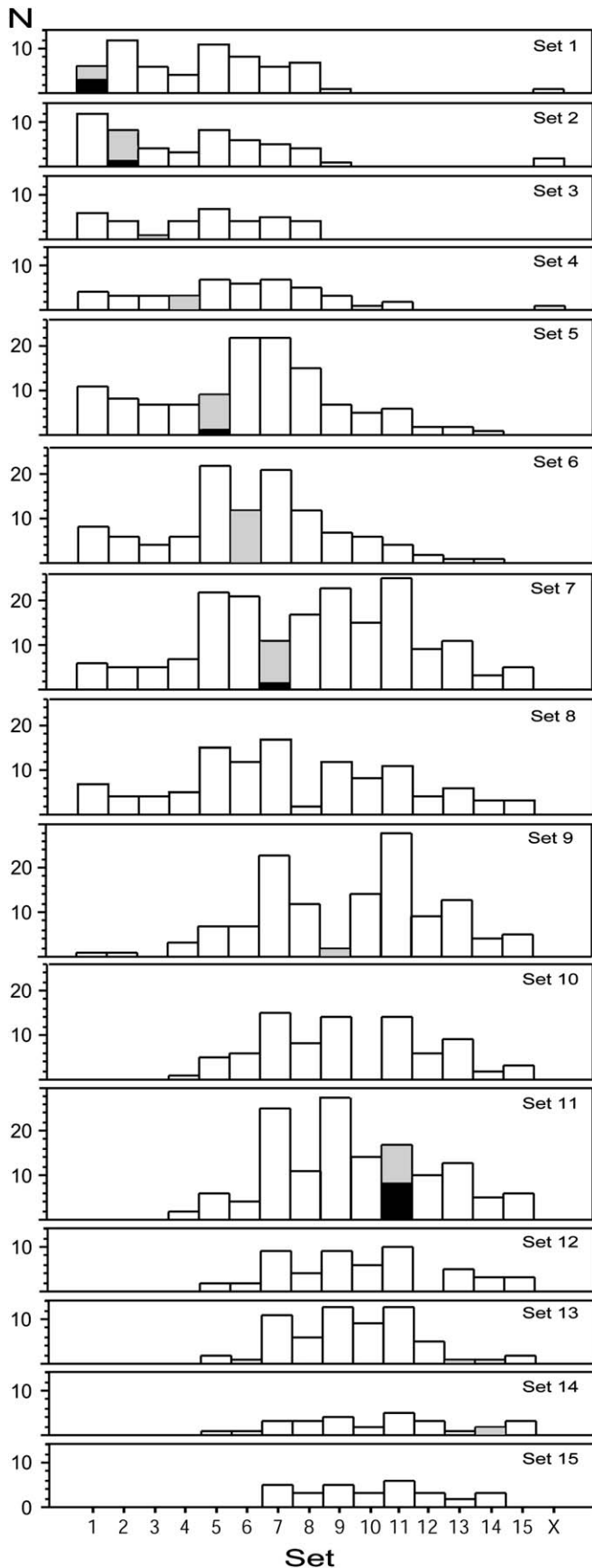
The first hypothesis implies that each of the identified sets corresponds to a particular time period and that changes between sets reflect a gradual evolution in bead use. Given that a clear correlation between sets of bead types and geographical regions is observed, the diachronic argument entails that the population or populations involved moved during their cultural evolution from one region to another. However, no evidence exists for such a chronological cline between the identified sets. Quite the opposite. With the exception of Southern Iberia, where sites attributed to the early phases of the Aurignacian are absent, each region identified by our analysis consists of Aurignacian sites dated and/or attributed to multiple periods or cultural phases within this technocomplex and each includes sites with long sequences spanning most of the Aurignacian interlude.

Six facts contradict the hypothesis that the observed pattern is determined by raw material availability. First, almost all the mammal species (fox, wolf, horse, ibex, bovid, bear, lion, hyena) that provided teeth used to manufacture personal ornaments in Germany, Belgium and the southwest of France were also available in southeastern France, Italy, Greece, Mediterranean Spain, and Austria, as demonstrated by the presence of remains of these animals at the Aurignacian sites from these areas [15,102,106,116,122,123,129,201]. Yet they were not used as beads.

Second, some clusters of coastal sites (Sets 4 and 5) reveal little use of shell for beadmaking in spite of its great availability in those areas. Third, absence of suitable raw material does not appear to have been an obstacle for Aurignacians bead users. Five shell species only available on the Mediterranean coast (*Columbella rustica*, *Homalopoma sanguineum*, *Nassarius corniculatus*, *N. gibbosulus*, *N. mutabilis*) are found at five sites from the southwest of France (Lartet, Pasquet, Blanchard, Castanet, Souquette), which is located more than 300 km from the Mediterranean Sea. Similarly, three Atlantic shell species (*Littorina obtusata*, *L. littorea*, *Nucella lapillus*) are found at five Mediterranean sites (Balauzière, Rothschild, Enfants, Fumane, Mochi). Also, Mediterranean shell beads are common at sites in Italy (Fumane) and Austria (Krems Hundsteig, Senftenberg) that were at least 300 km inland, considering sea level during OIS 3.

Fourth, raw material availability cannot explain the lack of interest among Atlantic Aurignacians in shell beads since more than half of the shells (*Acanthocardium*, *Astrea*, *Epitonium*, *Callista*, *Haliotis*, *Mangelia*, *Mitra*, *Mytilus*, *Ocenebrina*, *Osilinus*, *Patella*, *Ringicula*, *Rissoa*, *Tapes*, *Thais*, *Tricolia*, *Trochus*, *Venus*, *Vermetus*) used as beads by Mediterranean Aurignacian did not fulfil this function at Atlantic sites in spite of their presence on oceanic shores. Fifth, one may reasonably assume that human teeth were available to all Aurignacians. Still, personal ornaments made of human teeth are only found at four sites (Combe, Grotte des Hyènes, Isturitz, Rois), all located in southwestern France.

Finally, the raw material explanation is contradicted by differences between regions in the shapes of manufactured bead and pendants. If the observed pattern were simply due to the availability of raw material such as ivory, we would expect



to find the same bead shapes over all the area where mammoth ivory was available. Instead we see highly distinctive ivory bead morphologies confined to particular regions (cf. the flat elliptical double-perforated ivory beads from Set 1 or the ivory rings from Set 2) and imitations in bone or stone of ivory bead morphologies (e.g., basket beads) at sites located at the periphery of areas where ivory was available (e.g., Garma and El Pendo in the Cantabrian region, and Rothschild and Mochi in southeast France and Liguria).

Therefore, we must conclude that regional differences in personal ornamentation reflect cultural differences among the human groups that have inhabited Western Europe between ca 37,000 and 28,000 BP. The clear contrast between Aurignacian sites from Italy, Austria, Greece and Southeast France, on the one hand, and northern Europe, on the other hand, indicates that cultural differences between these areas were at work during the whole Aurignacian time span. This observation contradicts the view of the Aurignacian as single cultural entity, and supports instead the affiliation of the human groups from these regions to distinct cultural traditions.

How to interpret such long lasting regional trends? Available information on the role of beads in traditional societies suggests that identified sets and macro-sets may reflect ethno-linguistic diversity. We argue that the three macro-sets, each characterised by distinct bead types and bead-type associations, may represent distinct language families. Identified sets could mirror fluctuating boundaries between ethnic groups speaking different languages within these families.

The fact that sites from two regions, southwest and southeast France, create multiple non-juxtaposed sets does not contradict this interpretation. Such splitting cannot be attributed, or solely attributed, to a differential preservation or selective recovery of personal ornaments since sites preserving faunal remains and submitted to high-quality excavations are found in each of these six sets. We must therefore interpret such splitting as the consequence of an occupation of the sites in these two regions by different ethnic groups in the context of dynamic population processes that for the time being are difficult to disentangle due to the low chronological resolution provided by radiocarbon dating. That symptoms of the course of history come into sight in these two regions may be a function of the wealth of excavated sites therein, which allows for thorough comparisons.

At the opposite end of the archaeological resolution are the Aurignacian sites from eastern Europe and the Near East. These sites, which share some bead types with Northern or Mediterranean sets but which also yielded a few specific bead types, can be interpreted as single representatives of enshrouded sets belonging to one of the three identified macro-sets or to a macro-set still to be defined.

Fig. 6. Number of ornament types specific to each of the sets identified by the seriation analysis and found at more than one site (black pattern), at a single site (grey pattern) and number of ornament types that each set shares with the others (white pattern). "X" corresponds to sites that cluster in between the identified sets.

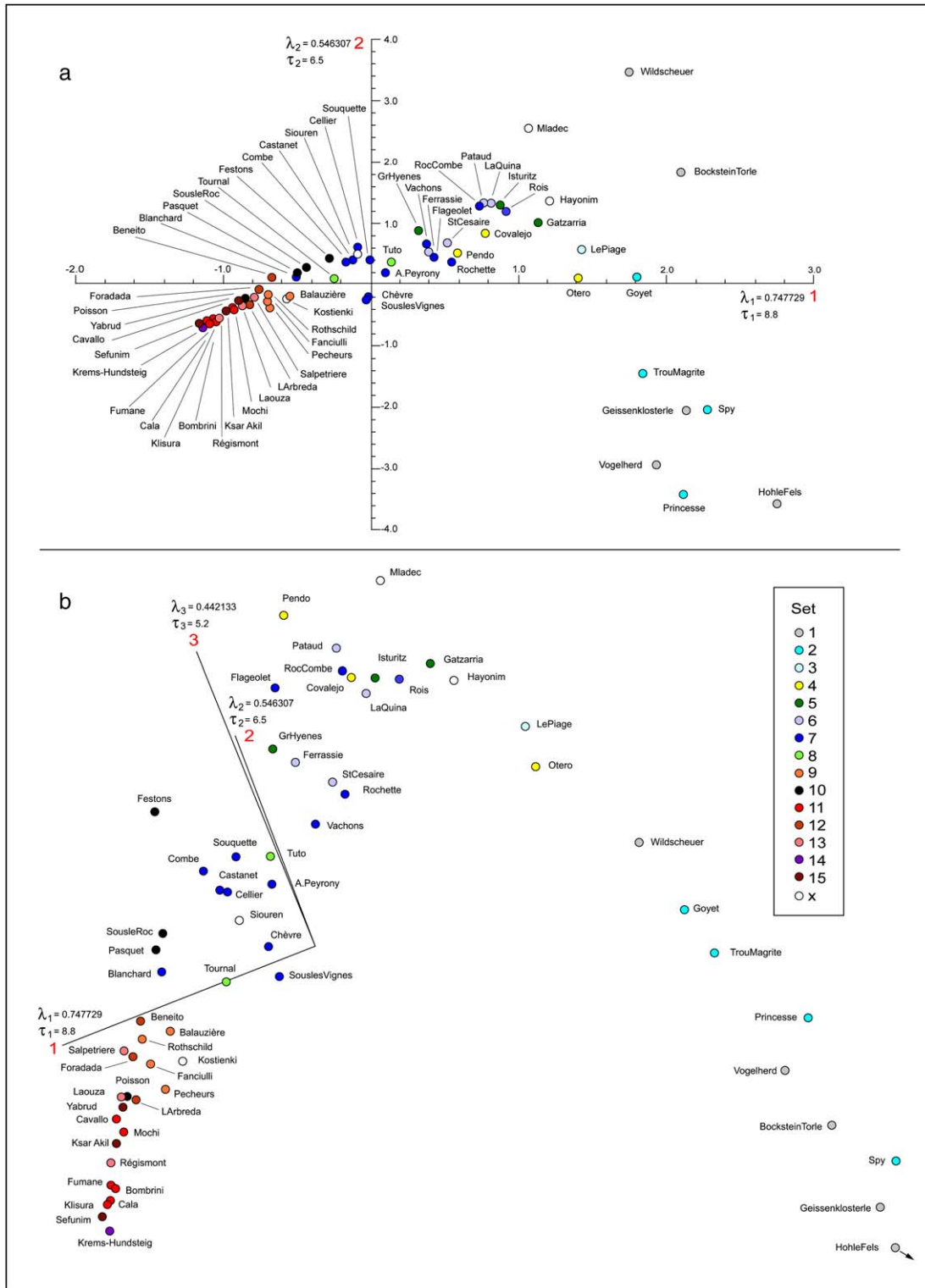


Fig. 7. (a) Projection of the first two axes of the correspondence analysis. (b) Projection of the first three axes of the correspondence analysis according to an orientation that positions the sites along a parabola. Colours indicate the sets identified by the seriation (see Fig. 5).

Our interpretation of the observed cline as a reflection of long-standing regional ethno-linguistic diversity is not contradictory to the hypothesis that a part of the observed variability in ornament type associations is due to changes in bead type preference through time within each of the identified regions.

To identify these regional trajectories we would need more precise chrono-stratigraphic attributions of Aurignacian assemblages. Unfortunately this is difficult for the large majority of the sites in our database since they were excavated long ago, and due to the known drawbacks of radiocarbon dating



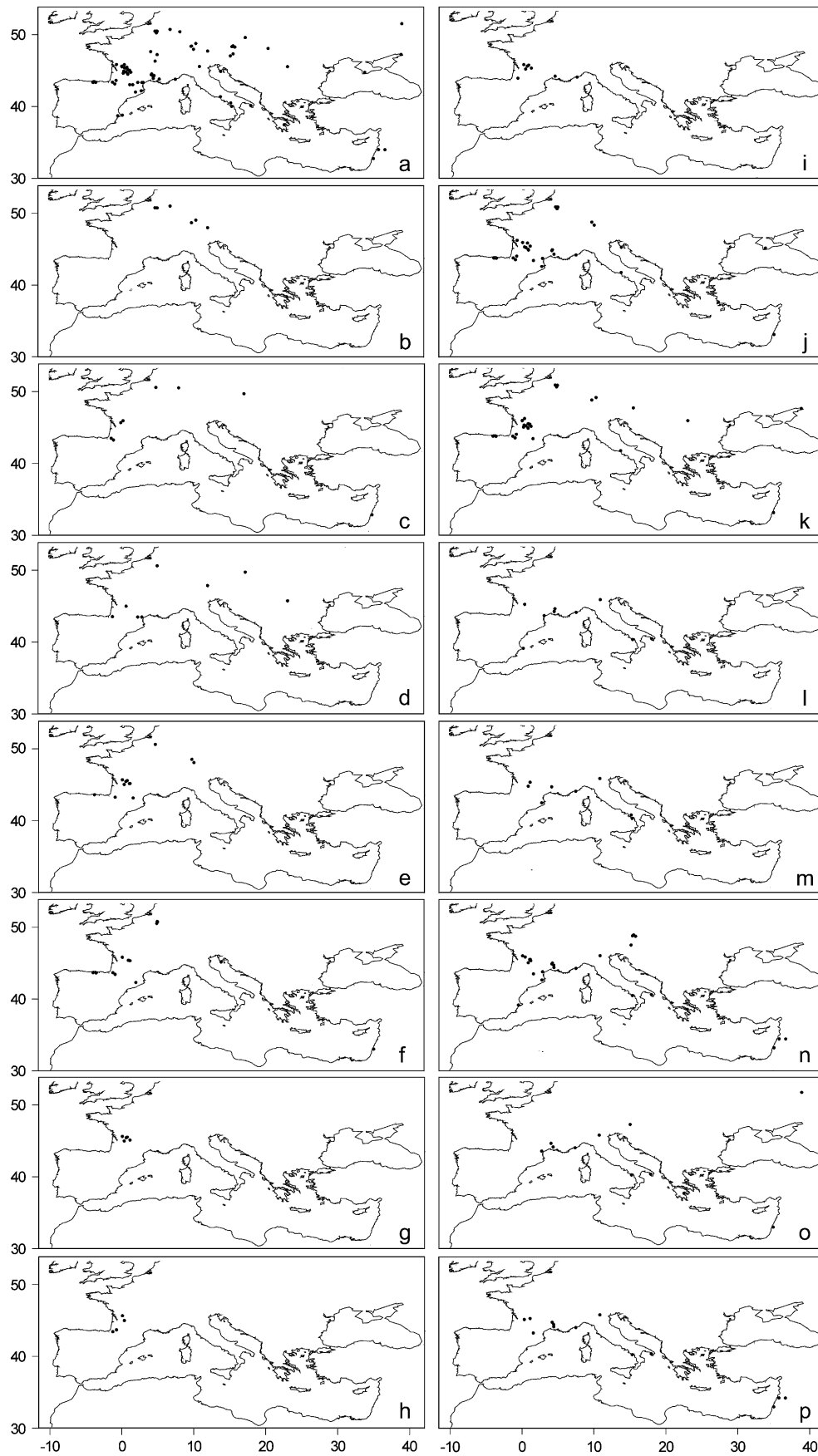


Fig. 8. Geographic distribution of Aurignacian bead type occurrences. a, all; b, drop-shaped ivory pendant; c, horse incisor; d, bear canine; e, tubular bone bead; f, deer incisor; g, urchin; h, human tooth; i, *Nucella lapillus*; j, deer canine; k, fox canine; l, *Glycymeris* sp.; m, *Homalopoma sanguineum*; n, *Dentalium* sp.; o, *Cyclope* sp.; p, *Nassarius gibbosulus*.

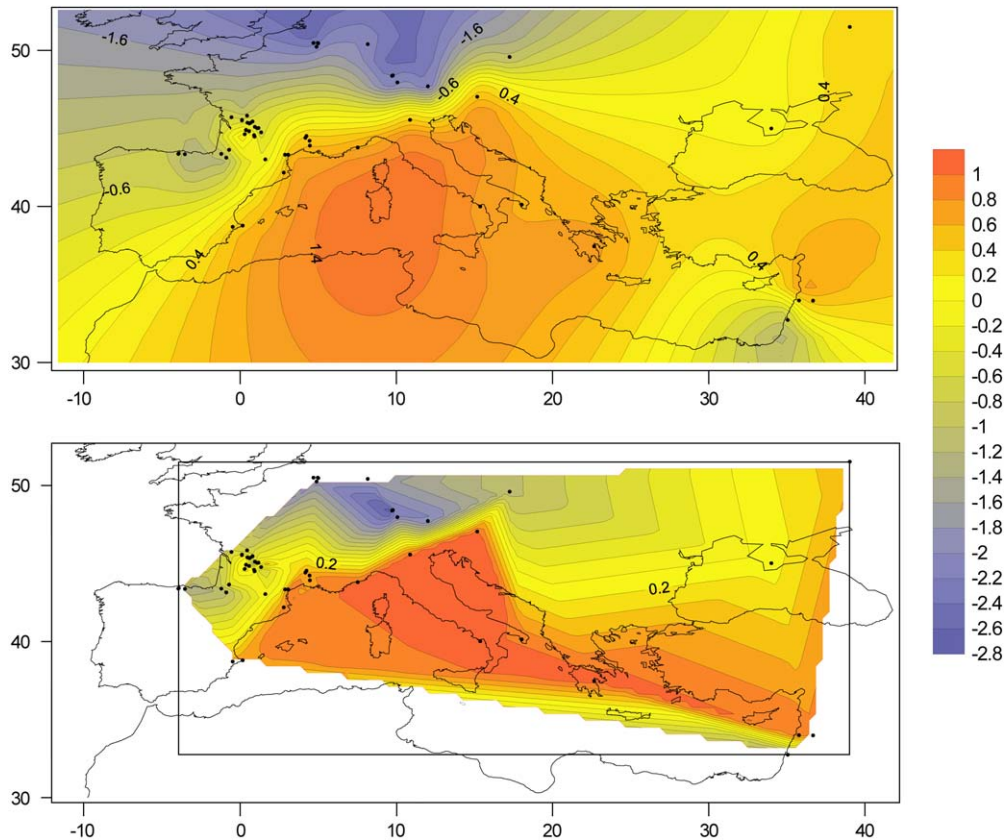


Fig. 9. Contour maps created by gridding with kriging (top) and triangulation (bottom) methods the values provided for each site (black dots) by the first component of the correspondence analysis.

for this period. Should this become feasible in the future, our dataset will increase its heuristic potential and be able to better follow cultural changes at regional levels and explore cultural boundary dynamics.

The cultural geography identified by personal ornaments does not closely match differences observed in other elements of Aurignacian material culture. Comparing our results to the assignments- Archaic *versus* Ancient - proposed for sites dated to the early phases of the Aurignacian [27,28,172] is problematic. Many assemblages are still not attributed to one component or the other, and the stratigraphic provenance of personal ornaments from sites that have yielded both components are in a number of cases, particularly for old excavations, ambiguous. However, bead associations found at sites that have only yielded one of these components reveal no obvious match with personal ornaments associations. Tuto de Camalhot, Salpetrière, Balauzière, Castanet, Pataud, Régismont, Geissenklösterle, Vogelherd, attributed to the Ancient Aurignacian, are scattered within the three identified Macro-sets; Rothschild, Fumane, Laouza, Grotte du Renne, and Trou de la Mère Clochette, attributed to the Archaic Aurignacian, are found in both Macro-sets A and C. We observe that sites attributed to one techno-typological component are more similar, from a bead point of view, to neighbouring sites attributed to the other component than to far away sites yielding the same stone tools. Split based bone points, a traditional *fossil directeur* of the early Aurignacian are found at sites from

all three Macro-sets and although generally associated with the Ancient, are also found in a few Archaic Aurignacian assemblages [149]. These mismatches are not surprising. As Jones ([95]: 100) correctly points out ethnicity is a multidimensional phenomenon and

“there is rarely a one-to-one relationship between representations of ethnicity and the entire range of cultural practices and social conditions associated with a particular group. From a ‘bird’s eye view’ the resulting pattern will be one of overlapping ethnic boundaries constituted by representations of cultural differences...”.

The main advantage of personal ornaments to accomplish this multiplex endeavour rests in the possibility they offer to translate the cultural signal into meaningful spatially correlated networks. This allows in perspective to effectively contrast the cultural geography of Upper Palaeolithic populations with hypotheses put forward by geneticists on the peopling of Europe during OIS 3–2.

## 9. Conclusion

Cultural entities of the European Upper Palaeolithic and the attempts made to infer cultural boundaries have been traditionally based on chronological and geographic variations in the technology and typology of lithic and bone artefacts. Our results show that personal ornaments can complement this picture by

taking into account another dimension of the human experience. Seriation, correspondence analysis and contour mapping of bead association appear to be robust and previously unexplored tools to identify the geography of prehistoric ethno-linguistic entities and determine the cultural affiliation of future archaeological sites yielding personal ornaments. Future research will focus on personal ornaments from the remaining Upper Palaeolithic technocomplexes in order to explore how the ethno-linguistic geography of human populations—reflected in ornament use—changed through time. In particular, comparison between the Aurignacian Bead Database and personal ornaments associated with the other Early Upper Palaeolithic technocomplexes can shed new light on the highly debated topic of cultural and biological interactions between the last Neanderthals and Anatomically Modern Humans.

By comparing the same database with personal ornaments associated with Upper Palaeolithic technocomplexes that post-date the Aurignacian, one may be able to establish if and to what extent the cultural geography identified by our analysis applies to the remaining European Upper Palaeolithic. In the event that such continuity is verified, and its independence from raw material availability confirmed, personal ornaments could be recognised as a category of Palaeolithic material culture particularly well suited for investigating fundamental aspects of prehistoric societies such as continuity in population, exchange networks, ideology and language. On the other hand, if analyses of an enlarged bead database reveal discontinuities in the cultural geography of Upper Palaeolithic populations, it will be necessary to establish the tempo and mode of such changes and determine whether or not they are correlated with the millennial scale climatic variability of OIS 3–2 [29,48,68,83]. The rapid climatic fluctuations that characterised this period certainly had an impact on population dynamics and may have periodically reshaped the human geography of Europe [25,50,55,73].

Our results suggest that personal ornament associations reflect the systemic relationships that existed at an ethno-linguistic level between different population clusters. In this respect, changes in bead type associations may be instrumental in investigating, at a regional level, the possible impact of specific environmental shifts on the construction and expression of hunter-gatherer ethnicity.

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### References

- [1] B. Adams, A. Ringer, New C14 dates for the Hungarian early Upper Palaeolithic, *Current Anthropology* 45 (2004) 541–551.
- [2] W.Y. Adams, E.W. Adams, *Archaeological Typology and Practical Reality: A Dialectical Approach to Artefact Classification and Sorting*, Cambridge University Press, 1991.
- [3] E. Alvarez Fernandez, L'axe Rhin-Rhône au Paléolithique supérieur récent: l'exemple des mollusques utilisés comme objets de parure, *L'Anthropologie* 105 (2001) 547–564.
- [4] E. Alvarez Fernandez, Perforated *Homalopoma sanguineum* from Tito Bustillo (Asturias): mobility of Magdalenian groups in northern Spain, *Antiquity* 76 (2002) 641–646.
- [5] E. Alvarez Fernandez, X. Delclos, E. Penalver, Analisis IRTF del ambar procedente del Aurinaciense de Cueva Morin y El Pendo, in: *Neanderthales cantabricos. Estado de la cuestion, Pre-actas de la Reunion Científica, Santillana del Mar, 20 al 22 de Octubre de 2004*, Museo Nacional y Centro de Investigacion de Altamira, Santillana del Mar, 2004.
- [6] Z.A. Abramova, *L'art paléolithique d'Europe orientale et de Sibérie*, Jérôme Million, Grenoble, 1995.
- [7] S.H. Ambrose, Chronology of the later Stone Age and food production in East Africa, *Journal of Archaeological Science* 25 (1998) 377–392.
- [8] P. Arias Cabal, R. Ontañón Peredo, La materia del lenguaje prehistórico. El arte mueble paleolítico de Cantabria en su contexto, Gobierno de Cantabria, Santander, 2004.
- [9] P. Bahn, Inter-site and inter-regional links during the Upper Palaeolithic: the Pyrenean evidence, *Oxford Journal of Archaeology* 1 (1982) 247–268.
- [10] M. Banks, *Ethnicity — Anthropological Constructions*, Routledge, London, 1996.
- [11] G. Barbujani, DNA variation and language affinities, *American Journal of Human Genetics* 61 (1997) 1011–1014.
- [12] G. Barbujani, Genetics and the population history of Europe, in: *Encyclopedia of the Human Genome*, Nature Publishing Group, 2003, pp. 1–5.
- [13] G. Barbujani, R.R. Sokal, Zones of sharp genetic change in Europe are also linguistic boundaries, *Proceedings of the National Academy of Sciences of the U.S.A.* 87 (1990) 1816–1819.
- [14] H. Barge, Essai sur les parures du Paléolithique supérieur dans le Sud de la France. La faune malacologique aurignacienne de l'Abri Rothschild (Cabrières, Hérault), *Bulletin du Musée d'Anthropologie préhistorique de Monaco* 27 (1983) 69–83.
- [15] G. Bartolomei, A. Broglio, P.F. Cassoli, L. Castelletti, L. Cattani, M. Cremaschi, G. Giacobinin, G. Malerba, A. Maspero, M. Peresani, A. Sartorelli, A. Tagliacozzo, La Grotte de Fumane: Un site aurignacien au pied des Alpes, *Preistoria Alpina* 28 (1994) 131–179.

- [16] D. Bar-Yosef-Mayer, Changes in the selection of marine shells from the Natufian to the Neolithic, in: O. Bar-Yosef, F.R. Valla (Eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, 1991, pp. 629–636.
- [17] O. Bar-Yosef, The middle/upper Palaeolithic transition: a view from the Eastern Mediterranean, in: E. Carbonell, M. Vaquero (Eds.), *The Last Neanderthals, The First Anatomically Modern Humans: A Tale about Human Diversity. Cultural Change and Human Evolution: The Crisis at 40 ka BP*, Universitat Rovira I Virgili, Servei de Publicacions, Tarragona, 1996, pp. 79–94.
- [18] O. Bar-Yosef, Symbolic expression in later prehistory of the Levant: why are they so few? in: M.W. Conkey, O. Soffer, D. Stratmann, N.G. Jablonski (Eds.), *Beyond Art: Pleistocene Image and Symbol* University of California Press, San Francisco, 1997, pp. 161–187.
- [19] O. Bar-Yosef, F. Valla (Eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, 1991.
- [20] H.C. Beck, Etched carnelian beads, *The Antiquaries Journal* XIII (1933) 384–397.
- [21] C. Beldiman, Parures paléolithiques et épipaléolithiques de Roumanie (25 000-10 000 BP): typologie et technologie, in: V. Dujardin (Ed.), *Industrie osseuse et parures du Solutréen au Magdalénien en Europe, table ronde sur le Paléolithique supérieur récent*, Angoulême (Charente, 28–30 mars 2003), SPF, Paris, 2006, pp. 39–71.
- [22] A. Belfer-Cohen, Art items from layer B, Hayonim Cave: a case study of art in a Natufian context, in: O. Bar-Yosef, F. Valla (Eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, 1991, pp. 569–588.
- [23] L.H. Binford, Mortuary practices: their study and their potential, *American Antiquity* 26 (1971) 6–29.
- [24] A.C. Blanc, A.G. Segre, Excursion dans les Abruzzes, les Pouilles et sur la côte de Salerne, IV Congrès INQUA, Roma-Pisa, Roma, 1953.
- [25] J.-P. Bocquet-Appel, P.-Y. Demars, L. Noiret, D. Dobrowsky, Estimates of Upper Palaeolithic meta-population size in Europe from archaeological data, *Journal of Archaeological Science* 32 (2005) 1656–1668.
- [26] A.R. Bomhard, J.C. Krems, *The Nostratic Macrofamily: A Study in Distant Linguistic Relationship*, Mouton de Gruyter, Berlin, 1994.
- [27] F. Bon, L'Aurignacien entre mer et océan: réflexion sur l'unité des phases anciennes de l'Aurignacien dans le sud de la France, SPF, Paris, 2002.
- [28] F. Bon, P. Bodu, Analyse technologique du débitage aurignacien, in: B. Schmider (Ed.), *L'Aurignacien de la Grotte du Renne*, CNRS, Paris, 2002, pp. 115–133.
- [29] G. Bond, W. Broecker, S. Johnsen, J. McManus, L. Labeyrie, J. Jouzel, G. Bonani, Correlations between climate records from North Atlantic sediments and Greenland ice, *Nature* 365 (1993) 143–147.
- [30] G. Bosinski, Die große Zeit der Eiszeitjäger. Europa zwischen 40 000 und 10 000 v.Chr. *Jahrbuch des Römisch-Deutsches Zentralmuseum* 34 (1989) 3–139.
- [31] J. Bouyssonie, D. de Sonneville-Bordes, L'abri no. 2 des Vachons, Gisement Aurignacien et Périgordien, commune de Voulgézac (Charente), in: *Compte rendu de la XV<sup>e</sup> Session, Congrès préhistorique de France, Poitiers-Angoulême, 1957, 15–22 juillet 1956*, pp. 271–309.
- [32] A. Broglio, G. Dalmeri (Eds), *Pittura paleolitiche nelle prealpi venete. Grotta di Fumane e Riparo Dalmeri*, Museo Tridentino di Scienze Naturali, Verona, 2005.
- [33] A. Brooks, L'Aurignacien de l'abri Pataud niveaux 6 à 14, in: H.M. Bricker (Ed.), *Le Paléolithique supérieur de l'abri Pataud (Dordogne). Les fouilles de H.L. Movius Jr. suivi d'un inventaire analytique des sites aurignaciens et périgordiens de Dordogne*, Editions de la Maison des Sciences de l'Homme, Paris, 1995, pp. 167–219.
- [34] E.S. Burch, Traditional Eskimo societies in Northwest Alaska, *Senri Ethnological Studies* 4 (1980) 253–304.
- [35] D. Caramelli, C. Lalueza-Fox, C. Vernesi, M. Lari, A. Casoli, F. Mallegni, B. Chiarelli, I. Dupanloup, J. Bertranpetit, G. Barbujani, G. Bertorelle, Evidence for a genetic discontinuity between Neanderthals and 24,000-year-old anatomically modern Europeans, *Proceedings of the National Academy of Sciences of the U.S.A.* 100 (2003) 6593–6597.
- [36] I. Casabo, J.A. Bernat, Cova Foradada (Xabia): economia i paleogeografia d'un assentament de caçadors recol lectors de principi del Paleolític superior, in: V.M. Rossello Verger (Ed.), *Geoarqueologia I Quaternari litoral, Memorial M.P. Fumanal, Edició de Departament de Geografia, Universitat de Valencia, Valencia, 1999*, pp. 113–124.
- [37] R. Casalpotti, L. Simoni, M. Belleli, G. Barbujani, Y-chromosome polymorphism and the origins of the European gene pool, *Proceedings of the Royal Society B* 266 (1999) 1959–1965.
- [38] L.L. Cavalli-Sforza, P. Menozzi, P. Piazza, *The History and Geography of Human Genes*, Princeton University Press, Princeton, 1994.
- [39] F. Champagne, R. Espitalié, Le Piage, site préhistorique du Lot, SPF, Paris, 1981.
- [40] P.C. Chase, H.L. Dibble, Scientific archaeology and the origins of symbolism: a reply to Bednarik, *Cambridge Archaeological Journal* 2 (1992) 43–51.
- [41] S.E. Churchill, H.F. Smith, Makers of the early Aurignacian of Europe, *Yearbook of Physical Anthropology* 43 (2000) 61–115.
- [42] D.L. Clarke, *Analytical Archaeology*, Methuen, London, 1968.
- [43] N.J. Conard, Palaeolithic ivory sculptures from southwestern Germany and the origins of figurative art, *Nature* 426 (2003) 830–832.
- [44] N.J. Conard, M. Bolus, Radiocarbon dating the appearance of modern humans and timing of cultural innovations in Europe: new results and new challenges, *Journal of Human Evolution* 44 (2003) 331–371.
- [45] N.J. Conard, P.M. Grootes, F.H. Smith, Unexpectedly recent dates for human remains from Vogelherd, *Nature* 430 (2004) 198–201.
- [46] R.S. Corchon, *El Arte mueble Paleolítico Cantabrico: contexto y análisis interno*, Ministerio de Cultura, Madrid, 1986.
- [47] M. Currat, L. Excoffier, Modern humans did not admix with Neanderthals during their range expansion into Europe, *PLoS Biology* 2 (2004) 2264–2274.
- [48] W. Dansgaard, S.J. Johnsen, H.B. Clausen, D. Dahl-Jensen, N.S. Gundestrup, C.U. Hammer, C.S. Hvidberg, J.P. Steffensen, A.E. Sveinbjörnsdóttir, J. Jouzel, G. Bond, Evidence for general instability of past climate from a 250-ky ice-core record, *Nature* 364 (1993) 218–220.
- [49] F. d'Errico, The invisible frontier: a multiple species model for the origin of behavioral modernity, *Evolutionary Anthropology* 12 (2003) 188–202.
- [50] F. d'Errico, M.F. Sanchez Goni, Neanderthal extinction and millennial scale climatic variability of OIS 3, *Quaternary Science Reviews* 22 (2003) 769–788.
- [51] F. d'Errico, M. Vanhaeren, Criteria for identifying red deer (*Cervus elaphus*) age and sex from upper canines. Application to the study of Upper Palaeolithic and Mesolithic ornaments, *Journal of Archaeological Science* 29 (2002) 211–232.
- [52] F. d'Errico, P. Villa, Holes and grooves: the contribution of microscopy and taphonomy to the problem of art origins, *Journal of Human Evolution* 33 (1997) 1–31.
- [53] F. d'Errico, J. Zilhao, D. Baffier, M. Julien, J. Pelegrin, Neandertal acculturation in western Europe? a critical review of the evidence and its interpretation, *Current Anthropology* 39 (1998) 1–44.
- [54] F. d'Errico, C. Henshilwood, M. Vanhaeren, K. van Niekerk, Nassarius kraussianus shell beads from Blombos cave: evidence for symbolic behaviour in the Middle Stone Age, *Journal of Human Evolution* 48 (2005) 3–24.
- [55] F. d'Errico, M.F. Sanchez Goni, M. Vanhaeren, L'impact de la variabilité climatique rapide des OIS3-2 sur le peuplement de l'Europe, in: E. Bard (Ed.), *L'homme face au climat*, Odile Jacob, Paris, 2006, pp. 265–282.
- [56] F. Delage, L'Abri de la Souquette, *Bulletin de la Société Historique et Archéologique du Périgord* 65 (1938) 3–25.
- [57] H. Delporte, *Les Aurignaciens – premiers hommes modernes*, La maison des roches, Paris, 1998.
- [58] R. Desbrosses, Périgordien et Aurignacien anciens de la Mère Clochette à Rochefort-sur-Nonon (Jura), in: *Hommages à Jacques-Pierre Millotte. Éléments de Pré- et Protohistoire Européenne*, Les Belles Lettres, Paris, 1984, pp. 71–95.

- [59] Ph. Descola, La Nature domestique: symbolisme et praxis dans l'écologie des Achuar, Fondation Singer-Polignac, Editions de la Maison des Sciences de l'Homme, Paris, 1986.
- [60] M. Dewez, Le Paléolithique supérieur Récent dans les Grottes de Belgique, Société Wallonne de Paléontologie, Liège, 1987.
- [61] L. Didon, L'abri Blanchard des Roches, Bulletin de la Société historique et archéologique du Périgord 87 (1911) 246–261, 321–324.
- [62] F. Djindjian, J. Kozłowski, M. Otte, Le paléolithique supérieur en Europe, Armand Colin, Paris, 1999.
- [63] A. Dolgopolsky, The Nostratic Macrofamily and Linguistic Palaeontology, McDonald Institute for Archaeological Research, Cambridge, 1999.
- [64] L.S. Dubin, The History of Beads. From 30,000 B.C. to the Present, Thames and Hudson, London, 1987.
- [65] L.S. Dubin, North American Indian Jewelry and Adornment. From Prehistory to the Present, Harry N. Abrams Inc., New York, 1999.
- [66] V. Dujardin, D. Armand, Y. Gruet, B. Kervazo, T. Young, L'Aurignacien de La Quina (Gardes-le-Pontaroux, Charente, France), in: Apport des fouilles récentes, Actes UISPP Forli, vol. 2, 1998, pp. 667–673.
- [67] C. Dupont, Parure en coquillage du site aurignacien de La Quina, station aval (Gardes-le-Pontaroux, Charente), Antiquités Nationales 33 (2001) 27–35.
- [68] M. Elliot, L. Labeyrie, J.-C. Duplessy, Changes in north Atlantic deep-water formation associated with the Dansgaard-Oeschger temperature oscillations (60–10 ka), Quaternary Science Reviews 21 (2002) 1153–1165.
- [69] J.M. Erikson, The Universal Bead, W.W. Norton, New York, 1969.
- [70] L. Excoffier, S. Schneider, Why hunter-gatherer populations do not show signs of Pleistocene demographic expansions, Proceedings of the National Academy of Sciences of the U.S.A. 96 (1999) 10597–10602.
- [71] C. Fiocchi, Contributo alla conoscenza del comportamento simbolico di Homo sapiens sapiens. Le conchiglie marine nei siti del Paleolitico superiore europeo: strategie di approvvigionamento, reti di scambio, utilizzo, Dottorato di ricerca in scienze antropologiche curriculum paleontologia umana XI ciclo, Consorzio Universitario di Bologna, Ferrara, Parma, 1998.
- [72] C. Fritz, R. Simonnet, Du geste à l'objet: les contours découpés de Labastide: résultats préliminaires, Techne 3 (1996) 63–77.
- [73] C. Gamble, W. Davies, P. Pettitt, M. Richards, Climate change and evolving human diversity in Europe during the last glacial, Philosophical Transactions of the Royal Society Biological Sciences 359 (2004) 243–254.
- [74] J.M. Granger, F. Lévêque, Parure castelperronienne et aurignacienne: étude de trois séries inédites de dents percées et comparaisons, Comptes Rendus de l'Académie des Sciences de Paris, Sciences de la terre et des planètes 325 (1997) 537–543.
- [75] J.H. Greenberg, Indo-European and its Closest Relatives: the Eurasian Language Family: Grammar, Stanford University Press, Stanford, 2000.
- [76] F. Gurioli, Analisi dei reperti in materia dura animale provenienti dal deposito aurignaziano della Grotta di Fumane (VR): Strumenti, Oggetti ornamentali e Superfici con tracce di interventi antropici, Corso di Laurea in Scienze Naturali, Dipartimento delle Risorse Naturali e Culturali, Università degli Studi di Ferrara, Facoltà di Scienze Matematiche, Fisiche e Naturali, Ferrara, 2002.
- [77] G. Gutierrez, D. Sanchez, A. Marin, A reanalysis of the ancient mitochondrial DNA sequences recovered from Neandertal bones, Molecular Biology and Evolution 19 (2002) 1359–1366.
- [78] J. Hahn, Aurignacian signs, pendants and art objects in Central and Eastern Europe, World Archaeology 3 (1972).
- [79] J. Hahn, Aurignacien das ältere Jungpaläolithikum in mittel- und osteuropa, Böhlau Verlag, Köln, Wien, Köln, 1977.
- [80] J. Hahn, Genese und Funktion einer Jungpaläolithischen Freilandstation: Lommersum im Rheinland, Rheinland Verlag GmbH, Köln, 1989.
- [81] K. Harvati, S.R. Frost, K.P. McNulty, Neandertal taxonomy reconsidered: Implications of 3D primate models of intra- and interspecific differences, Proceedings of the National Academy of Sciences of the U.S.A. 101 (2004) 1147–1152.
- [82] F.C. Hayes (Ed.), Proceedings of the 1982 Glass Bead Conference, Rochester Museum and Science Division, Rochester, Albany, New York, 1983.
- [83] H. Heinrich, Origin and consequences of cyclic ice rafting in the north-east Atlantic ocean during the past 130,000 years, Quaternary Research 29 (1988) 142–152.
- [84] R.F. Heizer (Ed.), Handbook of North American Indians: California, vol. 8, Smithsonian Institution, Washington DC, 1978.
- [85] H. Henri Martin, Nouvelles constatations faites dans la station aurignacienne de La Quina (Charente). Tranchées X et Y, Bulletin de la Société Préhistorique française (1936) 177–202.
- [86] D. Henri-Gambier, B. Maureille, R. White, Vestiges humains des niveaux de l'Aurignacien ancien du site de Brassempouy (Landes), Bulletins et Mémoires de la Société d'Anthropologie de Paris, n.s 16 (2004) 49–87.
- [87] D. Henri-Gambier, Les fossiles de Cro-Magnon (Les Eyzies-de-Tayac, Dordogne): nouvelles données sur leur position chronologique et leur attribution culturelle, Bulletin et Mémoires de la Société d'Anthropologie de Paris, n.s 14 (2002) 89–112.
- [88] C.S. Henshilwood, F. d'Errico, M. Vanhaeren, K. van Niekerk, Z. Jacobs, Middle Stone Age shell beads from South Africa, Science 304 (2004) 403.
- [89] I. Hodder, The distribution of material culture items in the Baringo district, Western Kenya, Man 12 (1977) 239–269.
- [90] I. Hodder, Symbols in Action: Ethnoarchaeological Studies of Material Culture, Cambridge University Press, New York, 1982.
- [91] J.-J. Hublin, F. Spoor, M. Braun, F. Zonneveld, S. Condemi, A late Neandertal associated with Upper Palaeolithic artefacts, Nature 381 (1996) 224–226.
- [92] M. Ingman, H. Kaessmann, S. Paabo, U. Gyllensten, Mitochondrial genome variation and the origin of modern humans, Nature 408 (2000) 708–713.
- [93] M.-L. Inizan, J.M. Gaillard, Coquillages de Ksar-Aqil: éléments de parure? Paléorient 4 (1978) 295–306.
- [94] G. Iturbe, M.P. Fumanal, J.S. Carrion, E. Cortell, R. Martinez, P.M. Guillem, M.D. Garralda, B. Vandermeersch, Cova Beneito (Muro, Alicante), Una perspectiva interdisciplinar, Recerques del Museu d'Alcoi 2 (1993) 23–88.
- [95] S. Jones, The Archaeology of Ethnicity. Constructing Identities in the Past and Present, Routledge, London, 1997.
- [96] P. Jordan, S. Shennan, Cultural transmission, language, and basketry traditions amongst the California Indians, Journal of Anthropological Archaeology 22 (2003) 42–74.
- [97] I. Karavanic, L'industrie aurignacienne de la grotte de Sandalja II (Istrie, Croatie) dans le contexte de la région de l'Est de l'Adriatique, L'Anthropologie 107 (2003) 577–602.
- [98] K. Karklins, Guide to the Description and Classification of Glass Beads, Glass Beads, second ed., in: Studies in Archaeology, Architecture, and History, Parks Canada, Ottawa, 1985.
- [99] K.E. Kidd, M.A. Kidd, Classification System for Glass Beads for the Use of Field Archaeologists, Canadian Historic Sites: Occasional Papers in Archaeology and History 1:45–89, Parks Canada, Ottawa, 1970. Reprinted in Proceedings of the 1982 Glass Bead Conference, edited by Charles F. Hayes, Appendix, pp. 219–257, Research Records 16, Rochester Museum and Science Division, Rochester, New York, 1983.
- [100] W.V. Kinietz, The Indians of the Western Great Lakes 1615–1760, University of Michigan Press, Ann Arbor, 1972.
- [101] Eiszschmuck, Status und Schönheit, in: S. Kölbl, N.J. Conard (Eds.), Urgeschichtliches Museum, Blaubeuren, 2003.
- [102] M. Koumouzelis, B. Ginier, J. Kozłowski, M. Pawlikowski, O. Bar-Yosef, R.M. Albert, M. Litynska-Zajic, E. Stronewicz, P. Wojtal, G. Lipecki, T. Tomek, Z.M. Bochenski, M. Pazdur, The early Upper Palaeolithic in Greece: the excavations in Klissoura cave, Journal of Archaeological Science 28 (2001) 515–539.
- [103] J. Kozłowski, L'art de la Préhistoire en Europe Orientale, CNRS Editions, Milan, 1992.
- [104] J.K. Kozłowski, Cultural context of the last Neandertals and early modern humans in central-eastern Europe, in: O. Bar-Yosef,

- L.L. Cavalli-Sforza, R.J. March, M. Piperno (Eds.), *The Lower and Middle Palaeolithic*, Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences, ABACO Edizioni, Forli, 1996, pp. 205–218.
- [105] M. Krings, A. Stone, R.W. Schmitz, H. Krainitzki, M. Stoneking, S. Paabo, Neanderthal DNA sequences and the origin of modern humans, *Cell* 90 (1997) 19–30.
- [106] S. Kuhn, M. Stiner, The earliest Aurignacian of Riparo Mochi (Liguria, Italy), *Current Anthropology* 39 (1998) S175–S189.
- [107] S.L. Kuhn, M.C. Stiner, D.S. Reese, E. Güleç, Ornaments of the earliest Upper Paleolithic: new insights from the Levant, *Proceeding of the National Academy of Science U.S.A.* 98 (2001) 7641–7646.
- [108] C. Lalueza-Fox, M.L. Sampietro, D. Caramelli, Y. Puder, M. Lari, F. Calafell, C. Martinez-Maza, M. Bastir, J. Fortea, M. de la Rasilla, J. Bertranpetit, A. Rosas, Neandertal evolutionary genetics; mitochondrial DNA data from the Iberian peninsula, *Molecular Biology and Evolution* 22 (2005) 1077–1081.
- [109] E. Lartet, H. Christy, *Cavernes du Périgord. Objets gravés et sculptés des temps préhistoriques dans l'Europe centrale*, *Revue archéologique* (1864).
- [110] E. Leach, *Culture and Communication*, Cambridge University Press, Cambridge, 1976.
- [111] M. Lejeune, *L'Art mobilier Paléolithique et Mésolithique en Belgique*, Editions du C.E.D.A., Treignes, 1987.
- [112] P. Lemonnier, The study of material culture today. Towards an anthropology of technical systems, *Journal of Anthropological Archaeology* 5 (1986) 147–186.
- [113] P. Lemonnier, *Elements for an Anthropology of Technology*, Museum of Anthropology, University of Michigan, Ann Arbor, 1992.
- [114] F. Lévêque, B. Vandermeersch, Les découvertes des restes humains dans un horizon castelperronien de Saint-Césaire (Charente-Maritime), *Compte Rendu de l'Académie des Sciences*, Paris 291 (1980) 187–189.
- [115] C.P. Lipo, M.E. Madsen, R.C. Dunnell, M. Hunt, Population structure, cultural transmission, and frequency seriation, *Journal of Anthropological Archaeology* 16 (1997) 301–333.
- [116] J. Maroto, N. Soler, J.M. Fullola, Cultural change between Middle and Upper Paleolithic in Catalonia, in: E. Carbonell, M. Vaquero (Eds.), *The Last Neandertals, The First Anatomically Modern Humans: A Tale about the Human Diversity*, Universitat Rovira i Virgili, Tarragona, 1996, pp. 219–250.
- [117] P. Mellars, Neandertals and the modern human colonisation of Europe, *Nature* 432 (2004) 461–465.
- [118] A. Morala, *Rapport de fouilles 1981. Abri Peyrony (Gavaudun, Lot et Garonne)*. 1981.
- [119] A. Morala, *Rapport de fouilles 1982. Abri Peyrony (Gavaudun, Lot et Garonne)*. 1982.
- [120] P. Mouton, R. Joffroy, *Le gisement aurignacien des Rois a Mouthiers (Charente)*, CNRS, Paris, 1958.
- [121] H.L. Movius Jr., Inventaire analytique des sites aurignaciens et périgordiens de Dordogne, in: H.M. Bricker (Ed.), *Le Paléolithique supérieur de l'abri Pataud (Dordogne)*. Les fouilles de H.L. Movius Jr. Suivi d'un inventaire analytique des sites aurignaciens et périgordiens de Dordogne, Editions de la Maison des Sciences de l'Homme, Paris, 1995, pp. 227–313.
- [122] M. Mussi, *Earliest Italy. An Overview of the Italian Palaeolithic and Mesolithic*, Kluwer Academic, Plenum Publishers, New York, 2000.
- [123] C. Neugebauer-Maresch, *Le Paléolithique en Autriche*, Editions Jérôme Million, Grenoble, 1999.
- [124] R.R. Newell, D. Kielman, T.S. Constandse-Westermann, W.A.B. Van der Sanden, A. Van Gijn, *An Inquiry into the Ethnic Resolution of Mesolithic Regional Groups. The Study of Their Decorative Ornaments in Time and Space*, Brill, Leiden, 1990.
- [125] M. Oliva, Le contexte archéologique des restes humains dans la grotte de Mladec, in: *Aurignacien en Europe et au Proche Orient*. Actes du XIIe Congrès International des Sciences Préhistoriques et Protohistoriques, Bratislava, 1-7 septembre 1991, Institut Archéologique de l'Académie Slovaque des Sciences, Bratislava, 1993, pp. 207–216.
- [126] M. Otte, *Le Paléolithique supérieur ancien en Belgique*, Musées Royaux d'Art et d'Histoire, Bruxelles, 1979.
- [127] M. Otte, J. Kozłowski, Constitution of the Aurignacian through Eurasia, in: J. Zilhao, F. d'Errico (Eds.), *The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications*, IPA, Lisbon, 2003, pp. 19–28.
- [128] I.V. Ovchinnikov, A. Götherström, G.P. Romanov, V.M. Kharitonov, K. Lidén, W. Goodwin, Molecular analysis of Neanderthal DNA from the northern Caucasus, *Nature* 404 (2000) 490–493.
- [129] A. Palma di Cesnola, *Il Paleolitico superiore in Italia*, Garlatti e Razzai, Firenze, 1993.
- [130] D. Peyrony, *La Ferrassie, Moustérien, Périgordien, Aurignacien*, *Préhistoire 3* (1934) 1–92.
- [131] D. Peyrony, Le gisement Castanet, Vallon de Castelmerle, commune de Sergeac (Dordogne). Aurignacien I et II, *Bulletin de la Société Préhistorique française* 32 (1935) 418–443.
- [132] E.S. Poloni, O. Semino, G. Passarino, A.S. Santachiara-Benerecetti, I. Dupanloup, A. Langaney, L. Excoffier, Human genetic affinities for Y-Chromosome p49a, f/TaqI haplotypes show strong correspondence with linguistics, *American Journal of Human Genetics* 61 (1997) 1015–1035.
- [133] E. Preston-Whyte, *Speaking with Beads*, Thames and Hudson, London, 1994.
- [134] A. Quintard, Document final de synthèse, fouilles de sauvetage à Sousles-vignes à Monsempron-libos (Lot-et-Garonne), 1994.
- [135] F. Ramirez Rozzi, J. Bermudez de Castro, Surprisingly rapid growth in Neanderthals, *Nature* 428 (2004) 936–939.
- [136] D.S. Reese, Marine shells in the Levant: Upper Palaeolithic, Epipalaeolithic and Neolithic, in: O. Bar-Yosef, F.R. Valla (Eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, 1991, pp. 613–628.
- [137] C. Renfrew, At the edge of knowability: towards a prehistory of languages, *Cambridge Archaeological Journal* 10 (2000) 7–34.
- [138] B. Reynolds, Beothuk, in: B.G. Trigger (Ed.), *Handbook of North American Indians*, vol. 15, Northeast, Smithsonian Institution, Washington DC, 1978, pp. 101–108.
- [139] M. Richards, V. Macaulay, E. Hickey, E. Vega, B. Sykes, V. Guida, C. Rengo, D. Sellitto, F. Cruciani, T. Kivisild, R. Villems, M. Thomas, S. Rychkov, O. Rychkov, Y. Rychkov, M. Golge, D. Dimitrov, E. Hill, D. Bradley, V. Romano, F. Cali, G. Vona, A. Demaine, S. Papiha, C. Triantaphyllidis, G. Stefanescu, J. Hatina, M. Belledi, A. Di Rienzo, A. Novelletto, A. Oppenheim, S. Norby, N. Al-Zaheri, S. Santachiara-Benerecetti, R. Scozzari, A. Torroni, H.J. Bandelt, Tracing European founder lineages in the near eastern mtDNA pool, *American Journal of Human Genetics* 67 (2000) 1251–1276.
- [140] J.-Ph. Rigaud, *Le Paléolithique supérieur en Périgord: les données du Sud-Ouest sarladais et leurs implications*, Ph. D. thesis University Bordeaux 1, IPGQ, Talence, 1982.
- [141] E. Rivière, Note sur l'homme fossile des cavernes de Baoussé Roussé en Italie, dites grottes de Menton, in: *Congrès international d'Anthropologie et d'Archéologie préhistoriques*, 6<sup>e</sup> session, Brussels, 1872, pp. 164–179.
- [142] S. Rostov, C. Magri, T. Kivisild, G. Benuzzi, H. Help, M. Bermisheva, I. Kutuev, L. Barac, M. Pericic, O. Balanovsky, A. Pshenichnov, D. Dion, M. Grobei, L.A. Zhivotovsky, V. Battaglia, A. Achilli, N. Al-Zahery, J. Parik, R. King, C. Cinnioglu, E. Khusnutdinova, P. Rudan, E. Balanovska, W. Scheffrahn, M. Simonescu, A. Brehm, R. Goncalves, A. Rosa, J.-P. Moisan, A. Chaventre, V. Ferak, S. Furedi, P.J. Oefner, P. Shen, L. Beckman, I. Mikerezi, R. Terzic, D. Primorac, A. Cambon-Thomsen, A. Krumina, A. Torroni, P.A. Underhill, A.S. Santachiara-Benerecetti, R. Villems, O. Semino, *Phylogeography of Y-Chromosome Haplogroup I Reveals Distinct Domains of Prehistoric Gene Flow in Europe*, *American Journal of Human Genetics* 75 (2004) 128–137.
- [143] M. Ruhlen, *The Origin of Language*, Wiley, New York, 1994.
- [144] M. Ruhlen, *On the Origin of Languages: Studies on Linguistic Taxonomy*, Stanford University Press, Stanford, 1996.

- [145] D. Sacchi, Le Paléolithique supérieur du Languedoc Occidental et du Roussillon, CNRS, Paris, 1986.
- [146] I. Saenz de Buruaga, El Paleolítico superior de la cueva de Gatzarria (Zuberoa, Pais Vasco), Vitoria-Gasteiz, Veleia, Anejos Series Maior, no. 6, 1991.
- [147] S. de Saint Perrier, R. de Saint Perrier, La grotte d'Isturitz. III. Les solutréens, Les Aurignaciens et les Moustériens, Archives de l'Institut de Paléontologie humaine, Paris, 1952.
- [148] J. Sanguino, R. Montes, Nuevos datos para el conocimiento del Paleolítico Medio en el centro de la Region Canabrica: la Cueva de Cobalejos (Piélagos, Cantabria), in: Neandertales cantabricos. Estado de la cuestion, Pre-actas de la Reunion Científica, Santillana del Mar, 20 al 22 de Octubre de 2004, Museo Nacional y Centro de Investigacion de Altamira, Santillana del Mar, 2004.
- [149] B. Schmider, Conclusion, in: B. Schmider (Ed.), L'Aurignacien de la Grotte du Renne, CNRS, Paris, 2002, pp. 271–281.
- [150] R.W. Schmitz, D. Serre, G. Bonani, S. Feine, F. Hillgruber, H. Krainitzki, S. Paabo, F.H. Smith, The Neandertal type site revisited: Interdisciplinary investigations of skeletal remains from the Neander Valley, Germany, Proceedings of the National Academy of Sciences U.S.A. 99 (2002) 13342–13347.
- [151] O. Semino, G. Passarino, P.J. Oefner, A.A. Lin, S. Arzubova, L.E. Beckman, G. de Benedictis, P. Francalacci, A. Kouvasi, S. Limborska, M. Marcikiae, A. Mika, B. Mika, D. Primorac, S. Santachiara-Benerecetti, L.L. Cavalli-Sforza, P.A. Underhill, The genetic legacy of Paleolithic *Homo sapiens sapiens* in extant Europeans: a Y chromosome perspective, Science 290 (2000) 1155–1159.
- [152] D. Serre, A. Langaney, M. Chech, M. Teschler-Nicola, M. Paunovic, Ph. Menecier, M. Hofreiter, G. Possnert, S. Paabo, No evidence of Neandertal mtDNA contribution to early modern humans, PLoS Biology 2 (2004) 313–317.
- [153] S. Shennan (Ed.), Archaeological Approaches to Cultural Identity, Unwin-Hyman, London, 1989.
- [154] A. Sinitsyn, Les niveaux Aurignaciens de Kostienki 1, in: Aurignacien en Europe et au Proche Orient. Actes du XIIe Congrès International des Sciences Préhistoriques et Protohistoriques, Bratislava, 1–7 septembre 1991, Institut Archéologique de l'Académie Slovaque des Sciences, Bratislava, 1993, pp. 242–259.
- [155] R.R. Sokal, Genetic, geographic, and linguistic distances in Europe, Proceedings of the National Academy of Sciences U.S.A. 85 (1988) 1722–1726.
- [156] R.R. Sokal, N.L. Oden, B.A. Thomson, Genetic changes across language boundaries in Europe, American Journal of Physical Anthropology 76 (1988) 337–361.
- [157] N. Soler i Masferrer, Les primeres industries del paleolitic superior al nord de catalunya. L'Aurinyacia del Reclau-Viver, Estudi general 1 (1981) 13–30.
- [158] N. Soler i Masferrer, Els jaciments Aurinyaciens de Catalunya. In Estat actual de la recerca arqueologica a l'istme pirinenc, Institut d'estudis ceretans, Puigcerda, 1982, pp. 57–83.
- [159] N. Soler-Major, Adorno, imagen y comunicacion, in: V. Villaverde (Ed.), De Neandertals a Cromanyons, Universita de Valencia, Valencia, 2001, pp. 367–376.
- [160] D. de Sonneville-Bordes, L'évolution du Paléolithique supérieur en Europe occidentale et sa signification, Société Préhistorique Française 63 (1966) 3–34.
- [161] D. de Sonneville-Bordes, Les industries du Roc-de-Combe (Lot). Périgordien et Aurignacien, Préhistoire du Sud-Ouest 9 (2002) 121–161.
- [162] M. Stiner, Trends in Paleolithic mollusc exploitation at Riparo Mochi (Balzi Rossi, Italy): Food and ornaments from the Aurignacian through Epigravettian, Antiquity 73 (1999) 735–754.
- [163] A. Strathern, M. Strathern, Self-decoration in Mount Hagen, G. Duckworth, London, 1971.
- [164] C. Stringer, Modern human origins: progress and prospects, Philosophical Transactions of the Royal Society London B 357 (2002) 653–579.
- [165] J.I. Svendsen, P. Pavlov, Mamontovaya Kurya: an enigmatic, nearly 40,000 years old Paleolithic site in the Russian Arctic, in: J. Zilhao, F. d'Errico (Eds.), The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications, IPA, Lisbon, 2003, pp. 109–122.
- [166] J. Svoboda, The depositional context of the early Upper Paleolithic human fossils from the Koneprusy (Zlaty Kun) and Mladec caves, Czech Republic, Journal of Human Evolution 38 (2000) 523–536.
- [167] J. Svoboda, J. van der Plicht, V. Kuzelka, Upper Palaeolithic and Mesolithic human fossils from Moravia and Bohemia (Czech Republic): some new 14C dates, Antiquity 76 (2003) 957–962.
- [168] Y. Taborin, La parure en coquillage au Paléolithique, CNRS, Paris, 1993.
- [169] A.R. Templeton, The “Eve” hypothesis: a genetic critique and reanalysis, American Anthropologist 95 (1993) 51–72.
- [170] K. Terberger, Das Lahntal-Paläolithikum, Selbstverlag des Landesamtes für Denkmalpflege Hessen, Wiesbaden, 1993.
- [171] T. Terberger, M. Street, New evidence for the chronology of the Aurignacian and the question of Pleniglacial settlement in western central Europe, in: J. Zilhao, F. d'Errico (Eds.), The Chronology of the Aurignacian and of the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications, IPA, Lisbon, 2003, pp. 213–222.
- [172] N. Teyssandier, Les débuts de l'Aurignacien en Europe. Discussion à partir des sites de Geissenklösterle, Willendorf II, Krems-Hundssteig et Bacho-Kiro. Ph. D. thesis, University Paris X, Nanterre, 2004.
- [173] J. Thompson, Preliminary Study of Traditional Kutchin Clothing in Museums, National Museums of Canada, Ottawa, 1972.
- [174] A. Torroni, H.J. Bandelt, V. Macaulay, M. Richards, F. Cruciani, C. Rengo, V. Martinez-Cabrera, R. Villems, T. Kivisild, E. Metspalu, J. Parik, H.-V. Tolk, K. Tambets, P. Forster, B. Karger, P. Francalacci, P. Rudan, B. Anicijevic, O. Rickards, M.-L. Savontaus, K. Huoponen, V. Laitinen, S. Koivumaki, B. Sykes, E. Hickey, A. Novelletto, P. Moral, D. Sellitto, A. Coppa, N. Al-Zaheri, A.S. Santachiara-Benerecetti, O. Semino, R. Scozzari, A signal, from human mtDNA, of post-glacial recolonization in Europe, American Journal of Human Genetics 69 (2001) 844–852.
- [175] A. Torroni, H.-J. Bandelt, L. d'Urbano, P. Lahermo, P. Moral, D. Sellitto, C. Rengo, P. Forster, M.-L. Savontaus, B. Bonnè-Tamir, R. Scozzari, mtDNA analysis reveals a major late Paleolithic population expansion from Southwestern to Northeastern Europe, American Journal of Human Genetics 62 (1998) 1137–1152.
- [176] B.G. Trigger (Ed.), Handbook of North American Indians, vol. 15, Northeast, Smithsonian Institution, Washington DC, 1978.
- [177] E. Trinkaus, O. Moldovan, S. Milota, A. Bilgar, L. Sarcina, S. Athreya, S.E. Bailey, R. Rodrigo, G. Mircea, T. Higham, C. Bronk Ramsey, J. van der Plicht, An early modern human from the Pesteria cu Oase, Romania, Proceedings of the National Academy of Sciences 100 (2003) 11231–11236.
- [178] M. Vanhaeren, Les fonctions de la parure au Paléolithique supérieur: de l'individu à l'unité culturelle. Ph. D. thesis, University Bordeaux 1. IPGQ: Talence. 2002.
- [179] M. Vanhaeren, Speaking with beads: the evolutionary significance of bead making and use, in: F. d'Errico, L. Backwell (Eds.), From Tools to Symbols. From Early Hominids to Modern Humans, Wits University Press, Johannesburg, 2005.
- [180] M. Vanhaeren, F. d'Errico, La parure de l'enfant de La Madeleine (fouilles Peyrony). Un nouveau regard sur l'enfance au Paléolithique supérieur, Paléo 13 (2001) 201–237.
- [181] M. Vanhaeren, F. d'Errico, The body ornaments associated with the burial, in: J. Zilhao, E. Trinkaus (Eds.), Portrait of the Artist as a Child. The Gravettian Human Skeleton from the Abrigo do Lagar Velho and its Archaeological Context, IPA, Lisbon, 2002, pp. 154–186.
- [182] M. Vanhaeren, F. d'Errico, Childhood in the Epipaleolithic. What do personal ornaments associated to burials tell us? in: L. Larsson, H. Kindgren, K. Knutsson, D. Loeffler, A. Akerlund (Eds.), Mesolithic on the Move, Oxbow Monographs, Oxford, 2003, pp. 494–505.
- [183] M. Vanhaeren, F. d'Errico, Le mobilier funéraire de la Dame de Saint-Germain-la-Rivière et l'origine paléolithique des inégalités sociales, Paléo 15 (2003) 195–238.
- [184] M. Vanhaeren, F. d'Errico, Grave goods from the Saint-Germain-la-Rivière burial: evidence for social inequality in the Upper

- Palaeolithic, *Journal of Anthropological Archaeology* 24 (2005) 117–134.
- [185] M. Vanhaeren, F. d'Errico, I. Billy, F. Grousset, Tracing the source of Upper Palaeolithic shell beads by strontium isotope dating, *Journal of Archaeological Science* 31 (2004) 1481–1488.
- [186] C. Vercoutère, Utilisation de l'animal comme ressource de matières premières non-alimentaires: industrie osseuse et parure. Exemple de l'abri Pataud (Dordogne, France), Ph. D. thesis, Museum National d'Histoire Naturelle, IPH, Paris, 2004.
- [187] J. Vézian, J. Vézian, Les gisements de la grotte de Saint-Jean-de-Verges (Ariège), *Gallia Préhistoire* IX (1966) 93–130.
- [188] R.S. Wells, N. Yuldasheva, R. Ruzibakiev, P.A. Underhill, I. Evseeva, J. Blue-Smith, L. Jin, B. Su, R. Pitchappan, S. Shanmugalakshmi, K. Balakrishnan, M. Read, N.M. Pearson, T. Zerjal, M.T. Webster, I. Zholoshvili, E. Jamarjashvili, S. Gambarov, B. Nikbin, A. Dostiev, O. Aknazarov, P. Zalloua, I. Tsoy, M. Kitaev, M. Mirrakhimov, A. Chariev, W.F. Bodmer, The Eurasian Heartland: A continental perspective on Y-chromosome diversity, *Proceedings of the National Academy of Sciences* 98 (2001) 10244–10249.
- [189] R. Whallon, J. Brown (Eds.), *Essays on Archaeological Typology*, Center for American Archaeology Press, Evanston, 1982.
- [190] R. White, Visual thinking in the Ice Age, *Scientific American* 260 (1989) 92–99.
- [191] R. White, A social and technological view of Aurignacian and Castelperronian personal ornaments in SW Europe, in: V. Cabrera Valdes (Ed.), *El Origen del Hombre moderno en el suroeste de Europa*, UNED, Madrid, 1993, pp. 327–357.
- [192] R. White, Ivory personal ornaments of Aurignacian age: technological, social and symbolic perspectives, in: M. Menu, P. Walter, F. Widemann (Eds.), *Le travail et l'usage de l'ivoire au Paléolithique supérieur*, Centre Universitaire européen pour les Biens Culturels, Ravello, 1995.
- [193] R. White, Actes de substance: de la matière au sens dans la représentation paléolithique, *Techné* 3 (1996) 29–38.
- [194] R. White, Intégrer la complexité sociale et opérationnelle: la construction matérielle de l'identité sociale à Sungir, in: *Préhistoire d'os. Recueil d'études sur l'industrie osseuse préhistorique offert à Henriette Camps-Faber*, Publications de l'Université de Provence, Aix-en-Provence, 1999, pp. 319–331.
- [195] R. White, Personal ornaments from the Grotte du Renne at Arcy-sur-Cure, *Athena Review* 2 (2001) 41–46.
- [196] J. Whittaker, D. Caulkins, K. Kamp, Evaluating consistency in typology and classification, *Journal of Archaeological Method and Theory* 5 (1998) 129–164.
- [197] B.L. Whorf, *Language. Thought and reality. The Selected Writings of Benjamin Lee Whorf*, Massachusetts Institute of Technology Press, Cambridge, 1956.
- [198] P.W. Wiessner, Risk, reciprocity and social influences on 'Kung San Economics, in: E. Leacock, R.B. Lee (Eds.), *Politics and History in Band Societies*, Cambridge University Press, Cambridge, 1982.
- [199] P.W. Wiessner, Considering the behavioural basis for style: a case study among the Kalahari San, *Journal of Anthropological Archaeology* 3 (1984) 190–234.
- [200] H. Wolff, Intelligibility and inter-ethnic attitudes, *Anthropological Linguistics* 1 (1959) 34–41.
- [201] J. Yravedra Sainz de los Terreros, Subsistencia en la transición del paleolítico medio al paleolítico superior de la península ibérica, *Trabajos de prehistoria* 59 (2002) 9–28.
- [202] J. Zilhao, F. d'Errico, The chronology and taphonomy of the earliest Aurignacian and its implications for the understanding of Neandertal extinction, *Journal of World Prehistory* 13 (1999) 1–68.
- [203] J. Zilhao, F. d'Errico (Eds.), *The chronology of the Aurignacian and of the transitional technocomplexes. Dating, Stratigraphies, Cultural Implications*, IPA, Lisbon, 2003.
- [204] J. Zilhao, E. Trinkaus (Eds.), *Portrait of the Artist as a Child. The Gravettian Human Skeleton from the Abrigo do Lagar Velho and its Archeological Context*, IPA, Lisbon, 2002.