Eurasian Prehistory, 5 (2): 29–42.

PERSONAL ORNAMENTS IN THE EARLY UPPER PALEOLITHIC OF WESTERN EURASIA: AN EVALUATION OF THE RECORD

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Abstract

The earliest occurrences of personal ornaments in Western Eurasia are known from assemblages that are placed at the Middle to Upper Paleolithic Transition (Chatelperronian, Uluzzian, *Blattspitzengruppen*, Bachokirian). However, the paucity of sites dating to this period which have produced such ornaments, the often doubtful contextual association of the finds, and the limited number of personal ornaments known to date from this period, bring into question their utilization prior to the Protoaurignacian.

In contrast, personal ornaments are a regular component of Aurignacian assemblages, showing a broad spectrum of form, raw material and techniques of attachment. In this paper we argue that personal ornaments did not occur in Europe before about 38.0 ka ^{14}C BP and that their appearance on the continent is linked to the arrival of Anatomically Modern Humans.

INTRODUCTION

The first evidence of symbolic behavior among hominins has repeatedly been addressed by prehistorians during the last decade (see e.g., Bednarik, 1998; Lorblanchet, 1999; d'Errico *et al.*, 2003; Hovers *et al.*, 2003; Álvarez Fernández, 2006, in press; Zilhão, 2007; Jöris *et al.*, in press). Personal ornaments and pendants are the most characteristic artifacts that help to trace human symbolic behavior. They are made from a variety of materials, sometimes ornamented or stained with pigments, and they are frequently found in archaeological contexts. These objects are regularly prepared for suspension as indicated by the high frequency of perforations and grooves. The "perforation" may sometimes be a natural hole, providing a simple means for suspension. However, their recognition as suspended objects of adornment (SOA) is not always straightforward, as traces left by the process of perforation or use-wear of suspension are not always well preserved.

The earliest securely dated evidence of the manufacture and use of SOA comes from North Africa. A total of 13 perforated gastropods belonging to the species *Nassarius gibbosulus* were found in levels ascribed to the Middle Stone Age (MSA) at Grotte des Pigeons (Taforat, Morocco) dated to about 82,000 $BP_{TL/ESR/U\text{-}series}$ (Bouzouggar *et al.*, 2007). Perforated *Nassarius kraussianus* were found in levels ascribed to the MSA phase M1 at Blombos Cave, dated to about 77–75,000 BP_{TL} (Henshilwood *et al.*, 2004; d'Errico *et al.*, 2005). Two perforated shells (*Nassarius gibbosulus*) reported from layer B at Skuhl (associated with the burials of Anatomically Modern Humans) as well as one of the same species at Oued Djebbana (Aterian), in Algeria (Vanhaeren *et al.*, 2006), are probably as old as ca 100 ka BP. However, this antiquity is controversial due to the

largely unknown chronology of the Aterian and doubts as to the age of layer B at Skuhl (Zilhão, 2007). Nevertheless, both sites can be assigned to OIS5.

Perforated shells (mainly *Arcularia gibbosula* and *Columbella rustica*) are recorded in high frequencies from the Near Eastern sites of Üçağizli (Levels G–H–I), Turkey (Kuhn *et al.*, 2001; Stiner, 2003), and Ksar 'Akil (Level XXI–XXIV), Lebanon (Kuhn *et al.*, 2001), both attributed to the Initial Upper Paleolithic (IUP). A single, double-perforated marine shell (*Columbellidae* sp.) of similar age is recorded from the Early Upper Paleolithic (EUP) level IVb at Kostenki 14 (Markina Gora) (Anikovich *et al.*, 2007). As regards Central Asia, the oldest SOA come from the sites of Dörölj 1 (Mongolia), where beads made of ostrich egg shells have been reported (Jaubert *et al.*, 2004), and Kara Bom (Russia) in the Altai region, where a perforated bovine tooth and several perforated bones were found (Derevianko and Rybin, 2003). Both sites have been ascribed to the EUP.

THE EARLIEST EVIDENCE OF SYMBOLIC BEHAVIOR IN WESTERN EURASIA

Earliest evidence of symbolic behavior?

At a variety of European sites evidence indicates that Neandertals collected fossil and recent molluscs. In all cases, none of the shells display any artificial perforations. Knapped cobbles with fossils and marine molluscs used for the manufacture of artifacts in Italy during the Middle Paleolithic (e.g., Lorblanchet, 1999; Stiner, 1994) have repeatedly been interpreted as evidence for Neandertals collecting 'curious' items. Nevertheless, the existence of a few objects with natural holes indicates their potential for suspension. However, the absence of research on possible wear marks means we cannot be certain whether or not these objects were indeed used as SOA.

The only unambiguously perforated mollusc (an example of *L. obtusata*) known from a presumably Middle Paleolithic site comes from level Vc at El Ruso I, Spain. A recent study of the lithic assemblage suggests that the material should instead be assigned to the early Aurignacian (Castanedo Tapia, 1997). Given that post-depositional erosion at this site may have mixed archaeological material from different periods (Muńoz Fernández and San Miguel Llamosas, 2001) the cultural affiliation of the perforated mollusc must remain in question. Similar contextual doubts concern a bear tooth grooved at the root collected by Courtier in the first part of the twentieth century from the Mousterian deposits of La Rochette, France (Taborin, 1990). The early age of the excavations and poor documentation, and the presence of overlaying Aurignacian layers at the site, raises the question whether this item should be assigned to the Aurignacian instead. The Middle Paleolithic context of a perforated lynx canine within level D1 at Cova Beneito (Iturbe Polo *et al.*, 1993) is also in question (Villaverde Bonilla *et al.*, 1998). In a recent review of the Middle–Upper Paleolithic sequence it was shown that the canine could also derive from the overlying Aurignacian layer B8 (Doménech Faus, 2004), which contains a single perforated object of this kind.

Suspended Objects of Adornment (SOA) at the Middle to Upper Paleolithic Transition in Europe?

A number of researchers have repeatedly claimed that the earliest evidence of SOA in Western Eurasia date at the Middle to Upper Paleolithic transition (e.g., d'Errico *et al.*, 1998, 2003; Taborin, 1990, 2004). However, the number of SOA assigned to this period is limited (*cf.* Fig. 1), and their archaeological context is problematic (Álvarez Fernández, 2006, in press; Gioia, 1990; Hahn, 1977; Jöris *et al.*, in press; White, 2001, 2002; Zilhão, 2007). In addition, few radiocarbon dates have been obtained for samples from levels containing such finds, and of those available many have large standard deviations and are of questionable validity (Jöris et. al., 2003, in press).

In Western Europe, SOA have been reported from only a few Chatelperronian levels (d´Errico *et al.*, 1998; Taborin, 1990, 1993; White, 1993), while in total more than 120 Chatelperronian inventories have been recorded in France and Cantabrian Spain (Demars, 1996) lacking any SOA. Among these the Grotte du Renne at Ary-sur-Cure, France, is most central to the discussion of SOA and the context of the so called "transitional" industries. In the Chatelperronian layers

(X–VIII) a fairly large number of personal ornaments (perforated and grooved teeth of different species) and some evidence of ivory working were found (d'Errico *et al.*, 1998; Taborin, 1990; White, 2002). According to White (2002), who restudied Leroi-Gourhan's original documentation, the Chatelperronian and Aurignacian levels were stratigraphically mixed. White further argues that many SOA found at Arcy-sur-Cure were not recorded precisely with respect to their three dimensional spatial orientation (White, 2001, 2002; Álvarez Fernández, 2006; Jöris *et al.*, in press; *cf*. Zilhão, 2007)

Whether two perforated teeth found during excavations by Poirier, Bailleau and Delporte in level B4 of the Grotte des Fees, France, may indeed belong to the Chatelperronian remains unclear, since the sequence (Layers B4–B1) also contains several tool types which are characteristic for the Aurignacian (Álvarez Fernández, 2006) as Delporte had already argued (*cf*. Delporte, 1999). Unfortunately, due to limited contextual information, the recently obtained radiocarbon samples from Layers B4–B1 (Gravina *et al.*, 2005) have not silenced the debate (Zilhão *et al.*, 2006; *cf*. Mellars *et al.*, 2007).

Other perforated pendants from French sites that date to this time period, such as those from Roche au Loup, Grotte du Trilobite, and Roc du Combe, are also associated with questionable archaeological contexts (Álvarez Fernández, 2006; Rigaud, 2001; *cf*. Bordes and Labrot, 1967; Sonneville Bordes, 2002; Taborin, 1990, 1993).

In 1968, Lévęque identified four Chatelperronian layers at Quinçay, France, which he grouped into two sequences, a lower one containing an "Archaic Chatelperronian" and an "Early Chatelperronian" and an upper one with "Evolved Chatelperronian" and Chatelperronian "*ŕ caracteres régressifs*". The site does not contain any Mousterian levels (Lévęque and Miskovski, 1983). Three fox canines, a wolf canine, and two atrophied red deer canines, all perforated, were recovered from the upper part of the sequence (Granger and Lévęque, 1997), but the lack of a detailed site report makes it impossible to evaluate the archaeological provenance of the SOA (Álvarez Fernández, 2006).

Several unpublished "dentalium beads" found within a Chatelperronian context at St. Cesaire are claimed to be associated with a Neandertal burial (Zilhão and d´Errico, 1999; Zilhão, 2007). Two *Turritella temprina* fossil shells were reported from level 7 at Cauna de Belvis (Sacchi, 1986; Taborin, 1993), but it remains unclear whether any of these specimens were artificially modified (*cf*. Zilhão, 2007)

Out of approximately thirty sites attributed to the Uluzzian, SOA have only been found at Grotta del Cavallo in Italy (Palma di Cesnola, 2004) and in the 'Uluzzian-like' assemblage of level V of Klisoura Cave I in Greece (Koumouzelis *et al.*, 2001). Grotta del Cavallo was dug by Palma di Cesnola, who identified several Middle Paleolithic layers (MIV–FI) below a layer with volcanic ash (Fa), which was overlain by a series of Uluzzian layers: Archaic Uluzzian (layer E-III: levels E7–E5), Evolved Uluzzian (layer E-II-I: levels E4–E2 and layer E-D: level E-1) and late to final Uluzzian (layer D-II: levels D4 and D3 and layer DIb: levels D2 and D1), with the uppermost Uluzzian levels displaying "Aurignacian elements". Romanellian layers (levels BII–BI) were superimposed above the Uluzzian. Recent scaphopods were found in the Archaic Uluzzian (E-III) and perforated specimens of the marine gastropods (*Cyclope neritea* and *Columbella rustica*) were found in the Evolved (level E1) and Late Uluzzian (layers DII and DIb) (Palma di Cesnola, 1966, 1989, 2001). Goia, who studied the Uluzzian lithic assemblage at the site, describes carinated and snout-shaped scrapers, blades with Aurignacian retouch, and backed bladelets from layer D, and suggests that an Aurignacian layer may have existed but has not been identified in the course of excavation. Layer D was disturbed by animal burrows and by trenches and structures of the more recent Romanellian layers (Gioia, 1990). Therefore, it is possible that the examples of *C. neritea* and *C. rustica*, presumed to originate from the Evolved and Late Uluzzian levels, may actually derive from Aurignacian or Romanellian layers (Álvarez Fernández, 2006).

Regarding some scaphopods (*Dentalium entalis*) from the Archaic Uluzzian of Grotta del Cavallo (Level E-III), no indication is given whether they were actually modified by humans; they may have been simply collected as curiosities, without being used as SOA (Álvarez

Fernández, 2006). Similarly, it is unclear whether the mollusc shells (one of them of *Pecten* sp.) in Level 4 of Castelcivita, Italy (Gambassini, 1997), and "Dentalium beads" found in Level V at Klisoura Cave (Koumouzelis *et al.*, 2001) were modified and used as SOA. However, at Grotta dell Caballo, Castelcivita, and Klisoura, Ulluzian or Uluzzian-like levels are overlain by layers ascribed to the Aurignacian, where remains of marine molluscs have also been documented, some of which were transformed into SOA.

In Central Europe, transitional industries, grouped together under the term "*Blattspitzenindustrien*" or "*Blattspitzengruppen*", are characterized by leaf-shaped semi or fully bifacially worked tools. These industries include the Szeletian, the Jerzmanowician, the Bohunician and the *Altmühlgruppe* (Bosinski, 2000–2001; Hahn, 1993; Jöris, 2004).

The only Central European *Blattspitzen* assemblage that produced SOA is Level X at Ranis 2, Germany. This level yielded a punch and a disc, both of ivory, although the latter broke and dissolved during excavation (Hülle, 1977: 29; Bosinski, 2000–2001: 128). While Hahn claims that Level X represents a deposit mixed with material from the overlaying Aurignacian (Hahn, 1977: 103), the later monograph by Hülle (1977) argues that the disc may indeed be attributed to the leaf point assemblage. Recently published ^{14}C AMS dates for Ranis (Grünberg, 2006) do not clarify the absolute age of the stratigraphic sequence (Jöris *et al.*, in press).

A fish-tail ivory pendant associated with leaf points and a laminar lithic technology (Ketraru, 1973: Fig. 29; Kozlowski, 1992: Fig. 31) has been found in Level 3 of Brynzeny I in Moldavia, and ascribed to the Szeletian. Its decorated pattern of dots is characteristic of the Aurignacian, which led Bosinski (1982, 1990) to place the object in a EUP context.

The Bachokirian is the term applied to a series of archaeological occurrences located in caves such as Temnata Dupka and at the eponymous cave site of Bacho Kiro, both located in Bulgaria. According to Hahn (1993: 67) this term is not sufficient to define a "technocomplex", although recent work defines the "transitional" character of the Bachokirian in greater detail, and suggests an origin in the (not necessary regional) Levallois Mousterian, combined with a laminar lithic scheme of production that resembles Upper Paleolithic technology (Teyssandier, 2007).

The site of Bacho Kiro was excavated by Kozlowski between 1971 and 1975. The basal part of the sequence (levels 11 and 9) was attributed to the "Bachokirian" or "Pre-Aurignacian", and is overlain by Aurignacian and younger levels (Kozlowski *et al.*, 1982; *cf.* Kozlowski, 1992; Rigaud, 2001). Level 11 yielded two fragmented perforated teeth belonging to bear and fox, while Level 9 yielded a perforated rib fragment with oval cross-section that was cut at its distal end (Kozlowski *et al.*, 1982: 141; *cf.* Ginter and Kozlowski, 1982: 170). The first radiocarbon sample obtained from Level 11 dated to 43,000 ^{14}C BP (GrN-7545). Later radiocarbon samples from the same level failed to clarify the chronology, producing results between 33,750 ± 850 ^{14}C BP (OxA-3184) and 38,500 ± 1700 ^{14}C BP (OxA-3213) (Hedges *et al.*, 1994; Table 1).

Finally, Zilhão (2007) argues that a perforated fossil gastropod found during Felgenhauer's excavations (1956–1959) in Level 2 at Willendorf II (Lower Austria) should be ascribed to the Middle to Upper Paleolithic transition. However, this level provided only a very small lithic assemblage (n = 32) lacking "typical Aurignacian or transitional forms" (Teyssandier *et al.*, 2006). Perhaps the gastropod shell is identical to the perforated "marine snail" mentioned by Papp (1956–1959) in his study of the molluscs recovered from Levels 1 to 4 at Willendorf II (*Viviparus* sp. with a dubious perforation and questionable identification). The same researcher also records the presence of local fossils in these levels (*Dentalium badense* PRATSCH and *Dentalium bouei* DESHAYES).

EARLY UPPER PALEOLITHIC SUSPENDED OBJECTS OF ADORNMENT (SOA)

From the outset of the Upper Paleolithic, a large number of SOA, made on a wide variety of raw materials have been recorded (Álvarez Fernández, 2006; *cf.* Vanhaeren and d´Errico, 2006).

In addition to the examples from Level 11 at Bacho Kiro, the earliest unambiguous evidence of SOA in Europe has been documented in Proto-

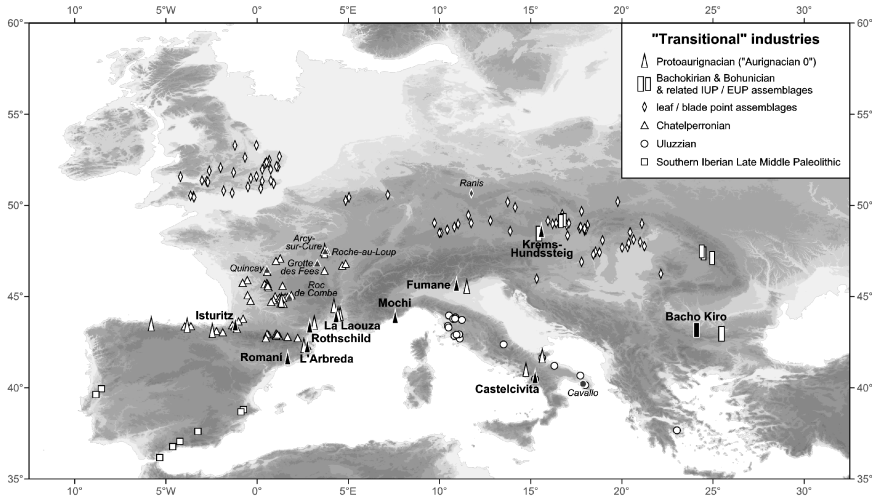

Fig. 1. European "transitional" industries. Black – sites with Suspended Objects of Adornment (SOA) discussed in text; Grey and italics – sites with dubious evidence of SOA. Map based on SRTM data (space radar topography measurements); sea level lowered by 75 m

aurignacian contexts (Fig. 1). The Protoaurignacian is technologically and typologically distinct from the preceding European technocomplexes; it is defined by a lithic technology geared toward the production of blades and bladelets within a single *chaîne opératoire*, where the fossil-director is *dufour* blades. It is dated to ca 38.3–34.2 ka ^{14}C BP (Table 1) and likely the product of Anatomically Modern Humans (Jöris *et al.*, in press; *cf.* Maíllo Fernández, 2002). Some of the assemblages ascribed to the Protoaurignacian (Table 1) have yielded abundant SOA, manufactured from marine shell of different species (the most frequent are *Homalopoma sanguineum*, *Littorina obtusata*, *Nassarius mutabilis*, *Nassarius gibosulus*, *Nassarius reticulatus*, *Cyclope* sp.), and mammal teeth. The latter category includes grooved red deer incisors from Fumane, a perforated carnivore tooth and beads of soft stone from Mocchi, perforated herbivore incisors and a bead of amber from Isturitz, a pierced red deer canine and steatite bead from Rothschild, and an atrophied red deer canine and some fish vertebrae from Romaní (Álvarez Fernández, 2006; Vanhaeren and d´Errico, 2006; Zilhão, 2007).

The number of SOA in Aurignacian contexts is much greater than in the Protoaurignacian. In addition (Fig. 2), the Aurignacian provides the earliest undeniable evidence for complex figurative art and the emergence of standardized bone, antler and ivory weapons technology. The oldest radiocarbon dates available for this period date to about 35.0 ka ^{14}C BP (Jöris *et al.* in press), i.e. about 3,000 radiocarbon years younger than the oldest dates for the Protoaurignacian, to be estimated to ca 38.3 ka ^{14}C BP (weighted mean of six measurements from level H[B1] of L'Abreda; *cf.* Table 1).

During the Aurignacian, various non-fossil marine mollusc shells of Atlantic and Mediterranean origin, including gastropods, bivalves and scaphopods, were modified and used for SOA (Álvarez Fernández, 2006; *cf.* Vanhaeren and d´Errico, 2006). These were shells without any nutritional value, collected at beaches (since they are eroded by wave action (Taborin, 1993; Stiner, 1999; Álvarez Fernández, 2006) for shape (globular as the Naticidae family, tubular as *Antalis* sp.) and color (red as *H. sanguineum*, yellow as *Turritella* sp.).

Few examples of gastropod species of exclusively Mediterranean origin (mainly *H. sanguineum*, *Cyclope* sp., *C. rustica*) have been found at various sites in Europe. So far, no examples of these have been found in Cantabrian Spain. In the Pyrenees, these Mediterranean species are practically absent, whereas they are more abundant in the French Midi. For example, in the Dordogne

Table 1

Earliest evidence of Suspended Objects of Adornment (SOA) in Western Eurasia

Layer	Method	N	Laboratory number	Age	STD	Material	Source	SOA type				
								shell	teeth	bone	ivory	stone
Chatelperronian?												
Quinçai, F							Granger and Lévêque, 1997		X			
			no reliable dates									
Leaf / blade point industries?												
Ranis 2, D							Hülle, 1977				X	
X			*no reliable dates*				Jöris *et al.*, in press					
Bachokirian												
Bacho Kiro, layer 11, BG							Kozlowski *et al.*, 1982; Ginter and Kozlowski, 1982		X			
11	14C	1	OxA-3212	34800	1150	tooth	Hedges *et al.*, 1994					
11	14C	2	OxA-3183	37650	1450	charcoal						
11	14C	3	OxA-3213	38500	1700	bone						
11	14C	4	GrN-7545	<43000		charcoal	Mook, 1982					
11	*14C*	*(1-3)*	*wm: t = 1.19*	36471	*796*							
Bacho Kiro, layer 9, BG							Kozlowski *et al.*, 1982; Ginter and Kozlowski, 1982			X		
9			*no reliable dates*									
Protoaurignacian												
Isturitz, F							Normand and Turq, 2005	X	X			X
4d	14C	1	GifA-98233									
4d	14C	2	GifA-98232									
4d	*14C*	(1-2)	*wm: t = 1.39*									
Abric Romaní, E							Saladié and Aímene, 2000		X	X		
2 (A)	14C	1	AA-8037A	35400	810	charcoal	Bischoff *et al.*, 1994					
2 (A)	14C	2	AA-8037B	37900	1000	charcoal						
2 (A)	14C	3	NZA-2311	36590	640	charcoal						
2 (A)	14C	4	AA-6608	36740	920	charcoal						
2 (A)	14C	5	AA-7395	37290	990	charcoal						
2 (A)	*14C*	*(1-5)*	*wm: t = 1.39*	*36644*	*374*							
2 (A)	U-series			43000	1000	travertine	Bischoff *et al.*, 1994					
L'Arbreda, E							Maroto Genover *et al.*, 1996	X				
H (B1)	14C	1	OxA-3730	35480	820	bone	Bischoff *et al.*, 1989					
H (B1)	14C	2	OxA-3729	37340	1000	bone						
H (B1)	14C	3	AA-3779	37700	1000	charcoal						
H (B1)	14C	4	AA-3780	37700	1000	charcoal						
H (B1)	14C	5	AA-3782	38700	1200	charcoal						
H (B1)	14C	6	AA-3781	39900	1300	charcoal						
H (B1)	*14C*	*(3-6)*	*wm: t = 1.13*	*38307*	*552*							

Table continued1

Layer	Method	N	Laboratory number	Age	STD	Material	Source	SOA type				
								shell	teeth	bone	ivory	stone
Grotte Tournal, F							Taborin, 1993	X				
G	14 C		Ly-1898	>35800		charcoal	Evin *et al.*, 1983					
Rothschild, F							Barge, 1983; Taborin, 1993	X	X			X
			no reliable dates									
La Laouza, F							Taborin, 1993	X				
Riparo Mochi, I							Stiner, 1999	X	X			X
G	14C	1	OxA-3588	32280	580	charcoal	Mussi *et al.*, 2006					
G	14C	2	OxA-3589	33400	750	charcoal						
G	14C	3	OxA-3590	34680	760	charcoal						
G	14C	4	OxA-3592	34870	800	charcoal						
G	14C	5	OxA-3591	35700	850	charcoal						
G	*14C*	*(3-5)*	*wm: t = 0.68*	*35045*	*462*							
Grotta di Fumane, I							Fiocchi, 1996	X	X			
A2	14C	1	OS-5999	32000	90	marine shell, SOA	Giaccio *et al.*, 2006					
A2	14C	2	OS-5871	32700	140							
A2	*14C*	*(1-2)*	*wm: t = 3.11*	*32205*	*76*							
A2	14C	1	UtC-2048	36500	600	charcoal	Giaccio *et al.*, 2006					
A2	14C	2	OxA-6566	31900	1100	charcoal						
A2	14C	3	OxA-8052	34120	460	charcoal						
A2	14C	4	UtC-2688	36800	+1200 -1400	charcoal						
A2	14C	5	UtC-2689	35400	+1100 -1300	charcoal						
A2	14C	6	UtC-2690	34200	900	charcoal						
A2	14C	7	OxA-6465	31620	500	charcoal						
A2	14C	8	OxA-8053	33640	440	charcoal						
A2	*14C*	*(3-6, 8)*	*wm: t = 2.14*	*34164*	*281*							
Castelcivita, I							Gambassini, 1995	X				
1a/II			*no reliable dates*									
Krems-Hundssteig, AUT*							Álvarez Fernández, 2006	X				
brown layer	14C		KN-654	35500	2000	charcoal	Hahn, 1977					
EUP of Kostenki 14												
Kostenki 14, RU							Anikovich *et al.*, 2007	X				
IVb	14C	1	OxA-9568	32600	280	charcoal	Sinitsyn, 2003					
IVb	14C	2	GrA-13302	34940	630	charcoal						
IVb	14C	3	OxA-9569	35280	330	charcoal						
IVb	14C	4	GrA-15957	36040	250	charcoal						
IVb	14C	5	GrA-15961	36540	270	charcoal						
IVb	*14C*	*(2-5)*	*wm: t = 1.89*	*35970*	*155*							
IVb	IRSL		UIC-1128	47730	3480		Anikovich *et al.*, 2007					

* association of SOA with Protoaurignacian or Mid Upper Palaeolithic assemblage unclear; wm – weighted mean

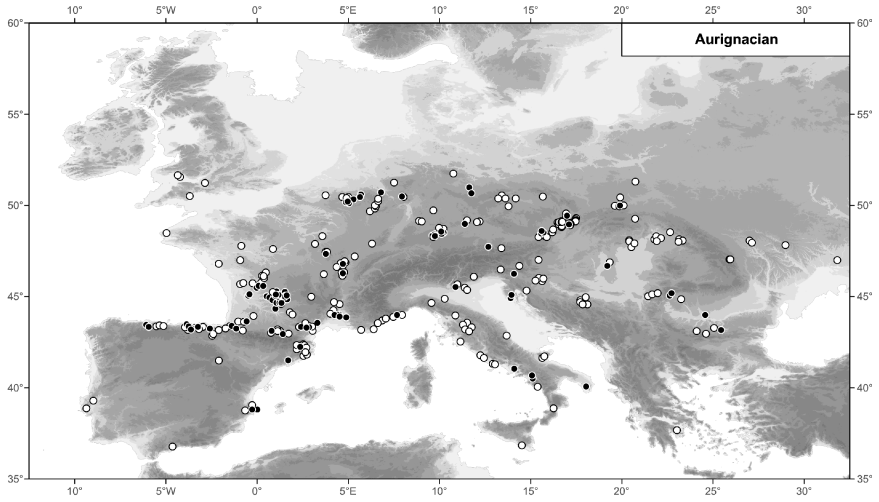

Fig. 2. Aurignacian sites in Europe. Black – sites with Suspended Objects of Adornment (SOA). Map based on SRTM data (space radar topography measurements); sea level lowered by 75 m

such shells were found at Castanet and Blanchard I, both of which are located 250 km from the Mediterranean coast. Along the Mediterranean coast of Spain, the Italian Peninsula and Greece, gastropods of exclusively Mediterranean origin predominate (e.g., Beneito and Foradada in Mediterranean Spain; Bombrini and Cala in Italy; and Klisoura in Greece). The sites located near the Atlantic coast contain exclusively Atlantic species, particularly *L. obtusata* (e.g., El Ruso I in Cantabria, and Isturitz in southwest France).

Gastropods that currently live in the Atlantic are known from French sites (Perigord, Charente and Gironde) that in some cases are located more than 300 km from the Atlantic coast (e.g., Souquette, La Combe). In the case of *L. obtusata*, SOA of this species are only present at sites in the Center-West of France (e.g., Blanchard I, Castanet) and the French Pyrenees (e.g., Tuto de Camalhot).

Non-fossil bivalves and scaphopods were rarely used as SOA during the Aurignacian. One of the most commonly used bivalves is *Glycymeris* sp. (e.g., at Beneito in Mediterranean Spain; and Isturitz in the Western Pyrenees). Non-fossil scaphopod species are found further to the south (e.g., Blanchard I and Castanet, and Klisoura).

With regards to fresh water gastropods, the genus *Teodoxus* has been found in EUP levels at sites in Mediterranean Spain, such as Cova Foradada and Beneito. Similarly, perforated examples of *Teodoxus* sp. have been recovered at Klisoura, Siouren I, and in the EUP of Kostenki 14. They are probably specimens collected from nearby rivers.

SOA were also manufactured from different kinds of teeth from a variety of mammals, mainly artiodactyls, and to a lesser degree carnivores and perissodactyls. Human (e.g., La Combe) and rodent teeth were used more rarely as SOA. Certain kinds of teeth were selected, depending on the animal species, with a preference for canines and incisors of red deer, horse, carnivores, and other species. In France, the teeth used most frequently for SOA were the canines of large or medium sized predators, mainly fox (e.g., La Souquette) but also wolf (e.g., Isturitz) and cave lion (e.g., Fourneau du Diable). Deer atrophied canines are also known (e.g., La Combe), while the incisors of other species, such as of reindeer (e.g., La Ferrassie), ibex (e.g, Gatzarria), horse (e.g., La Quina) and red deer (e.g., Gatzarria) were utilized far less frequently.

The teeth most frequently used as SOA during the Aurignacian in Central European were fox canines (e.g., Trou Renard, Breitenbach, Willendorf II), however teeth of large predators were also used (e.g., hyena incisors at Hohle Fels, bear

canines at Tischofer-Hohle): it is more unusual to find deer atrophied canines (e.g., Hohle Fels), horse (e.g., Willendorf II) or ibex incisors (e.g., Hohle Fels). Such objects are rarer further to the east (e.g., deer atrophied canines at Romualdova Pečina, fox canines at Mamutowa, bear canines at Cioclovina, horse incisors at Mladeč, beaver and reindeer incisors at Mladeč, wolf incisors at Bordu Mare in Ohaba Ponor, badger incisors at Sandalja II). In Cantabrian Spain, deer atrophied canines are most frequently encountered (e.g., El Pendo). In Mediterranean Spain, it is important to note the use of lynx canines, for example at Foradada. Red deer atrophied canines are also present at Romaní. In the rest of Mediterranean Europe, perforated teeth of the same species have been recorded at Klisoura.

Bone fragments with perforations, presumably used for suspension have been recorded at Mladeč (a mammal rib) and Abri Pataud (reindeer epiphysis). Beads, especially those made from bird diaphysis (e.g., La Garma A, Kostenki 14), and fish vertebrae (e.g.,Romani, Gatzarria) have also been discovered. Finally, bone fragments manipulated to imitate red deer atrophied canines have been found at sites such as Les Rois and Blanchard I.

Antler was modified more frequently than bone, especially at sites in western France and the Pyrenees, to produce, for example, "basket-type" beads (e.g., Gatzarria). Perforated objects made from this material have also been recorded in Central Europe (e.g., retouchers at Geissenklösterle), and assegais were re-used as SOA (e.g., La Souquette). Imitations of deer atrophied canines were also made of antler at Gatzarria.

However, during the Aurignacian, mammoth ivory was the material most frequently used for SOA production. Above all, ivory was used to make beads of different types and size, or perforated plaques (e.g., Trou Magrite), sculptures of animals (e.g., Vogelherd, Hohle Fels) and other pendants. Nonetheless, the most characteristic SOA of ivory during the Aurignacian are basket-shaped ivory beads (*perles ŕ panier*); such beads were also occasionally produced out of other materials such as soft stone, antler or bone. This type of bead is small in size, between 5 and 10 mm, although examples as large as 15 mm; it is found in Belgium (e.g., Spy), the German Lower Rhineland (e.g., Lommersum) and along the Upper Danube (e.g., Geissenklösterle). In addition, imitations of animal teeth made of ivory, such as deer atrophied canines, have been found at Gatzarria, and imitations of molluscs belonging to the Nassaridae family have been found at La Souquette and Tuto de Camalhot, and to the Cerithidae family have been found at Spy.

During the Aurignacian, a wide variety of minerals were employed in the production of SOA. Basket-shaped beads, for example, were made of soft stone (gypsum or limestone), for example at Gatzarria. Similar objects, but of different morphology and made of volcanic rocks, have been found at Spy. Comparable finds come from Isturitz and Wildscheuer. Beads were also made of ochre (e.g., Isturitz), clayey schist and nephrynite (e.g., Wildscheuer), jet e.g., Geissenklösterle), and sandstone (e.g., Vogelherd). Another organogenic raw material, amber, was used during the Aurignacian perhaps also in the production of SOA (Álvarez Fernández *et al.*, 2005)

With the onset of the Upper Paleolithic there is continuous and ample evidence for the use of marine fossils as SOA (e.g., different species of gastropods, bivalves, scaphopods, belemnites, ammonites, sea urchins). Such finds are documented at French sites (in the Dordogne, Pyrenees and Midi), but are particularly abundant at sites in the interior of the European continent. At some sites (e.g., Blanchard I), non-fossil shells from the Atlantic and from the Mediterranean and fossil beads have been recorded. Fossil scaphopods are only found in Aurignacian contexts in Central Europe (e.g., Willendorf II, Langmannersdorf, Potočka Zijalka, Istállóskö). Perforated fossils have also been recorded. Ammonites are described for the Aurignacian at La Souquette, belemnites at Blanchard I, sea urchins at the latter site and at La Ferrassie and shark teeth at La Piage.

It is difficult to determine from which geological deposits the different fossil species came. These fossils may have been gathered from the Tertiary beds of the Paris, Mainz, Vienna, Horn and Steinheim basins (Taborin, 1993; Álvarez Fernández, 2006).

Beginning with the Upper Paleolithic, ochre also appears to have been used side by side with SOA; in some cases SOA were stained with ochre

either intentionally or indirectly through contact with clothing.

SOA were in continuous use from the Aurignacian to the later European Upper Paleolithic and Mesolithic, and the raw materials, manufacturing techniques, decorations, and use of ochre remained consistent.

DISCUSSION AND CONCLUSION

Considering only the solid, unambiguous stratigraphical association, we argue that Anatomically Modern Humans were the only hominins to manufacture SOA. Early *Homo sapiens* were likely the producers of SOA at sites in Africa (e.g., Tofaralt, Blombos, Enkapune Ya Muto), the Near East (e.g., Skuhl, Üçağizli and Ksar 'Akil), at Kostenki 14, and at sites in Central Asia (e.g., Dörölj 1 and Kara Bon). They are also responsible for the first SOA identified in Europe which are attributed to the Protoaurignacian and Aurignacian technocomplexes.

A critical analysis of SOA found in archaeological contexts ascribed to the Middle to Upper Paleolithic transition (e.g., Chatelperronian, *Blattspitzengruppen*, Uluzzian and Bachokirian) indicates that the earliest SOA are only associated with the Protoaurignacian and Aurignacian (Fig. 1); no unambiguous evidence for the intentional perforation of objects is found for the entire European pre-Upper Paleolithic record. Likewise no debris associated with SOA production or SOA broken during manufacture have been identified in Middle Paleolithic or older contexts.

Claims for "transitional" sites (e.g., Grotte du Renne at Arcy-sur-Cure, Grotte des Fées, Roc de Combe, Grotta del Cavallo and Ranis 2) several researchers have suggested that some of these transitional contexts likely result from admixture with Aurignacian or later material (Álvarez Fernández, 2006, in press; Gioia, 1990; Hahn, 1977; Jöris *et al.*, in press; White, 2001, 2002; Zilhão, 2007). Such taphonmic problems may also apply to material from Roche au Loup and Trilobite Cave, however these sites were excavated in the early twentieth century and so this issue cannot be tested.à

To summarize, out of approximately 200 assemblages ascribed to the Middle to Upper Paleolithic transition, SOA have only been found at St. Césaire, Klisoura I, and Quinçay. At Quinçay six perforated animal teeth were found in the upper part of the Chatelperronian sequence (evolved Chatelperronian and Chatelperronian "*à caractères régressifs*"). In the case of the "Dentalium shells" from the Saint Césaire burial and Klisoura I, it is not clear whether any of these shells were artificially modified, or if they were used. They may simply have been collected as curiosities. The absence of a site monograph of Saint Césaire makes a critical assessment of the context of these finds impossible.

Layers 11 and 9 at Bacho Kiro produced few SOA and have not been studied in detail. However, the presence of overlaying Aurignacian levels with SOA suggests that younger material may have contaminated the transitional assemblages.

Based on these results, we argue that the earliest evidence of SOA in Europe is related to the spread of Anatomically Modern Humans into this territory, and may be ascribed to the Bachokirian and Protoaurignacian. The earliest radiocarbon dated sites with SOA range from ca 38.3–34.2 ka ^{14}C BP (Table 1; ca 42–40 ka cal BP_{Hulu}; Weniger *et al.*, 2007), with the greatest frequency of material dated to ca 36.0 ka ^{14}C BP (Jöris *et al.*, in press).

From the start of the EUP we find that SOA were made from a wide range of materials (mainly shell and teeth of different species, but also bone, antler, ivory, and a variety of minerals). At the same time we can observe the use of different techniques to perforate and shape objects, with a great variety of decorations that continue to be used throughout the subsequent phases of Upper Paleolithic and Mesolithic. In addition, some of these SOA, specifically various species of marine shell, prove the existence of large social networks distributed over several hundred kilometers. We believe such networks reflect social capabilities (probably neurologically predetermined) unique to *Homo sapiens sapiens* and that the lack of such behaviors among the Neandertals contributed significantly to their extinction.

Acknowledgements

We kindly acknowledge Daniel Adler for his editorial work and William Davies for valuable comments on an earlier draft of this paper.

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