# MARINE SHELL ORNAMENTS IN ATLANTIC EUROPE: STANDARDIZATION OF FORM IN THE GRAVETTIAN

LISA ROGERS

## ABSTRACT

Marine shells have been selected for the creation of ornaments – beads and pendants – for thousands of years. Some researchers (Bar-Yosef 2015; Stiner 2014) have suggested that particular shapes and genera of marine shells were preferentially selected for ornament creation during the Upper Paleolithic of Europe. This study examines the shapes of marine shells used for ornaments during the Gravettian period (27,000-20,000 BP) of Atlantic Europe. Results indicate that, similar to previous research, basket-shaped marine shells were being preferentially selected. This result is discussed in the context of social and environmental risk, standardization, and human-material entanglements.

## INTRODUCTION

At a global scale, marine shells have been used for the creation of ornaments for tens of thousands of years (d'Errico et al. 2005; Hovers et al. 2003). While these shells are found in archaeological contexts in a wide variety of textures, colours, shapes, and sizes, it has been suggested that modern humans in the Upper Paleolithic (UP) of Europe were preferentially selecting particular species for ornaments (Bar-Yosef 2015; Stiner 2014). In the Mediterranean Basin, for instance, this preferential selection of materials is suggested to relate to the size and shape of the shells, with basket-shaped species becoming dominant over time (Stiner 2014). Stiner (2014) suggests that this shift towards a more standardized form may suggest that a common visual communication system was emerging in the European UP. While Stiner (2014) focuses on assemblages in the Mediterranean, the present study adds to this by examining the shape of marine shell species selected for the creation of ornaments in the Atlantic zone of Europe during the Gravettian period (27,000-20,000 BP).

The purpose of this study is threefold: first, I will explore whether particular genera of marine shells were selected more commonly for the creation of ornaments in Atlantic Europe during the Gravettian. Following from this I will determine whether, similar to Stiner's (2014) study in the Mediterranean Basin, these shells are standard in their shape. Finally, I will discuss what this information can tell us about social interaction, human-material interaction, and communication during the Gravettian.

In order to address these questions this paper will first briefly explore the material culture, climate, and environment of the Gravettian period. I then discuss UP ornaments, with a particular focus on those made from marine shells. This is followed by a discussion of group mobility as it relates to the transferability of materials and how risk is mediated by social interactions. I then detail the methods by which I collected and analyzed my data and present the results of my study. The paper concludes with a discussion of the results in the context of risk, social interaction, and the preferential selection of materials.

## WHAT WAS THE GRAVETTIAN?

The Gravettian period immediately followed the Aurignacian in Western Europe, and lasted from approximately 27,000-20,000 BP. Gravettian populations occupied an extensive geographic range, from the Iberian Peninsula and Atlantic coast, across to the Eastern plains of Russia (Bicho et al. 2017). Assemblages from this time period are characterized most notably by the presence of stemmed, symmetrical, and backed points (i.e. Font Robert, *fléchette*, and Gravette points, respectively), an elaboration of burin technology, and backed micropoints (Djindjian 2000). Other aspects of material culture and social life from this time include the creation of ornaments and rock art, and the deliberate burial of the dead (Pettitt 2011).

## GRAVETTIAN CLIMATE AND ENVIRONMENT

This study focuses on the Atlantic coast of Europe, including modern day Portugal, Spain, and France. Much like the preceding Aurignacian period, the climate of the Gravettian oscillated quite rapidly until ultimately entering the Last Glacial Maximum (LGM) (Djindjian 2000). More specifically, southwestern France and northern Spain experienced a generally cool and humid climate between 29,000-27,000 BP, which then began to improve, encouraging the spread of woodlands, between 27,000-24,000 BP (Rigaud 2000). From this point, stable but harsh conditions prevailed between 24,000-20,000 BP, leading to a decrease in woodlands and an increase in fauna such as reindeer and arctic fox (Rigaud 2000). An increase in humidity and woodlands took place for another thousand years, until the extreme cold of the LGM set in (Rigaud 2000). Contrary to the pattern seen in southwestern France and northern Spain, the global cooling trend seen during this period did not seem to have an effect on the fauna and flora of Portugal (Zilhão 2000). Instead, the climate in this area remained relatively stable.

## PALEOLITHIC ORNAMENTS

Paleolithic ornaments are items of bodily adornment such as beads and pendants made from a variety of materials, including bone, shell, stone, and eggshell (Moro Abadía and Nowell 2015). Marine shells in particular have been selected for the manufacture of ornaments for tens of thousands of years. For instance, perforated *Nassarius kraussianus* shells from Blombos Cave in South Africa are argued to be among the earliest definitive evidence of symbolic expression in *Homo sapiens* (d'Errico et al. 2005:3). Dating to approximately 75,000 BP (d'Errico et al. 2005), this discovery helped dispel the previous assumptions (e.g., Conard and Bolus 2003; Mellars 1996; Mithen 1996) that the use of ornaments started some 40,000 years ago with the widespread movement of modern humans into Europe.

## MARINE MOLLUSKS

The 16 genera of marine mollusks included in this study come from three major groups – gastropods (10), scaphopods (2), and bivalves (4). The scaphopods in this study are smooth and elongated, or tusk-shaped. Bivalves (clams, oysters, mussels, and scallops) are composed of two similar or equally sized shells held together at a hinge. Gastropods are marine snails, which have a variety of shell shapes (see table 1.1). Basket-shaped marine gastropods are considered to be the most common species used for the creation of ornaments in the Paleolithic (Bar-Yosef 2015; Stiner 2014). Others included in this study are conical (or limpets), star-shaped (similar to basket-shaped but with star-like protrusions), and tubular (or elongated and highly spiraled).

| Shell Shape | Marine Gastropod Genera |
|---|---|
| Basket | *Hinia, Littorina, Nassarius, Neritinia, Nucella, Theodoxus, Trivia* |
| Conical | *Sipho* |
| Star | *Aporrhais* |
| Tubular | *Turritella* |

*Table 1: Marine shell genera by shape.*

## GROUP MOBILITY AND THE TRANSFERABILITY OF MATERIALS

In Paleolithic archaeology the transfer of raw materials is often used as a proxy for investigating the degree to which different groups interacted with one another (see Blades 1999, 2003; Féblot-Augustins 1993, 2009; Whallon 1989). By gaining a better understanding of how these networks functioned, we can begin to understand their role in social processes and group survival (Féblot-Augustins 2009). The movement of human populations (and the scale of these movements) is proposed to be largely influenced by the location and quantity of resources on the landscape (Féblot-Augustins 1993, 2009). Studying where materials at a particular site were sourced allows us to determine the approximate extent of that group's mobility. Such studies have shown that during the UP, groups in Western Europe may have travelled up to 200-300 km to procure raw materials (Féblot-Augustins 2009). This distance differs quite dramatically from the Middle Paleolithic, in which group mobility is estimated to have not exceeded 100 km (Féblot-Augustins 2009). The procurement of raw materials from such a great distance may be indicative of expanding social networks during the UP.

## RISK, SOCIAL INTERACTIONS, AND STANDARDIZATION

Social and environmental risks would have been a daily reality for Gravettian populations, as they lived during a time of rapid climatic variability, eventually culminating in the LGM (Rigaud 2000). Resource availability would likely have been equally unpredictable. Gravettian populations, however, seem to have thrived during these harsh conditions, as evidenced by the elaboration of their artistic traditions and other social expressions. The need to spread and manage the risks they faced may have led to an expansion in long-distance social networks. It has been noted in ethnographic studies that populations with at least some social connections outside of their immediate area are better protected against risk (Borck et al. 2015; Gamble 1999; Wobst 1974, 1977). Therefore, Gravettian populations may have mediated their risk through the maintenance of social relationships with other groups. The trade and exchange of easily transferable materials would have facilitated these complex social connections, entangling the social and the material. Drawing from ethnographic accounts, reciprocal exchange and delayed reciprocity are used to maintain these connections and to acquire goods in times of resource scarcity (Cashden 1985; Wiessner 1982).

Durable and easily transferable items like ornaments would have moved across these interactions quite easily (Álvarez-Fernández 2002; Stiner 2014). Through a materialist perspective ornaments are active material agents in the construction and maintenance of social relationships (Straffon 2016). These artifacts would have been entangled with those who created, viewed, wore, exchanged, or possessed them. Importantly, this widespread process of exchange allows for social information to pass from one group to another through individual and group interactions. As such, a relatively standardized and highly portable medium such as ornaments could have facilitated a wider dispersal of information (Stiner 2014). While it is ultimately unlikely that we will ever know just what, if any, information was being exchanged alongside these ornaments, we are able to hypothesize the social relationships, interactions, and processes within which they were embedded. Investigations into these social processes, rather than a focus on meaning, have the potential to reveal more about UP populations and their responses to stress or risk.

DATA COLLECTION

The first step in my data collection was to review previously known sites in Europe dating to the Gravettian period. I used the Radiocarbon Palaeolithic Europe Database (see Vermeersch 2017) to export an excel spreadsheet of all sites listed as having a Gravettian cultural affiliation. I then removed duplicate entries, narrowing the results from 2,345 entries to a total of 513. Following from this, I removed any sites with a longitude over 6°, as this would eliminate sites too far from the Atlantic coast. This resulted in a list of 162 sites that date to the Gravettian period.

The next step was to eliminate any sites that fell outside of my area of study. As previously discussed, ethnographic evidence and studies of raw material procurement during the Paleolithic suggest that the mobility range of hunter-gatherer groups typically does not exceed 300 km. Therefore, I deleted any sites that were 300 km or more from the Atlantic coast. To do this I first created an Excel spreadsheet listing the 162 sites and their coordinates. I then imported this spreadsheet into the open access software Gephi, so that I could convert the file to a .kmz format. Once converted, I was able to import the file into GoogleEarth Pro, which plotted the location of each site.

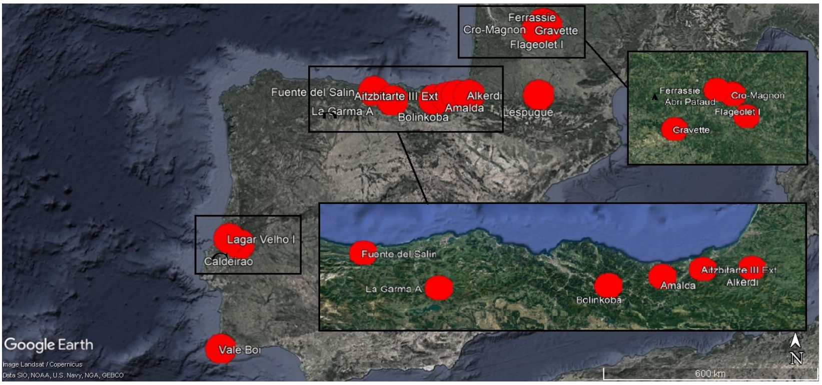


*Figure 1: Locations of sites and three regional clusters (A: Dordogne, B: north coast of Spain, C: west coast of Portugal.*

From this point I needed to consider the sea level during the Gravettian. Global sea levels during marine isotope stage (MIS) 3 were generally lower than today, exposing large areas of the coastal sea floor (Frigola et al. 2012). From 30,000-21,000 BP it is estimated that sea levels fluctuated between approximately 60-80 m below current levels, after which they dropped dramatically to as much as 130 m during the LGM (Gracia et al. 2008; Frigola et al. 2012). To determine where the exposed sea floor would have been in my study area, I used the European Marine Observation and Data Network's free online bathymetry software (http://www.emodnet-bathymetry.eu/data-products), which maps sea floor depths. I determined that the sea floor was likely exposed approximately 40-50 km along the coast of France, no more than 5-10 km off the northern coast of Spain and Portugal, and 20-30 km off the coast of Portugal.

To determine which sites to include from France I set the scale legend in GoogleEarth Pro to a maximum distance of 250 km (300 km maximum distance minus 50 km to account for the exposed sea floor) and used this to determine a rough geographic boundary. This procedure was used for the northern coast of Spain and Portugal (scale legend set to 290 km), and the coast of Portugal (scale legend set to 270 km). As a result, 35 sites were eliminated from the study.

The final step was to determine whether any of the remaining 127 sites are known to have marine shell ornaments dating to the Gravettian, and if so, what the species or genus of these shells are. To do this I engaged in an extensive search of various library databases to find any mention of marine shells. In total, this search resulted in 112 sites being eliminated for either not being reported to have marine shell ornaments, or due to a lack of information about them. Unfortunately, many sites that are known to have marine shell ornaments were excluded due to the specific species or genera not being reported. In total, this study analyzes 15 sites in Spain, Portugal, and France (see figure 1 for sites and regional clusters).

## DATA ANALYSIS

In a study of Üçağizli Cave 1, Klissoura Cave 1, and Riparo Mochi, Stiner (2014) had access to highly detailed data regarding the precise numbers and dimensions of each species of shell used to create ornaments. As such, Stiner (2014) was able to engage in a detailed statistical analysis. Unfortunately, due to the lack of detail in the data available for this study, it was not possible to conduct a similarly thorough statistical analysis of the marine shell species used. Therefore, my analysis will focus on the amount of species and genera used at each site and in each region, rather than on the amount of each species and genera found.

The analysis conducted was twofold: first, I analyzed the data for all sites included in the study, and second, I analyzed the data for three regional clusters of sites. The regional clusters are the Dordogne region of France, the northern coast of Spain to the west of the Pyrenees, and the central west coast of Portugal. While the latter only includes two sites, and is thus not a statistically significant sample, I proceeded with analyzing it out of interest.

Essentially, the analysis conducted for this study examines the relative percentages of basket-shaped shells found at all sites, as well as in the three regional clusters. For the total sample, I first calculated the total number of marine shell species found at all sites. I then determined how many of the species present at each site fall under the category of basket-shaped. Once this was done, I calculated the total number of basket-shaped shells used across all sites. This was compared with the total number of species present. This methodology was then used to analyze each of the three regional clusters.

## RESULTS

Of the data collected for this study, 19 species of marine shells were identified, in addition to four only identified at the genus level. When examined at the genus level, 16 are represented. In total, four of the 16 genera are bivalves, while 12 are gastropods (or sea snails). Seven of the 12 gastropods are basket-shaped, three are tusk-shaped or elongated, one is conical, and one is star-shaped. When considering the complete dataset, there is a total of 23 marine shell species (or genera) across all of the sites. Of these, 14, or 60.9%, of all species represented at the 15 sites are basket-shaped. In addition to this, there are 54 total incidences of marine shell species or genera reported at these sites. In total, 38, or 70.4% of these occurrences of marine shell are basket-shaped. This analysis suggests that, overall, basket-shaped species of marine shells were selected for the manufacture of ornaments more often or were more widely available.

| Region | Total Species/Genera | Total Basket-Shaped | Percent of Total |
|---|---|---|---|
| Dordogne | 12 | 6 | 50% |
| North Spain | 12 | 9 | 75% |
| West Portugal | 6 | 3 | 50% |
| All Sites | 23 | 14 | 60.9% |

*Table 2: Summary of analysis.*

A total of five sites included in this study are found in the Dordogne region of France (Abri Pataud, Cro-Magnon, Ferrassie, Flageolet I, and Gravette). Basket-shaped shells are reported from all of these sites, with two (Ferrassie and Flageolet I) having only this shape of shell in their samples. In total, there are 12 species or genera of marine shell present, and 6, or 50%, are basket-shaped. While this result indicates that basket-shaped beads were not necessarily dominant in this region, it is important to note that 2 of the 5 sites (Ferrassie and Flageolet I) are using only basket-shaped species.

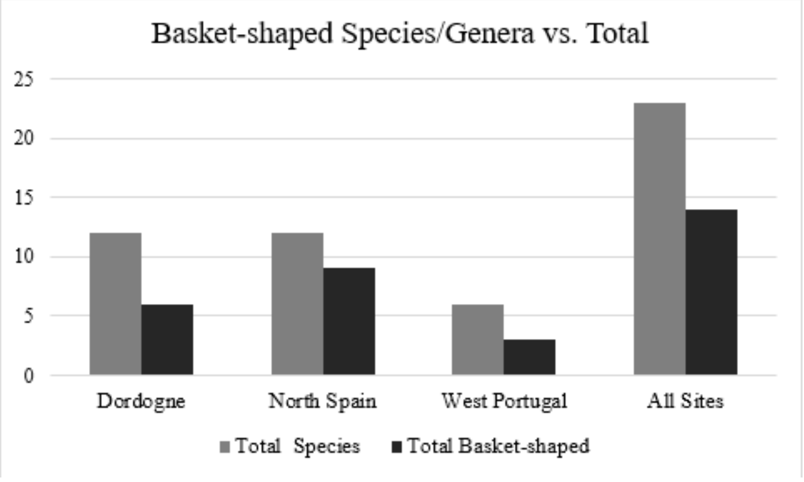


*Figure 2: Summary of analysis.*

Aitzbitarte III, Alkerdi, Amalda, Bolinkoba, Fuente del Salín, and La Garma A are all located on the northern coast of Spain, west of the Pyrenees. The majority of marine shell species or genera selected for the creation of ornaments in this region are basket-shaped. Of the six sites, five of the shell assemblages are 100% represented by basket-shaped species. In total, there are 12 species or genera of marine shell, and 9, or 75%, are basket-shaped. This result suggests that basket-shaped beads were being preferentially selected by Gravettian populations in this region for the creation of ornaments.

The two sites in close proximity to one another on the central west cost of Portugal are Caldeirao and Lagar Velho. There are 6 marine shell species or genera represented at these two sites, with a total of 3, or 50%, being basket-shaped species. Similar to the Dordogne region, this result indicates that basket-shaped beads were not necessarily dominant in this region. However, at one of the sites (Caldeiro) only basket-shaped species are present. The results for all regions and the total sample are summarized in Table 2 and Figure 1.

## DISCUSSION AND CONCLUSIONS

The general fluctuations and rapid deterioration of the environment during the Gravettian would have necessitated the development of strategies to manage risk. Long distance exchange and interaction between groups in different regions would have been an important strategy for risk management. Such exchange did take place during the Gravettian period, demonstrated through the recovery of shell ornaments from far Eastern Europe where populations had no immediate access to the sea or fossil outcrops (Taborin 2000). A common visual communication system would have facilitated this long-distance exchange and interaction (Stiner 2014). The standardization of ornament shape and size could have led to the development of a complex system of visual communication, as these small units could be easily transferred and recombined in a variety of ways to promote meaning (Stiner 2014).

Overall, this study supports the argument that basket-shaped marine shells were preferentially selected for the creation of ornaments. Of the 23 genera included in this sample, the majority (60.9%) are basket-shaped. Along the Northern coast of Spain this pattern is even more evident, with 75% of the sample being basket-shaped. This result indicates that Gravettian populations in the Atlantic zone of Europe, and Spain in particular, were preferentially selecting basket-shaped shells for the creation of ornaments. This may be indicative of a standardization in bead form similar to that noted in the Mediterranean Basin (Stiner 2014) and suggests that a common visual communication system may have been emerging at this time.

The somewhat inconclusive result from the Dordogne region (50% basket-shaped) analysis may actually be a reflection of extensive social entanglements. This region is situated approximately 300-350 km from the Mediterranean coast, which falls just on outside the limit of the range of UP mobility noted by Fébolet-Augustins (2009). This may mean that Gravettian populations in this region were either seasonally travelling to the Mediterranean coast where shells were gathered or were part of a larger network of social and material entanglements linked to their region. As such, they would have had access to a much more diverse range of marine shells, resulting in more diverse genera being used for the creation of ornaments.

The standardization of shell beads is particularly interesting when considering the selection of other materials for the creation of ornaments. It appears that when shells were not available for the creation of ornaments, other materials were used in their place. For instance, in some places red deer canines and shaped stone, ivory, and bone were used to mimic basket-shapes (Conneller 2011, Stiner 2014). At Pair-non-Pair in France, for example, a piece of ivory carved to mimic a cowrie shell was found dating to the Gravettian period (Taborin 2000). The substitution of other materials in place of marine shells seems to have its roots earlier in the Paleolithic. Pieces of ivory carved into a basket shape have been found at many sites dating to the Aurignacian, particularly in areas of Germany without immediate access to the sea (Conneller 2011). Additionally, it is believed that the use of red deer canines may be indicative of an effort to conform to the relatively standardized basket-shape of the predominant marine shell species used (Conneller 2011; Stiner 2014).

The basket-shaped *Nassarius* shell has been referred to by some as the preferred shell of the Paleolithic (Bar-Yosef 2015). However, this does not appear to be the case with regards to the sites examined here. Of the 23 species of marine shell represented in this sample, only three (or 13%) are of the *Nassarius* genus. Species from the *Nassarius* genus would have been readily available to Gravettian populations, as they are quite common in Atlantic waters off the coast of Europe (Galindo et al. 2016). The most common species represented in this sample are of the *Littorina* genus, of which there are six. These two genera are remarkably similar in appearance, however, and are both basket-shaped. Perhaps, then, it is best to discuss the marine shells in terms of their shape, size, and coloration rather than genus – after all, Gravettian populations would not have classified them by the standardized typologies we have developed for analytical purposes.

In some cases, it is difficult to come to a satisfactory conclusion when considering the data available for this study. In the Dordogne region of France, for instance, it was found that basket-shaped beads represent 50% of the selected materials for the creation of ornaments. It may be the case, however, that the non-basket shaped shells are very low in number, while the *Littorina* or *Nassarius* shells are more numerous, or vice-versa. Without further information as to the actual bead counts, the true extent of the dominance of basket-shaped shells used for the creation of ornaments in the Gravettian will remain unclear.

Future research may involve the application of a similar methodological approach to assess the preceding and subsequent time periods in the same regions in order to see if there are any marked changes in the selection of marine shells for the creation of ornaments. As previously discussed, a similar study was conducted on Mediterranean sites (Stiner 2014), that revealed distinct patterns in the material choices being made. By identifying and analyzing sites in Atlantic Europe with similarly long occupation histories, one could address the question of whether material choices become more standardized over time in this region, as they do in the records at Üçağizli Cave I, Klissoura Cave I, and Riparo Mochi. Considering the state of the available data, however, for such a study to occur one would need to access the collections in order to determine species, count, measure, and analyze them.

REFERENCES

Álvarez-Fernández, E.

2002. "Perforated Homalopoma sanguineum from Tito Bustillo (Asturias): Mobility of Magdalenian Groups in Northern Spain." *Antiquity* 76:641-646.

2011. Personal Ornaments Made from Mollusc Shells in Europe during the Upper Paleolithic and Mesolithic: News and Views. In *Archaeomalacology Revisited: Non-Dietary Use of Molluscs in Archaeological Settings*, ed. Canan Çakırlar. Oxbow Books.

Avezuela Aristu, B., and E. Álvarez-Fernández

2013. "Los Objetos de Adorno-Colgantes Durante El Solutrense En La Peninsula Iberica." *Espacio Tiempo Y Forma* 1(5). https://doi.org/10.5944/etfi.5.2012.10702.

Bar-Yosef Mayer, D.

2015. "Nassarius Shells: Preferred Beads of the Palaeolithic." *Quaternary International* 390 (December):79–84. https://doi.org/10.1016/j.quaint.2015.05.042.

Barandiarán, I., and A. Cava

2008. "Gravettian Identifications in the Western Pyrenean Limit: Occupation and Use Models." *Trabajos de Prehistoria* 65(1):13–28. https://doaj.org/article/5fd7969d84e049089dc6d0a6109f89cd.

Bicho, N. Ferreira, J. F. Gibaja, M. Stiner, and T. Manne

2010. "Le Paléolithique Supérieur Au Sud Du Portugal : Le Site de Vale Boi." *L'Anthropologie* 114 (1):48–67. https://doi.org/10.1016/j.anthro.2010.01.002.

Blades, B.

1999. "Aurignacian Lithic Economy and Early Modern Human Mobility: New Perspectives from Classic Sites in the Vézère Valley of France." *Journal of Human Evolution* 37(1):91–120. https://doi.org/10.1006/JHEV.1999.0303.

2003. "End Scraper Reduction and Hunter-Gatherer Mobility." *American Antiquity* 68 (1):141–56. https://doi.org/10.2307/3557037.

Borck, L., B. Mills, M. Peeples, and J. Clark

2015. "Are social networks survival networks? An example from the Late Pre-Hispanic US Southwest." *Journal of Archaeological Method and Theory* 22:33-57.

Cashdan, E.
1985. "Coping with Risk: Reciprocity Among the Basarwa of Northern Botswana." *Man* 20(3):454. https://doi.org/10.2307/2802441.

Cava, A., I. Elorrieta, and I. Barandiaran
2009. "El Gravetiense de La Cueva de Alkerdi (Urdax, Navarra): Análisis Y Contexto de Su Industria Lítica." *Munibe Antropologia-Arkeologia* 60:51–80. https://doaj.org/article/50626d73ec1a4bec92fee6d34832d8a3.

Conard, N. and M. Bolus
2003. "Radiocarbon dating and the appearance of modern humans and timing of cultural innovations in Europe: new results and new challenges." *Journal of Human Evolution* 44:332-371.

Conneller, C.
2011. *An Archaeology of Materials : Substantial Transformations in Early Prehistoric Europe*. Routledge.

Cuenca-Solana, D., F. I. Gutiérrez-Zugasti, M. R. González-Morales, J. Setién-Marquinez, E. Ruiz-Martinez, A. García-Moreno, and I. Clemente-Conte
2013. "Shell Technology, Rock Art, and the Role of Marine Resources during the Upper Paleolithic." *Current Anthropology* 54(3):370–80. https://doi.org/10.1086/670325.

d'Errico, F., C. Henshilwood, M. Vanhaeren, and K. van Niekerk
2005. "*Nassarius kraussianus* shell beads from Blombos Cave: evidence for symbolic behavior in the Middle Stone Age." *Journal of Human Evolution* 48:3-24.

Djindjian, F.
1999. The Mid Upper Paleolithic (30,000-20,000 bp) in France. In *Hunters of the Golden Age : The Mid Upper Palaeolithic of Eurasia, 30,000-20,000 BP*, ed. Wil Roebroeks. University of Leiden.

Duarte, C, J Maurício, P B Pettitt, P Souto, E Trinkaus, H van der Plicht, and J Zilhão
1999. "The Early Upper Paleolithic Human Skeleton from the Abrigo Do Lagar Velho (Portugal) and Modern Human Emergence

in Iberia." *Proceedings of the National Academy of Sciences of the United States of America* 96(13):7604–9. https://doi.org/10.1073/PNAS.96.13.7604.

Féblot-Augustins, J.
1993. "Mobility Strategies in the Late Middle Palaeolithic of Central Europe and Western Europe: Elements of Stability and Variability." *Journal of Anthropological Archaeology* 12(3):211–65. https://doi.org/10.1006/JAAR.1993.1007.

2009. Revisiting European Upper Paleolithic raw material transfers. In *Lithic Materials and Palaeolithic Societies*, ed. Brian Adams and Brooke S. Blades. Blackwell Publishing.

Frigola, J., M. Canals, I. Cacho, A. Moreno, F. J. Sierro, J. A. Flores, S. Berné, et al.
2012. "A 500 Kyr Record of Global Sea-Level Oscillations in the Gulf of Lion, Mediterranean Sea: New Insights into MIS 3 Sea-Level Variability." *Climate of the Past* 8(3):1067–77. https://doaj.org/article/087ef2465c374510b4a51be2619580a4.

Galindo, L., N. Puillandre, J. Utge, P. Lozouet, and P. Bouchet
2016. "The Phylogeny and Systematics of the Nassariidae Revisited (Gastropoda, Buccinoidea)." *Molecular Phylogenetics and Evolution* 99(June):337–53. https://doi.org/10.1016/j.ympev.2016.03.019.

Gamble, C.
1999. *The Palaeolithic Societies of Europe*. Cambridge University Press.

Gracia, F.J., J. Rodríguez-Vidal, L.M. Cáceres, G. Belluomini, J. Benavente, and C. Alonso
2008. "Diapiric Uplift of an MIS 3 Marine Deposit in SW Spain: Implications for Late Pleistocene Sea Level Reconstruction and Palaeogeography of the Strait of Gibraltar." *Quaternary Science Reviews* 27(23–24):2219–31. https://doi.org/10.1016/J.QUASCIREV.2008.08.013.

Henry-Gambier, D., R. Nespoulet, and L. Chiotti
2013. "Attribution Culturelle Au Gravettien Ancien Des Fossiles Humains de L'abri Cro-Magnon (Les Eyzies-de-Tayac, Dordogne, France)." *PALEO* 24(24):121–38. http://journals.openedition.org.ezproxy.library.uvic.ca/paleo/2563.

Hurcombe, L M.
2014. *Perishable Material Culture in Prehistory: Investigating the Missing Majority*. Routledge. https://doi.org/10.4324/9781315817729.

Hovers, E., S. Ilani, O. Bar-Yosef, and B. Vandermeersch
2003. “An early case of color symbolism: Ochre use by modern humans in Qafzeh Cave.” *Current Anthropology* 44(4):491-522.

Mellars, P.
1996. *The Neandertal Legacy: An Archaeological Perspective from Western Europe.* Princeton University Press.

Mithen, S.
1996. *The Prehistory of the Mind: A Search for the Origins of Art, Religion and Science*. Thames & Hudson, London.

Moro-Abadía, O. & A. Nowell
2015. “Palaeolithic personal ornaments: Historical development and epistemological challenges.” *Journal of Archaeological Method and Theory* 22(3):952-79.

Rigaud, J.-P.
1999. Human adaptation to the climatic deterioration of the last Pleniglacial in southwestern France (30,000-20,000 bp). In *Hunters of the Golden Age : The Mid Upper Palaeolithic of Eurasia, 30,000-20,000 BP*, ed. Wil Roebroeks. University of Leiden.

Stiner, M.
2014. “Finding a Common Bandwidth: Causes of Convergence and Diversity in Paleolithic Beads.” *Biological Theory* 9(1):51–64. https://doi.org/10.1007/s13752-013-0157-4.

Straffon, L.
2016. Signaling in style: on cooperation, identity and the origins of visual art. In *Understanding Cultural Traits: A Multidisciplinary Perspective on Cultural Diversity,* ed. Fabrizio Panebianco and Emanuele Serrelli. Switzerland: Springer International Publishing.

Taborin, Y.
1999. Gravettian body ornaments in Western and Central Europe. In *Hunters of the Golden Age : The Mid Upper Palaeolithic of Eurasia, 30,000-20,000 BP*, ed. Wil Roebroeks. University of Leiden.

Tátá, F., J. Cascalheira, J. Marreiros, T. Pereira, and N. Bicho
2014. "Shell Bead Production in the Upper Paleolithic of Vale Boi (SW Portugal): An Experimental Perspective." *Journal of Archaeological Science* 42(1):29–41. https://doi.org/10.1016/j.jas.2013.10.029.

Vercoutère, C., G. Giacobini, and M. Patou-Mathis
2008. "Une Dent Humaine Perforée Découverte En Contexte Gravettien Ancien À L'abri Pataud (Dordogne, France)." *Anthropologie* 112(2):273–83. https://doi.org/10.1016/j.anthro.2008.02.002.

Whallon, R.
2006. "Social networks and information: non-"utilitarian" mobility among hunter-gatherers." *Journal of Anthropological Archaeology* 25:259-270.

Wiessner, P.,
1982. Risk, reciprocity and social influences on! Kung San economics. In *Politics and history in band societies*, ed. E. Leacock and R. Lee. Cambridge University Press.

Wobst, H. M.
1974. "Boundary Conditions for Paleolithic Social Systems: A Simulation Approach." *American Antiquity* 39(2–Part1):147–78. https://doi.org/10.2307/279579.

1977. Stylistic behavior and information exchange. In *For the Director: Essays in Honor of James B. Griffen*, ed. C. E. Cleleand. University of Michigan.

Zilhão, J.
1999. Nature and culture in Portugal from 30,000-20,000 bp. In *Hunters of the Golden Age : The Mid Upper Palaeolithic of Eurasia, 30,000-20,000 BP*, ed. Wil Roebroeks. University of Leiden.