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The Upper Paleolithic of Iberia

El Paleolítico Superior de la península ibérica

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ABSTRACT

This article attempts to provide a relatively complete synthesis of what is currently known about the transition from the Middle to the Upper Paleolithic and the development of human adaptations and cultures during the latter period in the Iberian Peninsula (Spain and Portugal, as well as Andorra and Gibraltar). The emphases of the work, which is inescapably selective and reliant mainly on the most recent available literature, are on environmental conditions, human settlement, technologies, subsistence and artistic expression, from a perspective that gives importance to the nature and extent of social networks as they changed throughout the course of late Marine Isotope Stage 3 and all of Stage 2.

The aim is to give coverage to all regions of the Peninsula, despite their different research histories and their varying site densities. An overall conclusion is that despite the climatic fluctuations of the Last Glacial, one can write differing *histoires de la longue durée* for such major geographic units as Cantabrian (northern Atlantic) Spain, the Ebro basin, Levantine (Mediterranean) Spain, Andalucía, the Spanish interior mesetas and Duero and Tagus basins, and the Algarve, Estremadura and Douro regions of southern and north-central Portugal. Yet, to varying degrees through time, there was both Peninsular cultural unity created by social networks among these regions and evidence of inter-band contacts with forager groups living to the north of the Pyrenees.

RESUMEN

Este artículo intenta ofrecer una síntesis relativamente completa de lo que se conoce en la actualidad sobre la transición del Paleolítico medio al superior y el desarrollo de las adaptaciones humanas y de las culturas durante el último periodo en la Península Ibérica (España y Portugal, así como Andorra y Gibraltar). Los énfasis del trabajo, que es inevitablemente selectivo y se basa principalmente en la bibliografía disponible más reciente, son las condiciones ambientales, el asentamiento humano, las tecnologías, la

subsistencia y la expresión artística, desde una perspectiva que subraya en que medida la naturaleza y extensión de las redes sociales han cambiado durante todo el desarrollo del Estadio Isotópico Marino 3 tardío y todo el Estadio 2.

El objetivo es abarcar todas las regiones de la península, pese a sus diferentes historias de la investigación y sus desiguales densidades de yacimientos. Una conclusión general es que a pesar de las fluctuaciones climáticas del Tardiglacial, uno puede escribir diferentes historias de la longue durée sobre importantes unidades geográficas como la región cantábrica (atlántica septentrional) de España, la cuenca del Ebro, la España levantina (mediterránea), Andalucía, las mesetas interiores de España y las cuencas del Duero y el Tajo, y las regiones meridional y central-septentrional de Portugal. Además, en diferentes grados a través del tiempo, hubo tanto una unidad cultural peninsular, creada por redes sociales entre esas regiones, como contactos con bandas de cazadores-recolectores al norte de los Pirineos.

Key words: Iberia; Upper Paleolithic; Chronology; Environmental diversity and change; Technology; Subsistence; Art; Last Glacial.

Palabras clave: *Península Ibérica; Paleolítico Superior; Cronología; Diversidad y cambio medioambiental; Tecnología; Subsistencia; Arte; Tardiglacial.*

1. INTRODUCTION

By 1992, when *Trabajos de Prehistoria* changed its publication norms and periodicity, Upper Paleolithic studies in both Portugal and Spain had already been profoundly transformed from their states at the respective ends of the internationally marginalized Salazar and Franco regimes in the mid-1970s. As with the Lower Paleolithic (notably because of the seminal discoveries at Atapuerca) and the Middle Paleolithic

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(with a new focus on late survival of Neandertals in a southwestern refugium), the explosion of both new cave art finds and of high-quality publications of site excavations and comparative analyses in the late 1970s and 1980s had moved Iberia from the periphery to the forefront of European Upper Paleolithic research. Just as the international excavations in El Castillo (and other caves near Santander) in the years immediately preceding World War I had been critical to the development of that research area, the reactivation of work in both Spain and Portugal, with the significant participation of small numbers of foreign archeologists (including the present author) in the late 1960s-1970s, led to the creation of a much enlarged, enhanced, world-class record, the formation of cadres of highly qualified, experienced Spanish and Portuguese prehistoric archeologists (and specialists in allied Quaternary sciences). While not abandoning all aspects of the traditional (French-dominated) culture-historical approach, many members of the post-dictatorship generation of PhDs became open to and practiced aspects of American "Processual Archeology" or British "Economic Prehistory", with emphases on environmental reconstruction, artifact and site function, subsistence, human adaptation, regional perspectives and comparative analyses. Eventually this transformation of Paleolithic archeology involved the development of cutting-edge excavation and analytical methods, world-class curation and laboratory infrastructures, and the parallel expansion of Quaternary geological and paleobiological studies in universities and museums of both countries. This process was significantly assisted by membership in the European Union since 1986 and in other international organisms such as UNESCO, including the prestige of eventual inclusion of many rock art locations among the World Heritage Sites, beginning with Altamira in 1985. The period from the arbitrary date of 1992 (coincidentally the date of my book-length synthesis of Cantabrian Stone Age prehistory) until the present has been one of continued growth in the numbers, sophistication, specialization and (thanks to EU scholarships and academic mobility funding) internationalization of the corpus of practitioners. These developments came as the cohort of the 1970s—now with increased financial support—mentored and promoted their own (and non-Iberian) students in the field, classrooms, and labs. In archeology and other fields, however, the budget cuts resulting from the world economic crisis that began in 2008 are the price being paid by the new generations of superbly trained, internationally experienced, highly qualified PhDs.

In the pages that follow I attempt to present a personal and necessarily very partial view of the current state of Upper Paleolithic research in Spain and Portugal. I am most familiar with the record from the

Vasco-Cantabrian (northern coastal) region, where I have worked discontinuously, but followed developments continuously since 1973. My direct experience in Portugal is far more limited (surveys and test excavations in Estremadura, Alentejo and Algarve in 1987-88). While I have visited many sites in Mediterranean Spain (Catalonia, Valencia and Andalucía) and the interior regions of Old and New Castile and Extremadura, and have tried to follow much of the literature, I do not have field experience in these important parts of the country (aside from a survey and testing project with G. A. Clark in Burgos in 1972). This fact undoubtedly biases the following review in terms of the evenness and detail of its coverage. In large part, because of space limits and so as not to replicate my earlier overviews of the Upper (and Middle) Paleolithic, I am confining bibliographic references mainly to recent ones, with emphases on syntheses and reports on the most significant sites. I regret the impossibility of being more inclusive in citations. I refer the reader to my earlier reviews for Cantabrian Spain (Straus 1985, 1992, 2005, 2015a) for additional details and references on that region.

I structure the article with reference to the late Upper Pleistocene climate stages derived from marine and ice cores (some equivalent to classic pollen zones as applied to Iberian caves sites by the late Arlette Leroi-Gourhan and her "school"). I also structure it in terms of the conventional cultural phases originally developed in France, despite the fact that I regard the latter as falsely implying successive cultural discontinuities and population replacements, rather than a record of continuous human occupation of the Peninsula, with variable demography and uneven rates, aspects and mechanisms of adaptive change. However it is unavoidable to use these traditional terms for successive Upper Paleolithic cultures for the sake of reader comprehension, even I believe they tend to reify both normative thinking and a French source for all cultural innovation. The culture-history approach, of which the unit terms Aurignacian, Châtelperronian, Gravettian, Solutrean, Magdalenian and Azilian are part and parcel, masks variation (caused by functional, lithological, and sampling factors, as well as by "style") within each unit and over-emphasizes differences between units. I believe that there was a great deal of continuity in technologies (aside from a few key diagnostic types—mainly projectile tips—and even these often "lingered" in the record as would be predicted by "battleship curve" seriation models of artifact popularity phase-out) across time and certainly no evidence of massive human population replacements. Rather, I see periods of greater and lesser population density in different regions and periods of greater and lesser human interaction over long distances, with more or

less homogenization of art and artifacts. Expressed otherwise, there were variations in the relative strength of regionalization versus internationalization, more restricted or more widespread social networks cross-cutting geographic, ecological and economic boundaries. Reasons for such variations remain to be fully determined, but I argue that population density and environmental conditions played critical roles therein. In this enterprise, the application of independent dating (*i.e.*, radiocarbon) and correlation of cultural levels with precise climatic events are of paramount importance, and in this the Upper Paleolithic prehistory in Iberia has made enormous strides in the last four decades.

It is important to observe that there are very significant differences in the archeological records of the major regions of Iberia. These are fundamentally due to bedrock lithology (presence or absence of caves and rock shelters) and geomorphology (erosive destruction versus alluvial, colluvial or dunal burial of sites), history, intensity and institutional bases of archeological research, and the relative favorableness of different environments for human habitation at different density levels under varying Pleistocene climatic conditions. All inter-regional comparisons must keep these factors in mind. The biogeographical or ecological zones into which the Peninsula obviously were of great importance during the Last Glacial as they are today. Thus the distinctions among the Euro-Siberian environments of the Cantabrian coastal strip and the different variations of the Mediterranean zone of not only eastern and southeastern Spain, but also of the Spanish interior, western Andalucía and central and southern Portugal are very meaningful to any reconstruction of the diverse adaptations of Upper Paleolithic foraging peoples in Iberia. The paper reviews the records for each period through such a regional lens, while highlighting the fact of more-or-less intensive inter-regional human contacts. Similarly, while the Pyrenees mark a clear geographic boundary between Iberia and the rest of Europe, even under glacial conditions the mountain chain seems to have presented less of a deterrent to human interaction (especially at its western and eastern ends) than did the Strait of Gibraltar, despite recurring arguments to the contrary (especially concerning the Solutrean of southern Iberia) (see *e.g.*, Straus 2001).

2. THE DEMISE OF THE NEANDERTALS AND THE ORIGINS OF THE IBERIAN UPPER PALEOLITHIC IN MIS 3

The transition from Middle to early Upper Paleolithic (Mousterian to Châtelperronian/early Aurignacian) technology took place late in Marine Isotope Stage 3. It has long been known (from palynological and sedimen-

tological studies) that the Würm III/IV Interstadial was climatically very complex, with warmer and cooler episodes; this instability is thoroughly detailed by papers in van Andel and Davies (2003; see also Tzedakis *et al.* 2007). The fluctuations in temperature and humidity of MIS 3 are reflected in Iberia in the forms of mosaic vegetation spectra with greater or lesser presence of grasses and trees other than pine and clear reservoirs of more temperate taxa in the south. There was persistence of ecological differences between the Mediterranean and Euro-Siberian (*i.e.*, Cantabrian) zones, as synthesized by González-Sampériz *et al.* (2010; see also Sánchez-Goñi and d'Errico 2005; Carrión *et al.* 2008). The millennia between about 45-35 cal kya seem to have been particularly volatile climate-wise according also to the latest ice and marine core records (*e.g.*, Rasmussen *et al.* 2014; Martinson *et al.* 1987), as had already been deduced by earlier palynological and pedological studies that had identified numerous interstadials in this critical time range (*e.g.*, Hengelo, Les Cottés, Arcy, Kesselt). Alternation between open woodland, parkland, and more-or-less wooded steppe landscapes seems to have been the general tonic of MIS 3 in Iberia. Whether any of these variations were serious enough to have singlehandedly caused the extinction of the Neandertals, who had for so long and so successfully adapted to the highly varied and variable environments of Iberia, is an open question. But growing evidence based on high-quality AMS radiocarbon dates suggests that, as a recognizable subspecies, they were gone by around 42 cal kya in the entire Peninsula (with the possible, though contested, exceptions of the extreme southwest and south, including Gibraltar) (Wood *et al.* 2013; pace Finlayson *et al.* 2006; see review by Aubry *et al.* 2011). The last well-dated Neandertal remains in Cantabrian Spain are the cannibalized individuals from El Sidrón Cave (Asturias): *c.* 48-49 kya (Torres *et al.* 2010), well before the onset of the Upper Paleolithic (Fig. 1). These are about the same age as the Neandertals from the south side of the Cantabrian Cordillera in Valdegoba (Burgos) (Diez *et al.* 2014). There are two major problems in working out what happened: 1.) No diagnostic human remains (neither Neandertal nor *H. sapiens sapiens* [*H.s.s.*]) have been found from secure, well-dated contexts pertaining to the actual period of the Middle-Upper Paleolithic transition in either Spain or Portugal; 2.) This period lies near the practical limit of the radiocarbon dating method, when it is very easy for samples to be contaminated by more recent materials and at a time which is also at the limit of reliable calibration. Dates from the same levels at key sites are often disparate, permitting scholars reasonably to choose either the late survival or the early extinction scenario. In addition, because of point No.1, we all perforce operate under

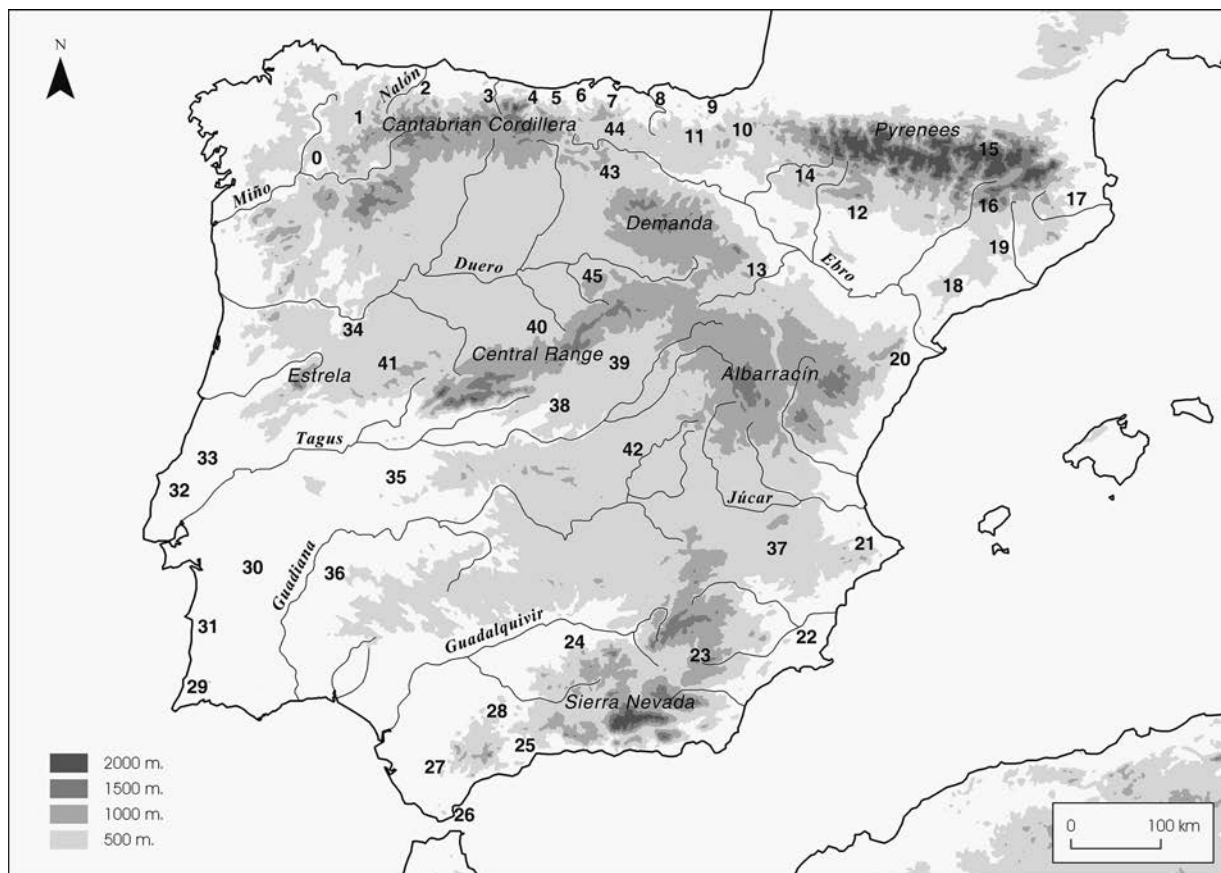


Fig. 1. Major Upper Paleolithic habitation & rock art sites of the Iberian Peninsula: 0. Valverde; 1. Cova Eirós, Valdavara; 2. Las Caldas, La Viña, La Luera, Peña de Candamo, La Paloma, El Conde; 3. Tito Bustillo, La Lloseta, Los Azules, La Güelga, Covaciella, Collubil; 4. Cueto de la Mina, La Riera, Llonín, Coimbre, Sopena; 5. Fuente del Salim, Altamira, Cualventi, La Pila; 6. El Castillo, La Pasiaga, El Pendo, El Juyo, Morín, La Garma, El Rascaño, El Piélago; 7. El Mirón, El Horno, Cullalvera, El Valle, El Otero, La Fragua, La Chora; 8. Santimamiñe, Santa Catalina, Antoliña, Bolinkoba, Askondo; 9. Labeko, Ekain, Irrikaitz, Erralla, Amalda, Ermitia, Altxerri, Urriaga, Ametzagaina, Aitzbitarte, Antón Koba; 10. Mugarduia, Berroberria, Abantz, Zatoya, Arrilor, Portugain; 11. Atxoste, Berniollo; 12. Fuente del Trucho, Chaves, Forcas, Alonsé; 13. Gato 2, Peña del Diablo, Alexandre, Vergara; 14. Legunova, Peña 14; 15. Margineda; 16. Montlleó, Cova Gran, Parco, Guilanyà; 17. L'Arbreda, Reclau Viver, Bora Gran; 18. Moli del Salt, San Gregori de Falset, Picamoixons; 19. Romaní, Agut; 20. Matutano; 21. El Parpalló, Les Mallaetes, Volcán del Faro, Beneito, Foradada, Cendres, Santa Maira, Tossal de la Roca; 22. La Boja, La Fina de Doña Martina; 23. Ambrosio, Piedras Blancas; 24. Pirulejo; 25. Nerja, Bajondillo, Humo, Higueral, Hoyo de la Mina; 26. Gorham's Cave; 27. Higueral, La Pileta; 28. Doña Trinidad de Ardales; 29. Vale Boi; 30. Escoural; 31. Petra do Patacho; 32. Caldeirão, Cabeço do Porto Marino, Pego do Diabo, Anecrial, Buraca Escura, Carneira, Vale Comprido, Buraca Grande, Lapa do Suão, Magoito, Casa da Moura; 33. Picareiro, Lagar Velho; 34. Cõa sites, Mazouco, Foz do Medal; 35. Maltravieso, Mina de Ibor; 36. Molino Manzánéz, Minerva; 37. El Niño; 38. El Sotillo, Las Delicias, Monte; 39. Jarama II, Los Casares, La Hoz, Peña Capón; 40. Estebanvela; 41. Siega Verde; 42. Buendía, Verdelpino; 43. Oña caves, Penches; 44. Nispera, Ojo Guareña; 45. Domingo García, La Griega.

the (plausible, but not infallible) *assumption* that the presence of more (e.g., antler projectile points) -or-less (e.g., blades) diagnostic Aurignacian tools means that the makers were *H.s.s.* Even less secure, because of the abundance of flake-based, “expedient” assemblages often made on local non-flint materials (so commonly the case in many Iberian regions), is the presumption of Neandertal authorship, something which can be disproven by C14 dates falling within an Upper Paleolithic or even Epipaleolithic age range (as in the case of

Abric Agut, Barcelona [Vaquero *et al.* 2002]). Finally, the record for central Portugal has recently been shown to include major erosional *hiati* in the critical period of Heinrich Event 3, c. 32-29.5 cal kya (Aubry *et al.* 2011).

With all these caveats, the last Mousterian artifact assemblages in northern Spain (presumably made by Neandertals) seem to date to around 44-43 cal kya, between Heinrich Events 5 and 4. Key levels are El Castillo 20 in Cantabria, L'Arbreda I and Romaní C

in Catalunya (Cabrera *et al.* 2006; Bernaldo de Quirós *et al.* 2010; Camps and Higham 2012; Vallverdu *et al.* 2012). A recent publication (Marín-Arroyo *et al.* 2018) has reported on Bayesian analyses of a large number of dates (including many new, carefully selected ones done with ultrafiltration), concluding that the Mousterian at least in the studied sites ended *c.* 48–45 cal kya. The oldest Aurignacian assemblages (particularly in El Castillo 18, Morín 8, La Viña VIII, L'Arbreda H, Romaní B) generally date to a few centuries or millennia later (*c.* 40–42 cal kya), depending on which dates are favored (Forzea 1995; Maíllo *et al.* 2001; Wood *et al.* 2014). Two AMS assays for the last Mousterian level in Sopeña Cave (Asturias) yielded *c.* 40 and 43 cal kya, but an ESR gave 49 ± 5 kya and the lowest Early Upper Paleolithic level has two AMS and one ESR dates centered around 40–38 k calendar years ago (Pinto 2014). This is in line with the most recently run AMS C14 dates from Isturitz in the French Basque Country (Szmíd *et al.* 2010). The Marín-Arroyo *et al.* (2018) study concludes that the Aurignacian appeared *c.* 40–43 cal kya. One Châtelperronian assemblage underlying a sequence of Aurignacian levels (Morín 10 in Cantabria) has recently been dated as young as *c.* 34 cal kya (demonstrating the difficulty of making sense of radiocarbon dates of this antiquity). Another (Labeko in Guipúzcoa) was dated to *c.* 39 cal kya and, in the latest work, to *c.* 42.5 cal kya (Wood *et al.* 2014), but again (unlike in two [contested] French Châtelperronian sites—St.Césaire and Renne), there is no evidence of Neandertal authorship (Arrizabalaga *et al.* 2009; Maroto *et al.* 2012). The Labeko Proto-Aurignacian, overlying the Châtelperronian, has recently been dated to *c.* 42 cal kya, about the same age as the Early Aurignacian of La Viña (Wood *et al.* 2014). There are a few other sites in both the Cantabrian and Catalanian regions with Châtelperronian points (with a couple of problematic hints in Castile and one in Galicia), but the existence of a widespread, separate cultural tradition across northern Spain is not clearly demonstrated. Marín-Arroyo *et al.* (2018) shed a little additional light on the age of the Châtelperronian, placing it between *c.* 42.6–41.5 cal kya. Possibly an offshoot of Mousterian, its dates overlap with the earliest Aurignacian. Although the radiometric dates do permit the possibility of Neandertal and *H.s.s.* co-existence in northern Spain, there are no cases of interstratification between Mousterian and Aurignacian levels and only one contested case of Aurignacian–Châtelperronian interstratification (El Pendo in Cantabria). This suggests that either co-existence between their respective (putative) maker populations was very brief or Neandertals quickly acculturated to and adopted the technologies of the newcomers before being genetically swamped into (as argued by Cabrera *et al.* [2006] for a so-called Transitional Aurignacian in

El Castillo). However, I reiterate that we do not (yet) actually know which human subspecies made the last Mousterian, or Châtelperronian, or Proto- and Early Aurignacian assemblages of northern Spain.

For southern Spain (below the so-called “Ebro Frontier” [*e.g.*, Zilhão 2009]) and Portugal relevant, recently excavated sites are even scarcer. Earlier claims (supported by myself [*e.g.*, Straus 1996]) for very late (≤ 30 uncal BP) survival of Neandertals in Zafarraya (Málaga), have been challenged on the basis of new assays done on animal bones after ultrafiltration that suggest an age close to the limit of the radiocarbon method (Wood *et al.* 2013). The several Neandertals from Sima de las Palomas del Cabezo Gordo in Murcia have been dated by C14 to *c.* 40–43 (Walker *et al.* 2008). Very recently, ultrafiltered AMS dates have been published for a terminal Mousterian in Cueva Antón (Mula, Murcia) —*c.* 32–33 uncal (36–37 cal) kya— and for an early Aurignacian in nearby La Boja rockshelter— *c.* 33 uncal (36.5 cal) kya (Zilhão *et al.* 2017). This is some of the strongest evidence currently available for the late survival of Middle Paleolithic technology in southern Spain.

While there are several sites in central and southern Portugal with Mousterian-associated C14 dates in the 35–25 uncal (39–34 cal) kya range and three Th-U dates from Foz do Enxarrique of *c.* 33–34 kya (Pereira *et al.* 2012; Zilhão 2009), much work remains to be done to re-date/re-excavate key sites in the country in order to pinpoint the credible end of the Middle Paleolithic. Controversy surrounds claims for Aurignacian presence in Portugal, notably at Pego do Diabo and Gato Preto (Zilhão 2009; contra Bicho 2005a, who argues for Gravettian attribution). In any event, there is currently no Proto- or Early Aurignacian evidence, though an argument (unsupported by any radiometric dates) has recently been made for a Final Aurignacian lithic assemblage at the open-air site of Gândara de Outil 1 near Coimbra (west-central Portugal) (Aubry *et al.* 2011). There *may* have been an overlap of late Mousterian and early Gravettian industries (and presumably Neandertals and *H.s.s.*) in the southern half of Portugal between *c.* 34–32 cal kya, in part based on U-Th dates of 35–32 kya from the open-air Middle Paleolithic site of Foz do Enxarrique (Haws 2012; Bicho *et al.* 2015).

In central eastern Spain, there may have been a very late Aurignacian presence in the caves of Les Mallaetes (Valencia province) with few artifacts that include three antler points associated with a date of *c.* 34.5 cal kya (Villaverde 2014) and Beneito (Alicante) (Iturbe *et al.* 1993). However this might actually correspond to an early Gravettian with two disparate C14 dates of *c.* 38 and 31 cal kya (both with huge standard errors). Cova Foradada (Alicante) has a banal industry that might be attributable to the Aurignacian

(dated to around 40 cal kya) overlain in turn by late Aurignacian levels (with perforated lynx teeth and shells) dated between about 31-35 cal Kya (Casabó 2001; Zilhão 2009). Overall, the presence of Aurignacian sites in Mediterranean Spain is very patchy though the La Boja (Murcia) finds seem to increase the evidence. There are indications that the appearance of Upper Paleolithic technologies appeared late in southernmost Spain (Andalucía) (see Peña and Vega 2013). Indeed, the only possible exception is Bajondillo in Torremolinos (Málaga). There a small, not very diagnostic lithic assemblage (59 retouched tools, but no osseous artifacts) was recovered from a level (11) with conflicting AMS C14 and TL dates (two of the former at *c.* 38 cal kya and two of the latter at *c.* 27 kya—all with very large standard deviations) attributed to the Aurignacian (Cortés 2007). An alternative possibility is that this is Gravettian—a techno-complex very well represented in eastern and southern Spain and Portugal. In Gibraltar, the southernmost part of the Peninsula, Gorham's Cave has long been known for its Mousterian occupations. The most recent of these have been dated on charcoal from two different parts of the cave at different laboratories for two different excavation teams and with very different results. Finlayson *et al.* (2006) favor a very late age (*c.* 33 cal kya, or even *c.* 32 cal kya, based on AMS dates by Beta Labs), while Pettitt and Bailey (2000) published widely divergent Oxford AMS dates, but centered on about 37 cal kya. Clearly, it might be useful to re-date Gorham's Cave using the latest ultrafiltration pretreatment methods. All in all, the technological transition from the Mousterian to the Aurignacian *sensu lato* and the nature and timing of the replacement of *Homo sapiens neanderthalensis* by *Homo sapiens sapiens* on the Iberian Peninsula remain very important, fascinating, but unresolved questions. How long both populations may have co-existed (thus providing the possibility for DNA-proven interbreeding and acculturation creating the Châtelperronian phenomenon) in northern Spain and whether southern Iberia was depopulated for a substantial time or saw the survival of some Neandertals until the first significant arrival of *H.s.s.* with late Aurignacian and/or Gravettian technology, are research areas in need of continued attention (and the chance discovery and excavation of relevant sites).

3. THE END OF MIS 3 AND THE AURIGNACIAN TECHNO-COMPLEX *SENSU LATO*

Even though it has long been apparent that “the” Aurignacian was many things (including “Proto-”, “Early” and “Evolved” concepts—not all necessarily

sequential) in terms of its archeological manifestations, sparse—, but clear evidence (mainly from its later phases, but none of it from Iberia) shows that the humans involved were *H.s.s.* and that major technological developments included antler projectile tips and stone blades and (often curved) bladelets made on specialized cores, while far from abandoning the use of flakes as tool blanks. Abundant throughout France, Aurignacian sites in Iberia are mainly confined to the Cantabrian and northeastern and central Mediterranean coasts. A map of sites with split-base points (Tejero 2016, Fig. 5.1), one of the classic hallmarks of the Aurignacian throughout Europe from Hungary to the Atlantic, is very demonstrative: the only Spanish find-spots are along the length of the Cantabrian coast (possibly including Galicia) and in the northeastern corner of Catalunya, *i.e.*, Iberia's narrow Euro-Siberian ecozone. Even the vast, intervening Ebro basin south of the Pyrenees may not have been occupied in the Aurignacian with the possible exception of Peña Miel upper Level C (Utrilla *et al.* 2010; Pilar Utrilla, personal communication, May 22, 2017). For roughly 10-12 millennia, probably small *H.s.s.* bands settled these two regions close to and connected by a line of sites in southern France, with artifact assemblages generally rich in large blades, bladelets (made on either the same or different cores), endscraper/cores, and other tools of both Middle and Upper Paleolithic types. Both marginally retouched (“Dufour”) and backed bladelets can be found, sometimes making it difficult in the absence of split-base or rhomboidal osseous points (or C14 dates) to distinguish between small Aurignacian and Gravettian lithic assemblages. The Aurignacian records from various regions have been summarized recently: Catalunya (Mangado *et al.* 2010), Asturias (Fortea *et al.* 2010); Cantabria (Cabrera *et al.* 2006; Lloret and Maíllo-Fernández 2006) and Euskadi (Arrizabalaga and Iriarte 2010). These include varying foci on lithic technology and typology, including the effects of raw material availability on flake/blade/ bladelet production and blank size (always a far cry from the huge blades of sites in SW France near outcrops of large nodules of excellent-quality flint). It is interesting to note that most of the principal sites also contain Mousterian occupations, suggesting a continuity in settlement criteria between Neandertals and the presumably “modern” human makers of Aurignacian technologies.

But what of subsistence evidence? Beyond early overviews by J. Altuna, L. G. Freeman and L. G. Straus in the 1970s (followed, for example, by J. M. Quesada [2006]), one of the most recent syntheses for the Peninsula is that of Straus (2013a; see also Yravedra 2001, 2013, for Cantabria, particularly Covalejos), but even it contains few “new” data: Labeko (Guipúzcoa) and Beneito (Alicante, Valencia Region). In Canta-

brian Spain, compared to the Mousterian, there are generally fewer carnivores and bears in Aurignacian faunas, suggesting greater human frequency/intensity of cave site occupation and less carnivore agency in the accumulation of ungulate carcasses, with the oldest Proto-Aurignacian (and Châtelperronian) levels being exceptions. There are occasionally small numbers of remains of archaic fauna (rhino, mammoth and giant elk), but red deer, together with smaller numbers of bovines and equids, were the main game species. The red deer-focus in human subsistence began its long, rising trend at this time. There is no meaningful evidence of marine resource exploitation. The situation is similar among the few Catalanian (l'Arbreda) and Valencian (Beneito and Mallaetes) faunas: some carnivores (especially abundant in the material culture-poor "Aurignacian" level in Mallaetes) and bears, red deer dominance in some levels, ibex in others, plus horse, ass, bovines, traces of boar and roe deer, and some levels with large amounts of rabbit remains (though the presence of lynx in some contexts might suggest that humans were not the only rabbit-killers). As in Cantabria, there are traces of rhino and mammoth in l'Arbreda-archaic taxa on route to extinction in Iberia like the Neandertals. There is some evidence of marine mollusk, crustacean and urchin exploitation in Cova Foradada, which is near even the glacial shore at Cabo de la Nao (Alicante, Valencia region) (Casabó 2001). Indeterminate Early Upper Paleolithic deposits in Caldeirão and Picareiro caves in Portuguese Estremadura have yielded red deer, together with ibex, boar, roe deer, chamois, rabbit, hedgehog, and, in the former site, bear and a variety of carnivores.

Cave art presumably made by *H.s.s.* first appears in the record by at least 40 cal kya in Sulawesi (Indonesia) and, closer at hand, by around 36 cal kya in Chauvet (Ardèche, France), while ivory figurines of humans and animals first erupted on the scene in the Aurignacian of southwest Germany at the same time. Therefore it would not be too surprising to find art of Aurignacian age in Iberia. To date, however, it is very rare and not very spectacular (see Garate *et al.* 2015). Based on stratigraphic arguments related to archaeological layers banked up against and below lineal engravings on the back wall of La Viña rockshelter (Asturias), González-Pumariega *et al.* (2014) argue convincingly for an Aurignacian age for the art and a similar case can be made for similar linear markings in nearby El Conde Cave (Straus 1992). Recently a series of AMS C14 assays on bones from hearths immediately below a panel of red paintings of a bison, a feline and a bear in the Basque Country cave of Altzerri B have yielded dates of around 39 cal kya (Garate *et al.* 2014; Ruíz-Redondo 2014; Ruíz-Redondo *et al.* 2017; Garate 2018). Pike *et al.* (2012) have dated by

means of Uranium/Thorium calcite formed above (and in two cases also below) various signs (discs, spots, claviforms), with results ranging from 41.4 ± 0.6 kya (above a red disk in El Castillo) to 29.7 ± 0.6 kya (above a red dot in Tito Bustillo [Asturias]), with several dates on the order of 35 kya for these two caves plus Altamira. The authors go so far as to suggest that Neandertals might have been responsible for the first cave art in Cantabrian Spain, although the ages they give are fully in line with the calibrated AMS C14 dates for the Proto-, Early and Middle Aurignacian of the region as discussed above. All these U/Th results have been criticized by Clottes (2012) and Pons-Branchu *et al.* (2014), but they are suggestive of some decorative activity on the part of *H.s.s.* in this region (also attested in nearby Isturitz Cave). Finally, there has also been considerable controversy over the inconsistent AMS C14 dates for paintings in Peña de Candamo (Asturias), where Fortea (2002) had obtained pairs of dates on the same black (charcoal) dots of *c.* 33 uncal kya and *c.* 15.5 uncal kya from two different, experienced laboratories. These dots have been redated with extreme pretreatment measures, resulting in dates ranging from 18-22.5 uncal kya (*c.* 21-27 cal kya) (Corchón *et al.* 2014)-Solutrean or late Gravettian age, not Aurignacian. There are a few stone and bone objects with engraved lines that might represent "artistic" activity of some sort from a few sites, but no figurative art of definite Aurignacian provenance. As in Valencia and elsewhere, the Cantabrian record does include perforated teeth and other objects of presumed personal ornamentation from Aurignacian contexts in such sites as El Pendo, El Otero and Cueva Morín (Corchón 1986: 250-254). The apparently relatively low-level of artistic activity in the Iberian Peninsula indicated for the Aurignacian would seem to continue in the succeeding Gravettian.

4. THE ONSET OF MIS 2 AND GRAVETTIAN ADAPTATIONS

The transformation of Aurignacian technologies into Gravettian ones and the blossoming of the latter cultural phenomenon corresponded to the onset of MIS 2-the Last Glacial (a.k.a. Würm IV). The end of MIS 3 was marked by Heinrich Event 3 (*c.* 31 cal kya [Hemming 2004] followed by the onset of MIS 2 *c.* 29 cal kya. It was at about this time or somewhat earlier that glaciers in the Pyrenees (and some other mountains including the Cantabrian Cordillera) reached maximum extent for the Last Glacial (Serrano *et al.* 2015 with references). The sharp climatic downturn (roughly corresponding to the start of Greenland Stadial 5 according to ice core chronology of Rasmussen *et al.* [2014]) throughout the

wide area of Europe occupied by *H.s.s.* undoubtedly led to changes in weaponry (the most dynamic component of technology), but also in other aspects of material culture especially on the northern frontier in the famous Pavlovian culture of Central Europe (*e.g.*, basketry sealed with clay, mammoth bone houses, clothing as manifested by the eyed bone needle and probable fur-trapping). And, through a far-flung network of social relations (reified by extensive distributions of Mediterranean and Atlantic shells and fossils and possibly important as a risk-reduction strategy in the face of environmental and resource uncertainty), a common belief system seems to have existed at some level, as manifested by the widespread phenomenon of human burials with red ochre and grave goods stretching from Sunghir well north of Moscow to Paviland in Wales and even to Lagar Velho in Portugal. The other common trait of the Gravettian culture-complex, the so-called “Venus figurines” (probably originating in a local Aurignacian-age art-form represented by the female human statuette from Höhle Fels in SW Germany) is however absent (so far at least) from the Iberian record, despite the proximity of the Brassempouy and Lespugue figurines on the French side of the Pyrenees. Without wishing to appear to be a strict environmental determinist, I do believe that there is more than coincidental correlation involved in the Aurignacian-Gravettian transition and suggest that a significant reorganization of existing modes of adaptation took place gradually across the course of the millennia centered on 30 cal kya. There was perhaps greater urgency to develop new cultural means of confronting the onset of the pleniglacial in northern Europe, but in Iberia some of the same changes (particularly in weaponry) appeared on the scene and there was at last a major expansion of the territory of *H.s.s.* into southernmost Spain and Portugal, regions that had at most been sparsely occupied (or not at all) by the Aurignacian ancestors or even (according to some, notably C. Finlayson and colleagues) inhabited by the last-surviving Neandertals of the continent. The relationship between major, abrupt climatic swings and the development of new cultural adaptations such as the phenomenon archeologists call the Gravettian is interestingly explored from the theoretical perspective of the “repeated replacement model” by Bradtmöller *et al.* (2010; Bradtmöller *et al.* 2015; Schmidt *et al.* 2012). Whether major technological changes are always ultimately caused by cold climate crises has, however, recently been challenged by Bicho *et al.* (2017), who argue that at least the onset of the Portuguese Gravettian was correlated by the abrupt Dansgaard-Oeschger 6 warming event at *c.* 33.6 kya (GI 6). Particularly the coastal zone of southern Portugal would have included important refugia for thermophilous taxa within a highly mosaic pattern of late MIS 3 vegetation (Haws 2012).

The most recent research on the Cantabrian Gravettian are the doctoral dissertations of Bradtmöller (2014) and Peña¹ from both of which they have published a number of articles. Shortly before those studies, the Cantabrian and Iberian Gravettian records were reviewed during a symposium at the Altamira Museum in 2011 (Heras *et al.* 2013a; see also Villaverde 2001). Much of what follows is derived from that proceedings volume.

The Gravettian of Cantabrian Spain is now dated (excluding unlikely outliers) between about 33-24 cal kya (Arrizabalaga and Peña 2013; Bradtmöller 2014: 467-468, but see Marín-Arroyo *et al.* 2018 for a start date between *c.* 35-36 cal kya, overlapping with the most recent Aurignacian), Mediterranean Spain about 31-25 cal kya (Villaverde and Román 2013), and Portugal about 32-26 cal kya (not including assemblages classified as “Proto-Solutrean”, which ended around 25 cal kya) (Bicho *et al.* 2013). The Gravettian-Solutrean transition took place around the time of Heinrich Event 2 (24 cal kya). The Iberian Peninsula experienced a general decrease in temperatures and humidity during the onset of MIS 2, albeit with fluctuations in the pre-LGM period, an overall mosaic pattern of vegetation types, and significant interregional differences between the Euro-Siberian (notably Vasco-Cantabria, but also Catalunya) and Mediterranean eco-zones, the latter becoming a reservoir for many temperate arboreal taxa, while the former was dominated by open vegetation with varying densities of scattered pines often accompanied by junipers (Naughton *et al.* 2007; González-Sampériz *et al.* 2010; Bicho *et al.* 2013; Iriarte and Murélagu 2013; Rofes *et al.* 2015). Conditions worsened further at the end of this period.

Although one of the overriding characteristics of “the” Gravettian lithic technology is variability—a fact which was already reflected in the early syntheses of the “Upper Perigordian”-Gravettian in France, but generally in temporal organization (especially by D. Peyrony and D. de Sonneville-Bordes) until the notion of “facies” was incorporated by H. Movius’ Abri Pataud team and by J. P. Rigaud. The numbered French subdivisions were adopted to some extent in Iberia, especially along the Cantabrian coast (notably by J. González Echegaray, but much simplified by F. Bernaldo de Quirós), but these are now largely abandoned although the notions of Early, Middle and Late Gravettian do exist, for example as used and C14-dated in the outer and inner sectors of Aitzbitarte III Cave (Altuna *et al.* 2011, 2017). As in the Aurignacian and Magdalenian, the great site of Isturitz seems to have been

¹ Peña, P. de la 2011: *Sobre la Unidad Tecnológica del Gravetiense en la Península Ibérica*. Unpublished doctoral dissertation, Universidad Complutense, Madrid.

a key point of contact between the Gravettian worlds of Aquitaine and Vasco-Cantabria. Despite considerable overlap between so-called Evolved Aurignacian and Early Gravettian assemblages, Gravettian lithic technology emphasized the production of straight, narrow standardized blades and bladelets on prismatic cores and the backing (abrupt retouching) of many of those products into knives and small elements for composite projectiles. Stiletto-like Gravette and micro-gravette points are also fairly ubiquitous. Burins are often among the most common “substrate” tools, and can include many truncation types, notably the diminutive, multi-spall Noailles types, so localized and common in the eastern part of the Cantabrian zone. This peculiar tool type, whose function has been much debated, seems to linger in the Basque and eastern Cantabrian record in otherwise Solutrean assemblages (e.g., at Antoliña [Aguirre and González Sainz 2011]). A spectacular, recently excavated case of a temporally mid-range Gravettian stone tool assemblage dominated by Noailles burins is the inner area of Aitzbitarte III Cave near San Sebastián (Altuna *et al.* 2017), while the outer part of the same cave had far fewer of these artifacts, suggesting functional specialization. Simple endscrapers do outnumber burins in some assemblages. Although quantitatively less important than in the Aurignacian, antler points are present, including small (or single) numbers of the distinctive sagaie d’ Isturitz type concentrated in the French Pyrenees and a string of (mainly Basque Country) sites along the Cantabrian coast (San Juan 2013; Ríos Nuñez 2017). Antler projectile points do exist even in Portugal, where osseous industry is poorly represented overall in the Upper Paleolithic (Gravettian *azagayas* being mainly found in Vale Boi at Cape Saint Vincent, Algarve [Evora 2016]). However, it is clear that there was a reorganization of weapons technology in the Aurignacian–Gravettian (MIS 3 and 2) transition, with an emphasis on multi-component backed bladelet barbs and cutting edges for (presumably) wooden points and larger, single-component backed spear and javelin points.

The numbers of known sites increase significantly in the Gravettian relative to the Aurignacian, with a particularly great boom in Portugal and southern Spain. And new discoveries—including some highly unusual open-air sites in both the coastal and interior Basque Country (Irikaitz, Ametzagaina, Mugarduia, Pelbarte, Prado), some tied to the exploitation of excellent flint outcrops (Barandiarán *et al.* 2013; Arrizabalaga *et al.* 2014)—have recently boosted both the count and the representativeness of the sample. Such open-air sites had already been known in the sandy deposits near excellent flint sources around Rio Maior, Portuguese Estremadura (Zilhão 1997). Finally, unambiguous Upper Paleolithic sites (with clear Gravettian lithic charac-

teristics) are common in southerly regions of especially coastal/peri-coastal Iberia, including Gibraltar (Cortés *et al.* 2013) and the Baetic Mountains (Peña 2013). Perhaps a southward human expansion into Andalusia was facilitated along the Mediterranean coast by lowered sea level. The Portuguese “explosion” of sites is well documented in the works of J. Zilhão (e.g., 1997, for Estremadura), spectacularly augmented by the discovery of the typically “Gravettian” human burial in a Gravettian residential context in Lagar Velho (Zilhão and Trinkaus 2002), some of the rock-art associated living sites (Olga Grande, Cardina) at Côa, NE Portugal (Aubry *et al.* 2012), and the excavation of Gravettian components in the exceptional site of Vale Boi in the far southwest (Marreiros *et al.* 2013). A recent, Bayesian modeling study of the radiometric chronology of the Portuguese Gravettian concludes that this techno-complex began between *c.* 34.5 and 32 cal kya (coinciding with Heinrich Event 3) and ended between *c.* 27.4 and 26.3 cal kya (at Heinrich 2) (Bicho *et al.* 2015). Furthermore, this study argues for an early Portuguese Gravettian characterized by bi-pointed, bilaterally backed bladelets and a late phase with Gravette and micro-Gravette points, with the change in favored weapon elements having occurred around 30 cal kya. Each region of the Peninsula with significant evidence of Gravettian settlement contains several major sites with multiple occupation layers of this culture complex: for Vasco-Cantabria, Aitzbitarte III, Antoliñako and Bolinkoba; El Castillo, El Pendo, Cueto de la Mina, La Viña; for Portugal, the Côa sites and Vale Boi; for Catalunya, l’Arbreda, Reclau Viver; for greater Valencia, El Parpalló, Les Mallaetes, Beneito and Cendres; for Andalucía, Nerja and Bajondillo. In addition to these, each region has many smaller sites (for example, the recently published 25.3 uncal kya Gravettian layer in Angel 1 rockshelter in southern Teruel [Utrilla *et al.* 2017]). The clear impression is of human population expansion throughout much of Iberia, a trend already apparent nearly two decades ago, when I and colleagues tried to chart overall demographic patterns through the imperfect proxy of site numbers (Straus *et al.* 2000a, 2000b) and that has since been accentuated by new discoveries. The recent reassignment of a navicular bone from a mainly carnivore-generated assemblage of apparent MIS 2 age in Los Torrejones Cave in Guadalajara to *Homo sapiens sapiens* provides the first direct evidence of modern human presence (possibly as early as the Gravettian) in the high interior of Spain (Pablos *et al.* n. d.).

Subsistence evidence for the Gravettian is also synthesized in Straus (2013a; see also Marreiros *et al.* 2013 for Vale Boi; Aura *et al.* 2013 for Nerja; Castaños and Álvarez 2013 for El Castillo, La Garma and Antoliña; Altuna and Mariezkurrena 2011 and 2017 for Aitzbitarte III; Utrilla *et al.* 2017 for Angel 1). In the

Cantabrian zone red deer are generally the dominant game taxon, but in some steep, rocky, mountainous contexts (*e.g.*, Bolinkoba [Vizcaya], Amalda [Guipúzcoa]) ibex or chamois can be the main (or close second in the case of ibex at Antoliña [Vizcaya] or that of chamois in El Castillo Level 14) species by minimum numbers of individuals or numbers of identified specimens (although not necessarily in terms of meat weight). Bovines dominate one level (IV) in Aitzbitarte III outer cave, followed by red deer. Bovines (both bison and aurochs) heavily dominate the inner cave at Aitzbitarte III. Horse is the dominant taxon (followed by red deer) in Level 12 of El Castillo, but statistics based on the century-old and much dispersed Obermaier collection must be viewed with caution. Archaic megafauna are all but absent and carnivores are rare in most (but not all) cases. Bear and hare are rare. Salmonid and eel remains are present in small numbers in the Gravettian levels of outer Aitzbitarte III (Roselló and Morales 2011). Evidence for meaningful use of marine mollusks as food resources is limited in the region (except in the Cantabrian sites of La Garma A, Levels E and F, with nearly 400 limpets and over 100 periwinkles and in Fuente del Salín, with hundreds of limpets, along with remains of salmonids), although shells (and one seal canine at La Garma) were perforated and used for ornaments (Castaños and Álvarez 2013; Gutiérrez Zugasti *et al.* 2013).

In Catalunya, at l'Arbreda, horse dominates all Gravettian assemblages, followed by red deer, with small to trace amounts of ass, boar, chamois and aurochs. There is bear in one level and rabbits become increasingly abundant through time. Red deer (together with ibex in Beneito and Les Cendres) dominates Valencian Gravettian faunas, with very large amounts of rabbit of anthropogenic origin. Nerja (Málaga) has a very high percentage of rabbit remains; ibex (in this cave at the foot of steep, rocky slopes near the present shore) outnumbered red deer considerably. Marine mollusks and fish are present, beginning a trend that would culminate at the end of the Late Glacial when sea level rise was bringing the shore to its near-present location after the maximum recession of the LGM (Solutrean times). Pine nuts been found in Nerja provide rare evidence of the vegetal component of the diet. Vale Boi, near the present shore at Cape Saint Vincent, has a Gravettian component dominated by vast numbers of rabbit remains (24% of NISP), but also a large number of red deer bones that obviously would have translated into more food. There are also significant numbers of horse, plus traces of lion. Marine mollusks are highly diverse, but numerically overwhelmed by limpets (*Patella*). There are a (presumably scavenged) cetacean bone and a few fish remains. Vale Boi has yielded some of the earliest clear evidence for bone grease

extraction by stone boiling in the European Upper Paleolithic (Stiner 2003). Rabbit remains are extremely abundant in the Gravettian levels of the nearby Picaireiro and Anecrial caves in central Portugal and in the rockshelter of Lagar Velho. Anecrial also has ibex as the dominant ungulate game species, as does another Gravettian site, Buraca Escura, which is in a narrow mountain valley further north (Haws 2012). The Picaireiro Gravettian sequence covers a variety of climatic conditions, but the surrounding landscape in central Portugal always seems to have been a fluctuating mosaic of open and wooded vegetation, with human subsistence based on red deer, ibex and rabbit, sometimes supplemented by chamois, boar, roe deer and horse, plus abundant, ecologically diverse bird species (Haws 2012). Similarly, the faunas of the Gravettian levels of Lagar Velho record fluctuating local vegetation characteristics, but with constant food sources being rabbit and red deer, plus occasional traces of horse, aurochs, ibex, roe deer, boar and birds (Haws 2012). The systematic exploitation of small (both fast and sessile) food resources was clearly well underway before the Last Glacial Maximum in the Mediterranean eco-zone of Iberia, environments that were perhaps less rich in large ungulates (especially red deer) than Vasco-Cantabria (and Catalunya), as humans began filling up the environments of the east, southwest and south of the Peninsula.

Artistic activity and ornamentation on the part of Gravettian people was still moderate in frequency when compared with the later Magdalenian, if the surviving record is a true reflection of reality. In eastern Spain, the long tradition of engraving and painting limestone slabs at the site of Parpalló (Valencia), some with animal representations, although this was to really take off explosively in the Solutrean (Villaverde 1994). There is also a limestone slab from the Gravettian deposit in nearby Les Mallaetes with an aurochs engraving (García-Díez and Ochoa 2013). Single engraved stones with animal images have also been found in Vasco-Cantabrian Gravettian layers in Antoliña, Cueva Morín and El Castillo (Aguirre and González Sainz 2011; García-Díez and Ochoa 2013).

In both Altamira and Nerja, recent direct (U-series by Pike *et al.* [2012] in the former) and indirect (C14 on organic materials from excavations near panels in both sites), along with stylistic arguments suggest the possibility of Gravettian-age cave art (Heras *et al.* 2013a; Sanchidrián *et al.* 2013). There are experimental TL-based arguments for a Gravettian age of some of the paintings in caves of the Carranza Gorge in Vizcaya (González Sainz and San Miguel 2001). The single-component Gravettian site of Fuente del Salín (Cantabria), with handprints (García-Díez and Garrido 2013), is reminiscent of the most famous handprint site

of Gargas in the French Pyrenees also with Gravettian occupations and a C14-dated bone stuck in a crack near the images. It is also possible, based on U-series dates of calcite overlying a couple of handprints in El Castillo (Pike *et al.* 2012), that some of these most personal of all images were made by Aurignacian-age people. The recently discovered parietal art in Askondo Cave (Vizcaya) may be attributable to the Gravettian because of the discovery of a sagaie d'Isturitz on the surface and because of the date of *c.* 28.5 cal kya on a bone stuck in a crack in the cave wall near the art (Gárate and Ríos 2013). Various painted dots and a bison image in the cave of Peña de Candamo (Asturias) have yielded AMS dates in the late Gravettian (or earliest Solutrean) age range (Corchón *et al.* 2014). Connecting the Cantabrian and Mediterranean zones of Spain is the site of Fuente de Trucho in Huesca (Aragón), where, among the paintings, are hand stencils and other images (notably horses) argued (stylistically and by U/Th assay on overlying flowstones) to date to the Gravettian, as well as possibly to the Solutrean (Utrilla *et al.* 2013b, 2014c, 2014d; Utrilla and Bea 2015; Hoffman *et al.* 2017). Based on stylistic arguments and radiocarbon dates from a sedimentary deposit in the cave, the art in the rather isolated El Niño Cave in Albacete (La Mancha) is sometimes attributed to the Gravettian (Garate and García Moreno 2011). The Andalusian caves of Ardales (Cantalejo *et al.* 2006) and La Pileta have been argued on stylistic grounds to contain some figures of Gravettian age (Bicho *et al.* 2007). As with the ivory figurines of the Swabian Jura in SW Germany, there is considerable continuity between the rock art attributed to the Aurignacian and Gravettian in at least northern Iberia, further suggesting that the latter archeological phenomenon simply developed out of the former.

Some of the open-art rock art (especially the pecked figures [Bahn 2016, ch.9, with references]) of the Côa Valley in the Douro basin in NE Portugal is probably of Gravettian age, based on stylistic arguments and associated archeological deposits at Fariseu and loose engraved slabs found in Gravettian context at Cardina (unit 4) (Aubry and Sampaio 2008). Other open air rock art in Spain (as Siega Verda, Piedras Blancas, Domingo García) may include Gravettian-age figures, although the stylistic arguments used are often circular in character. If these ages are true, these open-air and cave art sites could be other indicators of growing populations humanizing the landscapes of Iberia and marking territories. Also connecting the Portuguese, Cantabrian and Pyrenean worlds of Gravettian art is the cave of Maltravieso in Cáceres City, with —among other figures (some possibly Solutrean)— hand stencils like those of Gravettian age in Gargas (Haute-Garonne, France), El Castillo and Fuente del Salín (Cantabria) and Fuente del Trucho. Vast stylistic similarities among

the Gravettian (and possibly Solutrean) age images of horses are believed by Utrilla *et al.* (2014c) also to connect the latter site with rock art sites in Vasco-Cantabria, Languedoc (SE France), Valencia, Andalusia and Old Castile. On the Río Guadiana border with Portugal, Spanish Extremadura (Badajoz Province) also has an open-air rock art site, Molino Manzánuez, with engraved geometric and animal images stylistically attributed to no later than the Solutrean (Balbín 2009; Collado 2009).

5. THE LAST GLACIAL MAXIMUM AND THE SOLUTREAN TECHNO-COMPLEX

The definition and age range of the Last Glacial Maximum within MIS 2 are subjects of a certain amount of debate; some advocate for a long LGM that includes much of the traditional Oldest Dryas, while others (following the classic 1976 CLIMAP paper in *Science*) believe in a shorter, worst-of-the-worst cold event (*i.e.*, Greenland Stadial 2c+2b). Although relative aridity may have increased even in the Cantabrian region, some glaciers in the Cordillera re-advanced during this time (see Serrano *et al.* 2015, with references) and sea level regression reached its greatest extent. Both these phenomena (especially the latter) changed the amounts of land available for potential human occupation. The exposed continental shelf was widest off Valencia, Algarve and Portuguese Estremadura, with only minor (*c.* 5-12 km) northward displacement of the littoral in Vasco-Cantabria. According to Clark *et al.* (2009), the LGM spanned between about 26-19 kya. In calendar years this corresponds almost exactly to the Solutrean techno-complex in Iberia (see Aura and Jordá 2014a; Calvo and Prieto 2014; Cascalheira and Bicho 2015; Schmidt 2015; Straus 2015b). Heinrich Event 2, depending on exactly how it is finally dated (*c.* 26.5-24.3 cal kya) (Sánchez Goñi and Harrison 2010) seems to have occurred abruptly and not just coincidentally around the time of the first appearance of Solutrean technology (Bicho *et al.* 2017), for which the oldest dates in various regions of Iberia —north and south— are between *c.* 25.5-24.5 cal kya. This was the time of the most severe conditions of cold and aridity for Upper Paleolithic humans in Europe. As I have long argued (*e.g.*, Straus 1991; see also Haws 2012), this cold crisis had clear and major repercussions for all aspects of human existence in Europe. The LGM which followed was briefly interrupted by Greenland (ice core) Interstadial 2 at around 23 cal kya, possibly corresponding to the classic palynological Laugerie Interstadial. Greenland Stadial 2b, just prior to Heinrich Event 1 which began *c.* 17 cal kya, was also slightly less cold (perhaps equivalent to the Lascaux pollen

zone defined in cave deposits in SW France). It was in this latter context that the Solutrean technology first began to be phased out in France. Thus, environmental conditions were not always absolutely at their worst during the entire Solutrean cultural period, and undoubtedly they were always relatively more temperate at the southern end of its range in coastal regions of Iberia than in France. On the other hand, the northern Atlantic region was certainly always more humid than the rest of the Peninsula in the Mediterranean eco-zone. (For long sequences of recently acquired, multi-proxy paleoenvironmental evidence from Vasco-Cantabrian sites with records before, during and after the LGM, see for example Cuenca-Bescós *et al.* [2009] and Straus and González Morales [2012] for El Mirón and Rofes *et al.* [2011] for Antoliñako.) It is worth noting that the extant Solutrean sites of western France were much farther from the Atlantic and thus its oceanic climatic effects than were any Iberian sites because of the vast area of the continental shelf between Bayonne and Brittany that was exposed by sea level regression far greater than any then-emerged areas in Cantabrian Spain or other coastal regions of Iberia. The presence of a sand desert in the large Les Landes triangle of extreme SW France was an impediment to communication between Solutrean people in what are today Charentes, Périgord, Quercy, etc. and those of the Basque Country and beyond, that had to be circumvented. Pyrenean glaciers made that Cordillera an effective barrier, probably funneling all contact through the narrow coastal corridors at the western (Basque) and eastern (Catalán) ends of the chain, explaining the concentrations of Solutrean sites around Isturitz and Serinya, respectively.

As argued for several years by this author (*e.g.*, Straus 1991, 2000, 2013b, 2014, 2015b, 2016) and others, the Solutrean represents a phase in the history of the human settlement of Europe (and certainly not the only one) during which people (see Fu *et al.* 2016) (like many plants and animals, such as red deer [Stevens *et al.* 2014] and even salmon [Consuegra *et al.* 2002]) retreated from the northerly parts of their earlier range and concentrated in refugia in southern France and Iberia. *Salmo salar* even invaded the eastern Mediterranean and is found in the Solutrean of L'Arbreda and Nerja (Kettle *et al.* 2011; Aura *et al.* 2016). In short, the human range contracted because of extreme LGM cold and aridity in regions that had been previously occupied by Gravettian people, namely southern Britain, northern France, the Low Countries, Switzerland, Germany, Poland and the former Czechoslovakia. Although there may have been minor northward "pulses" of momentary recolonization during relatively favorable climatic fluctuations within the LGM, northern Europe was essentially abandoned for some five

millennia and the surviving human populations existed in the Southwest (and in the partially merged Italian and Balkan peninsulas, where the Early Epigravettian cultural complex was a contemporary of the Solutrean). With extreme aridity (with active loess deposition and, in some areas, glacial cover), plant, animal and human life was simply impossible during much of the LGM in most areas of the North. In contrast, while cold, southern Europe, with greater insolation, many areas of montane relief and water courses that also permitted the growth of at least dense non-arboreal vegetation (graze), rich and diverse ungulate faunas, the marine resources of coastlines, karstic bedrock in many regions with abundant caves and rockshelters in sheltered valleys, was viable and even quite favorable for the survival of highly competent hunting-based societies. Separated by the Pyrenees, there were two "food areas" during the Solutrean: that of France with abundant reindeer and horses on the "periglacial steppe-tundra" and that of Iberia with abundant red deer and ibex, both complemented by other game species such as bison and chamois, but only rare true woodland animals like roe deer and boar. Despite their ecological and economic differences, the humans of both areas (probably in part because of low overall population numbers and the need to maintain social contacts to find mates and to insure the availability of help during crises) were certainly part of a wider, trans-Pyrenean network of relationships as an important way of dealing with their at times precarious situation. The relationship between Solutrean technology and the LGM environments has recently been explored on a theoretical level by Banks *et al.* (2009) in most stimulating fashion.

Much of the recent research on the Solutrean in Iberia has been the subject of the Vélez Blanco (Almería) symposium proceedings volume edited by Ripoll *et al.* (2014) and several papers on Spanish and Portuguese Solutrean topics were published in the earlier Preuilly (France) symposium collection edited by Société d'Études et de Recherches Archéologiques sur le paléolithique de la Vallée de la Claise (SERAP 2013) and a later one held at the UISPP Congress in Burgos edited by Straus (2015c). I draw mainly on these sources for the most recent information in what follows.

The LGM was manifested in most of Iberia by largely treeless landscapes ranging from grassland/heathland to steppe, dotted with small stands of pine, juniper and sometime birch. More warm-loving deciduous trees were limited to refugia mainly in the southernmost habitats of the Peninsula (but also locally in regions such as Catalunya and even Galicia) (Naughton *et al.* 2007; González-Sampériz *et al.* 2010). There must have been many bare, rocky upper and north-facing slopes and trees in the majority of Iberia were probably clustered in sheltered areas (such

as south-facing lower slopes) adjacent to reliable watercourses. Areas with karstic bedrock and hence good selections of caves would have been favored, although clearly not absolutely. While the northern Atlantic region was still relatively humid, the Ebro Valley, SE Spain and southern Portugal were quite arid (see Badal *et al.* 2014). Like the trees, humans must have sought out the most sheltered spots for residential habitation, ones with caves facing south or west, available water, wood for fuel, etc. Favored areas would also have to have reliable game and other food resources. Not surprisingly, many of the humanly-preferred caves in the peri-coastal regions of the Peninsula continued to be used in the Solutrean, but many more sites appear in the record, especially in Vasco-Cantabria and in Andalucía, which during the LGM was probably a particularly favorable region within the greater SW European refugium.

The number of Solutrean-point-yielding sites in Cantabrian Spain is significantly greater relative to the Gravettian ones, but most of them are small and many of the occupations are seemingly not very long or repetitive. The boom in Solutrean sites also characterizes Portugal, eastern and southern Spain (Straus *et al.* 2000a, 2000b). In Vasco-Cantabria, the most important sites include Las Caldas, La Riera/Cueto de la Mina (Asturias), Altamira, El Pendo, La Pasiiega (Cantabria), Antoliña, Aitzbitarte IV, Amalda (Euskadi), but, with a few exceptions, the cultural horizons are not as impressively thick or rich in artifacts, features and fauna as the succeeding Magdalenian ones either in the same or nearby caves. In Catalunya the principal sites are Cau de les Goges, Reclau Viver and l'Arbreda; in greater Valencia, Parpalló, Les Mallaetes, Les Cendres and Santa Maira; in Andalucía, Nerja, Ambrosio; in Portugal, Caldeirão (Estremadura), Olga Grande and Cardina at Cõa (ex-Alto Douro), Vale Boi (Algarve). The Atlantic and Mediterranean worlds were connected via the Ebro Basin, where there are a number of (mainly minor) Solutrean sites (*e.g.*, Abauntz, Chaves, Fuente del Trucho) with possible typological links to both the Cantabrian and Mediterranean point styles (Utrilla *et al.* 2010; Domingo *et al.* 2012b). The central Asturian cluster of sites along the Nalón Valley may be linked to the sites of Cõa by at least a recently discovered one in Galicia (Valverde) (Lombreira *et al.* 2014) and another in NE Portugal in the Douro tributary Sabor River valley (Foz do Medal) (Gaspar *et al.* 2015). The important Portuguese Estremadura site cluster may be connected to Vale Boi by Solutrean evidence at Escoural in Alentejo, and in turn there are two sites called El Higueral (respectively in the interiors of Málaga and Cádiz) that are located between Vale Boi and the cluster of sites in eastern Andalucía (Giles *et al.* 1998; Jennings *et al.* 2009; Torres *et al.* 2014). There is Sol-

utrean evidence all the way down to Gorham's Cave in Gibraltar (Simón *et al.* 2009). The Andalusian and Valencian sites are now linked by the rockshelter sites of La Boja and La Finca de Doña Martina in Murcia (Lucena *et al.* 2014). Both of these have stemmed/winged ("Parpalló") points, but also large numbers of backed bladelets, especially in Doña Martina (*c.* 23 cal kya) (Zilhão *et al.* 2010). The whole southern arc of Solutrean sites is characterized by stemmed/winged ("corner-notched") points, from Casa da Moura north of Lisbon to Vale Boi to Ambrosio (with many extraordinarily elegant, delicate examples [Ripoll and Muñoz 2014])-presumably representing a significant interaction sphere, just as do the concave base points of the Cantabrian region. There are traces of Solutrean occupation in the lowest level of El Pirulejo Cave in Córdoba (Cortés *et al.* 2014). Penetration(s) of the deep interior of Spain of at least a minor and/or ephemeral character are indicated by the sites of Las Delicias, El Sotillo (and others, several substantially destroyed long ago) in Madrid and Peña Capón in Guadalajara (Alcolea *et al.* 1997; Alcaraz-Castaños *et al.* 2014; Alcaraz-Castaños 2015; Fernández-Gómez and Velasco 2014). The presence of non-local flints at the Cõa sites is indicative of Solutrean movements into Old Castile and possibly beyond (Aubry *et al.* 2015) and a C14 date squarely within the Solutrean range associated with a small, typologically banal set of artifacts (but, tellingly, with two perforated marine shells) in the cave art site of Maltravieso (Cáceres) might also point to contacts between the southern Portuguese sites and the Spanish interior (Canals *et al.* 2014). But Solutrean sites definitely occur in clusters (often including one or two more or less major sites associated with a few minor ones) and these are separated by empty areas or ones with only a few finds. The impression is that some locales were favored for settlement, while other "marchlands" were less hospitable, although they had to be crossed to contact other human bands. Evidence for such long-distance interactions include the distinctive flints of Chalosse (Les Landes, SW France) and the trans-Cordilleran areas of Alava, Treviño and Navarra that are present in Solutrean sites from central Asturias (Las Caldas) to central Cantabria (Altamira) to Vizcaya (Antoliña) (Tarrío *et al.* 2013).

In calibrated years, the distinctive Solutrean weapons technology of invasively retouched (uni- and bifacial) points and either invasively and/or backed points, as well as tanged points, began to appear in both France and Iberia around 25 kya. In general it is clear that the Solutrean developed out of local manifestations of the Gravettian and that the social networks already in place among bands in southern France and around the peripheries of Iberia spread the new weapon tips and/or the ideas for them and their manufacture. One possible

Gravettian source that has received recent attention is the so-called Vale Comprido “Proto-Solutrean” phenomenon, marked by the creation of a distinctive type of unifacial point first defined in Portuguese Estremadura, but also present in southern France (though not in the intervening region of northern Spain) (Zilhão and Aubry 1997; Zilhão 2013). Each region of SW Europe witnessed its own *in situ* transition into the Solutrean, but clearly ideas for new types of weapons spread inter-regionally via human contacts. Dating between *c.* 26.5-24.5 cal kya, the Portuguese Proto-Solutrean is argued to represent the fundamental break with the Gravettian that led to the important (weapon-centered) technological re-adaptation of the Solutrean (Bicho *et al.* 2015). However, in general, the “substrate” tools in Solutrean assemblages are like those of the Gravettian in many respects, with flakes, blades and bladelets used as blanks for retouched pieces. Backed bladelets (as in the Gravettian) can be numerous and antler *azagayas* (sometimes of distinctive types such as round-section, medially flattened, and long basal bevel ones) are often present (though less abundant than in Magdalenian contexts), indicating that the mono-point projectile tips were not the only weapon technology in use in this period. However it is generally true that antler points are less abundant than in later Magdalenian assemblages in the various inhabited regions of the Peninsula (aside from Portugal, where *azagayas* are rare in all periods and nearly only found in small numbers in the Solutrean of Vale Boi [Evora 2016]). Although invented earlier (in the Pavlovian of Central Europe and even earlier in the Caucasus), the eyed bone needle made its appearance in Western Europe in the Solutrean, likely as a technological advance in the manufacture of fitted clothing and moccasins and tents in the face of great cold. The spear-thrower was also invented during the Solutrean, although the only example known to date from this period is from a SW French site, Combe Saunière. Finally, there is evidence of heat-treatment in preparation for the invasive flaking of some of the very delicate winged and tanged and other foliate points (see Tiffagom 2006).

The distinguishing aspects of the Solutrean techno-complex, the often very elaborate, fragile, but effectively deadly stone points have recently been the subjects of detailed doctoral research by Marc Tiffagom (2006) and Isabel Schmidt (2015). Among other things, the former is a study of the highly distinctive “winged and stemmed” (corner-notched) points of eastern and southern Spain, first discovered at Parpalló, but also present in Portuguese Solutrean contexts from Casa da Moura in northern Estremadura to the important site of Vale Boi in Algarve (Casalheira *et al.* 2014). Indeed, one of the things that stands out about Solutrean technology are the regional stylistic differences

among point types, including the large concave base projectiles of the Cantabrian region, the very large, bifacial laurel leaf points of various French sites such as Les Maitreaux and the Le Volgu cache, the elongated invasively worked shouldered points of SW France, the short “hooked” ones of Asturias and Cantabria, the backed, non-invasively retouched ones of eastern Spain, the “fat” asymmetrical shouldered points of Les Landes and the “slender” ones of Serinya (Catalunya). These differences are explored and analyzed in depth by Schmidt. The variations were no doubt the results of multiple factors: lithological constraints, functionality (*e.g.*, use on thrusting spears, hand-thrown javelins, atlatl propelled darts, or even arrows shot by bow), and social/territorial aspects. Experimental work by Muñoz and colleagues (2014) suggests the likelihood that the tanged “Parpalló” points were projected by bow as arrow tips. Effective, efficient, reliable, albeit delicate, killing technology in the Solutrean reflect continuing developments in the arms race that had begun with the Aurignacian *azagayas* and the Gravettian “stiletto-like” points. Good weapons—along with good clothing—could have made the difference between life and death on many occasions during the Last Glacial Maximum, even in Iberia.

Unlike the Solutrean of France, whose subsistence in most sites was dominated by reindeer or horses, in all of Iberia the chief game taxa were red deer and ibex—the latter especially in sites on or near steep, rocky slopes. These two species alternate in their dominance in Cantabrian sites such as La Riera, Las Caldas, Altamira, El Mirón, Aitzbitarte, etc., in Valencian ones such as El Parpalló and Les Mallaetes (Davidson 1989), in Andalusian ones such as Nerja, Beneito, Ambrosio and Bajondillo, and in Portuguese ones such as Caldeirão and Vale Boi. Other game such as horse, bison and chamois were also hunted. In Catalunya horses were sometimes important, as in the recently excavated site of La Balma de la Xemencia (Girona) (Mangado *et al.* 2010: 67). Rabbits are very abundant in Solutrean assemblages of Mediterranean Spain and Portugal (*e.g.*, Beneito [Domènech *et al.* 2014] Vale Boi [Casalheira *et al.* 2014]), while marine mollusks are locally abundant in both La Riera in the North (Straus and Clark 1986) and Nerja in the Southeast (Aura and Jordá 2014a, 2014b), together with small amounts of fish and traces of (probably scavenged) seals in both. (The Cantabrian marine resource exploitation evidence has recently been summarized by Álvarez and Fernández [2013]). Other sites that are today near the shore, but that would have been at moderately greater distances from the LGM littoral, also have evidence of some marine resource exploitation and many truly coastal sites are certainly under water, especially in the areas where a relatively wide, shallow continental shelf had

been dry land during the LGM (notably off the present shores of Portuguese Estremadura and Valencia). Riverine fishing is suggested by the presence of relatively abundant fish vertebrae alongside the usual ibex and red deer bones in the Solutrean of El Mirón Cave, at least 25 km from the LGM shore (Straus *et al.* 2014b).

Nearly 90 years after Luis Pericot began excavating El Parpalló, the collection of 2323 engraved stone slabs from the Solutrean levels (Villaverde 1994) is still one of the principal sources of evidence for artistic activity during this period and a key stylistic referent for “dating” cave art. Other examples of portable Solutrean art include the recently discovered slab from Vale Boi with images of three aurochs and a cervid stylistically similar to figures at both Parpalló and Côa (Bicho *et al.* 2010; Bicho *et al.* 2012), together with earlier finds from Les Mallaetes, Nerja and Gorham’s Cave. In Cantabrian Spain portable art of Solutrean age is very scarce, including notably a bear canine modified to look like a bird from El Buxú (Asturias), fragments of perforated antlers (*bastones de mando*) from Cueto de la Mina (Asturias), El Pendo (Cantabria) and Aitzbitarte (Guipúzcoa), several edge-ticked bones and mammoth ivory plaques (some perforated) from sites including Altamira, Las Caldas, Cueto de la Mina and adjacent La Riera, and Bolinkoba, as well as decorated *azagayas* from many sites (Corchón 1986; Corchón *et al.* 2013). The *baston de mando* from Volcán del Faro (Valencia) Level XIX may also be of Solutrean age (Schmidt 2015:184). There is an as-yet unpublished scallop shell from the earliest Solutrean of El Mirón Cave (Cantabria) (24.5 cal kya) with apparent engraved lines (David Cuenca-Solana and Igor Gutiérrez-Zugasti, personal communications, 2017). Perforated teeth (usually red deer canines) and shells are relatively common in many Solutrean sites (Álvarez and Fernández 2013), including Vale Boi (Cascalheira *et al.* 2014), Nerja (Aura and Jordá 2014b), El Mirón (Straus *et al.* 2014b) and Las Caldas (Corchón *et al.* 2013). Curiously, there are no human remains beyond isolated teeth and bones that are unambiguously date to the Solutrean in Iberia.

Solutrean rupestral art is directly dated by C14 in Nerja and La Pileta (Málaga) (Sanchidrián *et al.* 2001). There is art spectacularly dated *vis à vis* dated posterior sediments banked over animal paintings and in relation to levels below them from which they had been executed by standing artists in Ambrosio rockshelter (Almería) (Ripoll *et al.* 2015). Some of the open-air rock art of Côa may be attributed on stratigraphic grounds to the Solutrean according to the last published synthesis (Aubry and Sampaio 2008; Bahn 2016, ch. 9, with references). These certainly support many of the original stylistic arguments comparing Côa images to ones on slabs from the Solutrean of El Parpalló (Zil-

hão 1992). Some of the images in Fuente del Trucho (Huesca, Aragón) may be of Solutrean age on both stylistic and indirect U-series dating (Utrilla and Bea 2015; Hoffman *et al.* 2017). Cave art sites attributed stylistically at least in part to the Solutrean in Andalucía are numerous, including the major long-known cave of Doña Trinidad de Ardales—a Solutrean site like Nerja (Cantalejo *et al.* 2006)—and the open-air site of Piedras Blancas (Bicho *et al.* 2007, with references). The existence of a Solutrean occupation in Escoural, Portugal’s only cave art site, is an argument for attributing the figures to that period. Arguments for attributing several cave art images or whole sites to the Solutrean in Cantabrian Spain were given by Straus (1987a), although some of these have been more recently (but inconclusively) attributed to the Gravettian as noted above. There is, for example, archeo-stratigraphic evidence for attributing the masses of engravings in La Lluera caves (Asturias) to the Solutrean (Rodríguez-Asensio and Barrera 2013), as is also the case for some of the red tampon paintings in Cualventi (Cantabria) (Lasheras *et al.* 2005). Many of the cave art sites in southern Spain have been argued on stylistic grounds (often in comparison to the Cantabrian record) to be of Solutrean age (Bicho *et al.* 2007). Some of the Andalusian sites (*e.g.*, El Moro, La Jara, El Ciervo, Las Palomas, Realillo and other sites in the Campo de Gibraltar) contain images stylistically very similar to ones in the Cantabrian region and are attributed to the Solutrean (Ruiz *et al.* 2014). They are probably yet another indication of the existence of networks of social relationships that tied the Solutrean world together despite—or perhaps because of—the environmental stresses of the LGM, significant ecological differences, and the existence of many uninhabited (or only occasionally or ephemerally inhabited) areas across the Peninsula. Invasively retouched lithic points, exotic flints, marine mollusk shells, portable and rupestral art all are proxies for human contacts and exchanges that were, in part, important as risk-reduction mechanisms in climatically very difficult and fluctuating times.

6. OLDST DRYAS AND THE INITIAL AND LOWER MAGDALENIAN

The literature on the Magdalenian of Iberia is vast and fast-developing. One major source for much of what follows is the special issue of *Quaternary International* on “The Magdalenian Settlement of Europe” (Straus *et al.* 2012), as well as papers in several specifically Iberian symposia such as Bicho (2005b) and Mangado (2010). For this rich period, it is even more impossible in this review to cover the gamut of studies that have been published just in the last few years, so

I can only present a very abbreviated and unfortunately partial sample of the state of our knowledge of human adaptations during the Late Glacial in Spain and Portugal. The start dates for the several ice-core recorded climate fluctuations within Greenland Stadial 2 and Interstadial 1 are from Rasmussen *et al.* (2014).

The Last Glacial Maximum ended only gradually and relatively. Conditions for plants, animals and humans ameliorated only slightly for the first few millennia after about 21 cal kya but deteriorated again c. 17.5 cal kya. The Solutrean technology began to disappear first in France around 24-23 cal kya, where, due to higher latitudes, the climatic changes possibly would have been more marked at an early stage of the post-LGM than in Iberia. The characteristic invasively retouched stone projectile points disappeared and a lithic industry characterized by raclettes, transverse truncation burins (but few or no backed bladelets), together, sometimes, with many splintered pieces and tools made on both flakes and blades, also together with flaked (as opposed to groove-and-splinter) antler blanks, called the Badegoulian (ex-Magdalenian 0), appeared in many sites in the southern half of Atlantic France. “Archaic” stone tool types (denticulates, notches, sidescrapers), always present in varying frequencies, are also found in Badegoulian contexts. Raclettes (small flakes with abrupt retouch on multiple edges that sometimes look like gun-flints), usually in large quantities, are the non-exclusive hallmark of the original (*i.e.*, French) Badegoulian (see Trotignan 1984; Ducasse and Langlais 2007; Clottes *et al.* 2012). The Badegoulian-Lower Magdalenian transition in France took place around 20.5 cal kya (Ducasse 2012), about a millennium before the beginning of the classic Cantabrian Lower Magdalenian.

But what of the Solutrean-Magdalenian transition and the existence of assemblages reminiscent of the French Badegoulian in Spain? In Mediterranean Spain, the traditional convention was to label assemblages after the classic Solutrean as “Solutreo-Gravettian”, characterized by abundant backed pieces, including “Mediterranean” shouldered points whose stems were produced by backing and unmodified by invasive retouch. These are now generally placed in a Final Solutrean, although it is the case that points disappear in the records of several caves rather gradually—either because of actual shifts in the popularity of new weapon elements and/or because of inter-strata mechanical mixing. Recent scholarship, principally by J. E. Aura (*e.g.*, 2007; Aura *et al.* 2012), has identified assemblages dating to around 22 cal kya (based on one assay) in the sole site of El Parpalló that bear resemblances to the French Badegoulian. Yet the overwhelming radiocarbon evidence from throughout Iberia shows that Solutrean technology more or less disappeared around 20-21 cal

kya, *i.e.*, late in Greenland Stadial 2c (Schmidt 2015; Calvo and Prieto 2014). The elements at Parpalló that are considered indicative of a Badegoulian component include some raclettes and flake tools, decreased numbers of backed bladelets, and antler *azagayas* with forms and decorations reminiscent of ones from certain Badegoulian sites in France and early Magdalenian ones in Cantabrian Spain, although some antler blank production was in fact done by flaking as opposed to the groove-and-splinter method (Borao *et al.* 2015). Whether these similarities are coincidences or evidence of long-distance contacts and influences is unknown. It is important to note that the sites mentioned in this review of the Iberian Magdalenian are ones for which we have either radiocarbon and/or temporally diagnostic artifact evidence for placing them in specific phases. There are many more sites that are deemed certain, likely or possible Magdalenian *loci*, phase unknown. Indeed, some of the latter, in the absence of other diagnostic artifacts, could even be of Solutrean age, but lacking Solutrean points.

In Cantabrian Spain, where the Solutrean-Magdalenian transition has been the subject of debate since the studies by the Conde de la Vega del Sella and Hugo Obermaier in the early 20th century, there are few sites that seem to contain the earliest post-Solutrean phase of cultural development, notably Coimbre (Asturias) Level B5.1 (*c.* 20.5 cal kya), El Rascaño Level 5 (*c.* 19.8 cal kya), and El Mirón Levels 119-117 (*c.* 20.4 cal kya) (González Echegaray and Barandiarán 1981; Straus *et al.* 2014a; Álvarez-Alonso *et al.* 2016). There are other candidates, including the base of Obermaier’s 1.5-2 m-thick Magdalenian Beta horizon in El Castillo (Cantabria) and certain Magdalenian levels in Las Caldas in Asturias (some with raclettes, the oldest level of which produced a spearthrower), La Riera (Asturias) and Urtiaga (Guipúzcoa) (see reviews by Utrilla 1981, 1996, 2004; Aura *et al.* 2012; Álvarez-Alonso and Arrizabalaga 2014; and the recent monograph on Las Caldas by Corchón 2017). (Note that in El Mirón and Las Caldas, a few raclettes appear in later Magdalenian levels, so this tool type is not a strict diagnostic of the Initial Magdalenian/Badegoulian in Cantabrian Spain). However, there are no Badegoulian assemblages in the region if one applies all the strict criteria of the definitions originally developed in France. It is however true that there can be some raclettes and especially assemblages with many flake tools, including “archaic” types such as denticulates, notches and sidescrapers (generally made on local non-flint raw materials such as quartzite and mudstone, as in El Mirón) and splintered pieces (which may be bipolar flake cores), but without the antler blanks extracted by flaking. Backed bladelets (as in many Solutrean assemblages of the region) can be numerous. However, as in El Parpalló, Solutrean points

can be found in small numbers in many of these levels (as in the cases of Urtiaga, El Mirón, La Riera and Las Caldas), causing some of the levels in question to be labelled Final Solutrean, while others have been called Archaic Magdalenian. One plausible interpretation (long favored by this author and others) is a process of “desolutreanization” during which a kind of selection for new kinds of weapons was taking place in a classic case of seriation, as Solutrean points were phased out, while backed bladelets-cum-antler points became more “popular” in classic “battleship curve” fashion. Just as at Parpalló, there is much evidence of continuity in lithic and osseous technologies, as well as in settlement locations and subsistence strategies between the last so-called Solutrean and the first so-called Magdalenian, and certainly not an incursion from France. The key fact is that human bands were in contact with one another, so that new ideas (technological solutions and artistic/ornamental “fads”) spread “down the line”, with the main corridors of communication being the Ebro Valley and the Cantabrian coast. One possible “marker” of this earliest Magdalenian are antler wands with wavy pseudo-excised lines from the SW French sites of Le Placard, Badegoule, Pegourié and Laugerie-Haute and the Vasco-Cantabrian ones of Aitzbitarte IV, El Castillo (base of the Magdalenian Beta horizon), El Rascaño, Cueto de la Mina and Llonín (Utrilla 1986, 1996). The only currently unambiguous Initial Magdalenian site between the Spanish Mediterranean and northern Atlantic coasts is Gato-2, near the confluence of the Jalón River with the Ebro in south-central Aragón. With five AMS dates for level II ranging between 22.7-21.2 cal kya, this site lacks raclettes, but contains a “Le Placard”-type antler point with a long single-bevel base decorated with chevron engravings like pieces from the Initial Magdalenian levels in El Rascaño, El Castillo and El Parpalló, along with two Mediterranean *Homalopoma sanguineum* shells (Utrilla *et al.* 2012). The technological transition between the Solutrean and Badegoulian in France and Initial Magdalenian in Spain took place well before Heinrich Event 1, whose onset is dated to slightly less than 17 cal kya (Hemming 2004; see discussion in Schmidt 2015: 14-17)

The Initial Magdalenian of Cantabrian Spain is followed by a very clearly defined regional Lower Magdalenian, first independently defined by F. Jordá and J. González Echegaray in late 1950s/early 1960s principally at the sites of La Lloseta (Asturias), El Juyo and Altamira (Cantabria). This was a period of slight climatic moderation within Oldest Dryas, namely Greenland Stadial 2b (perhaps partly equivalent to the classic Lascaux “interstadial”?) that ended with Heinrich Event 1. According to micro-mammalian and palynological records, landscapes in this high-relief coastal and montane region were still very open: grass-

land-steppe-tundra-heathland, with scattered pines and junipers (albeit with temporally and geographically localized appearances of some deciduous trees) and barren upper and north-facing slopes, with arbustive/arboreal vegetation concentrated along water courses in sheltered spots (see Cuenca-Bescós *et al.* 2009; Iriarte *et al.* 2015, both based on the long El Mirón Cave sequence and both with references to relevant marine and terrestrial records).

The Cantabrian Lower Magdalenian is characterized at many sites by large quantities of so-called nucleiform endscrapers (some of which were merely exhausted pyramidal bladelet cores, but others of which may actually have been recycled into small scrapers [Utrilla 1984, 2004; Domingo *et al.* 2012a; Straus *et al.* 2016]), quadrangular section antler points (often with tectiform or other geometric engravings), and—in Cantabria per se and eastern Asturias—red deer scapulae with striation-engraved images of red deer hinds (and other ungulates) (González Morales *et al.* 2006; Heras *et al.* 2010). More widely, the Lower Magdalenian of Vasco-Cantabria, with other major sites that include Las Caldas, La Paloma in central Asturias, La Güelga, Cueto de la Mina, La Riera, Coimbre and Llonín in eastern Asturias, El Castillo, El Rascaño and El Mirón in Cantabria, Santimamiñe, Antoliñako, Erralla, Eka-in, Praile Aitz and Urtriaga in Euzkadi, dates between c. 19-17 cal kya (Utrilla 2004; Corchón 2005, 2017; González Sainz and Utrilla 2005). The numbers of sites is large enough to allow meaningful characterization of patterned variability among lithic artifact assemblage types/“facies” including some assemblages with microlithic triangles and more burins than the endscraper-rich ones, although microlithic triangles and nucleiform endscrapers can co-occur as at El Mirón. These have been long argued by Utrilla (1981, 1994, 2004) and colleagues (Domingo *et al.* 2012a) to be related to functional differences among sites in the same way that Straus (1983, 1986, 1992 *e.g.*) had made similar cases for not only the Magdalenian, but also the Solutrean. Several of the main Cantabrian Lower (and Middle) Magdalenian sites (*e.g.*, Urtriaga, Santimamiñe, El Juyo, El Mirón, Altamira, El Castillo, La Güelga, Las Caldas) are characterized by massive palimpsest horizons rich in lithic and osseous manufacturing debris, tools/weapons, hearths, pits and other possible anthropic features (as in El Mirón, Altamira and El Juyo [Freeman and González Echegaray 2001; Straus and González Morales 2007; Nakazawa *et al.* 2009; López Quintana 2011; González Echegaray and Freeman 2015]), faunal remains (terrestrial and aquatic), ochre pigments, ornaments and works of portable art, sometimes clearly or likely associated with rupestral art. These were probably repeatedly used as major residential “hub” or “base” camps and are often

physically associated in the same valleys with smaller, special-purpose (“logistical”) sites (see Straus 1986; Marin-Arroyo 2009a, 2009b). The intensity of repeated human occupation and the diversity of activities represented are suggestive of increased regional human population levels even beyond the fairly high levels of the Solutrean. The intensity of human movements and contacts within the framework of a dense network of local band territories from one end to the other of Cantabrian Spain and into both the trans-Cordilleran interior Basque region and the French Basque Country and Gascony during the Lower Magdalenian is indicated by the “traffic” in non-local flints (Basque region coastal flysch, Urbasa, Treviño, Chalosse) (Tarriño *et al.* 2014; Fontes *et al.* 2016, both with references). More distant contacts to the north of the Les Landes wasteland (namely with the basins of the Gironde and Charente in SW France) are suggested by the presence of a spear-thrower and an grooved reindeer incisor (an otherwise absent animal) in El Mirón level 17 that are identical to more numerous such objects in the contemporaneous Le Placard and Roc de Marcamps sites (González Morales and Straus 2009; Jeanne-Marie Geiling, personal communication, 2016).

Beyond northern Atlantic Spain, what is the evidence of Lower Magdalenian human settlement in other regions of Iberia? Compared to the abundance of Solutrean sites in Mediterranean Spain and in Portugal, there is (at least at present) relatively little evidence of either Initial or Lower Magdalenian occupation (*i.e.*, early Oldest Dryas, *c.* 21-17.5 cal kya). Did human populations decline in the post-crisis period in these regions, while it boomed in Vasco-Cantabria? Nevertheless, there are hints of human connections (presumably inter-band contacts, down-the-line exchanges of objects, as well as of information and perhaps mates) in the form of Mediterranean shells (*Homalopoma sanguineum*, *Cyclope* sp.) in the Lower Magdalenian of El Mirón Cave (Álvarez-Fernández 2006; Gutiérrez-Zugasti and Cuenca-Solana 2015). Some of the links between the two coasts in the Ebro Basin are the Huesca Province (southern edge of the Pyrenees) rock shelters of Alonsé, where there is a backed bladelet-rich late Lower Magdalenian dated to 18.2 cal kya (Montes and Domingo 2013), and Forcas I, where the basal Magdalenian level is dated to 17.7 cal BP (Utrilla and Mazo 2014).

In all the known sites of the Mediterranean region of Spain except Parpalló (and apparently Volcán del Faro), there is an erosional *hiatus* between the Final Solutrean and the first Magdalenian levels (J. Emili. Aura, personal communication, May 14, 2017).

In Catalunya, at 1,130 m a.s.l. in the Pyrenees of Lleida, there is a recently excavated open-air site, Montlleó, with two AMS dates of *c.* 18.5 and one of

c. 20.2 cal kya and a lithic industry including backed bladelets and at least one raclette. There are both Mediterranean and Atlantic shells and two hearths, one filled with burnt/calced bones, possibly used as fuel given the scarcity of trees (Mangado *et al.* 2010). The lowland southern zone of Lleida has the site of Cova Gran whose lithic assemblage includes many backed bladelets, along with truncated blades, endscrapers and burins, plus a few antler points and tooth and shell beads. It has C14 dates ranging from 20-17 cal kya, straddling the time range equivalent to the Cantabrian Lower and Middle Magdalenian (Fullola *et al.* 2012).

There is some evidence of Oldest Dryas human occupation of the interior of Spain (Cacho *et al.* 2010). Based on typological characteristics of the osseous industry, the small cave of Jarama II (on the southern edge of the Sierra Central in Guadalajara) is attributed to the Lower Magdalenian. This site is notable for a mustelid figurine carved on a whale (!) tooth. In Madrid Province is Monte rock shelter with an occupation layer dated by two disparate assays (*c.* 17.5 and 16.5 kya) and a laminar industry, decorated osseous artifacts and fox canine beads. Buendía rock shelter in Cuenca (La Mancha) has two C14 dates of *c.* 17.9 and 17.5 cal kya. Verdelpino, also in Cuenca, has a conventional C14 date of for level Vb that is centered on *c.* 17 cal BP, placing this occupation problematically in either the Lower or Middle Magdalenian. Both Cuenca sites, as well as Alejandro shelter in Soria —Old Castile— (with a conventional date of *c.* 18.5 cal kya), have rather classic Magdalenian lithic assemblages (*i.e.*, burins, endscrapers, perforators, backed bladelets).

Andalucía (at least at the present time) seems largely devoid of evidence for human occupation during the time equivalent to the Initial and Lower Magdalenian (Cortés 2010), leaving open the possibility of either a late survival of Solutrean technology (now placed in doubt by the re-dating of Ambrosio’s last levels thereof to *c.* 23 cal kya as opposed to *c.* 20.7 cal kya [Jordá *et al.* 2014]) or a significant decline in human population (or even abandonment) in early Oldest Dryas.

Portugal so far has rather little evidence of early Magdalenian occupations, with the last Solutrean dates at several sites in the center and south being *c.* 20-2-21.4 cal kya and the first Magdalenian dates being 20.3-18.7 cal kya at Cabeço do Porto Marinho, an open-air site in Estremadura north of Lisbon (Bicho and Haws 2012). Other Initial/Lower Magdalenian sites include Caldeirão, Picareiro and Suão caves also in Estremadura and Vale Boi in Algarve, all with dates ranging from 20-16 cal kya. Excluding Caldeirão level Fa, with a large standard deviation on a conventional assay, ages of *c.* 18.6-19.9 cal kya seem to cover most of the early Magdalenian levels. These assemblages often contain many flakes made on local,

non-flint raw materials, but there are also numerous backed bladelets; simple burins are abundant. Osseous industry is essentially absent from these sites.

7. BEFORE AND DURING BØLLING: THE MIDDLE MAGDALENIAN

The Middle Magdalenian of Cantabrian Spain began around 16.5 cal kya according to González Sainz and Utrilla (2005). This would be soon after the onset of Heinrich Event 1. The Middle Magdalenian lasted until around 16 cal kya, corresponding to the latter part of Greenland Stadial 2a, a very cold period following the slight warming of GS2b, with conditions beginning to ameliorate again at the end (Rivero 2015). That end is clearly marked in many sites by the appearance of “true” harpoons (with marked barbs) at 16 cal kya, about a millennium before the onset of Bølling (Greenland Interstadial 1e) —the first major warming episode of the Last Glacial (MIS 2)— but perhaps corresponding to what was classically known in palynology as Pre-Bølling. Recognition of the existence of a Middle Magdalenian in Cantabrian Spain had been slow in coming, first with attention to the proto-harpoons of Ermitia and other sites, notably Las Caldas (Utrilla 1981, 2004; Fortea 1989; Corchón 1995, 2017; Corchón *et al.* 2005), and then with the discovery of contours découpés (small perforated images of horse and caprine heads usually cut out of hyoid bones) and rondelles (round, wafer-like objects cut out of scapulae with a central hole and usually engraved with either geometric or animal designs) in a string of sites the length of the Cantabrian coast from Ekain to Las Caldas (but mainly in Cantabria and Asturias). The flurry of discoveries of such artifacts (*e.g.* at La Viña, Las Caldas, Coimbre and Tito Bustillo in Asturias, La Garma, El Linar and Cualventi in Cantabria and Ekain in Guipúzcoa [Fortea 1983; Balbín *et al.* 2003; Arias and Ontañón 2004; Schwendler 2012; Altuna and Mariezkurrena 2013; Rivero 2015; Corchón 2017; Heras *et al.* 2007]) is nothing short of amazing, given that no contours découpés or rondelles had been discovered in northern Spain during the first century of excavations there. Antler wands with semi-circular cross-sections, often heavily decorated, are found in many Middle Magdalenian sites. Split-base antler points are exceptionally common in Las Caldas (Corchón 2017). A Lussac-Angles (short, longitudinally grooved and single-bevel base) *azagaya*, typical of SW and central France, has been found in a late Lower Magdalenian level in El Mirón (González Morales and Straus 2005). Almost all Magdalenian-period sites yield needles (including whole ones or proximal fragments with “eyes”). A pair of bones from Abauntz Cave’s Middle Magda-

lenian are engraved with lines in multiples of seven that are interpreted as possible lunar calendar devices (Utrilla *et al.* 2014a).

Remarkable sites dating to this period include La Garma (Cantabria) with its dense living floors and structures exposed on the surface of the cave, unique works of portable and splendid (probably contemporaneous) rupestral art (Arias *et al.* 1999; Arias *et al.* 2008; Ontañón 2003). Las Caldas is notable for the quantity of engraved sandstone plaques and other works of art (some on unusual materials including a whale tooth) (Corchón 2017). Non-local (indeed often distant-source) flints were transported all along the corridor north of the Cordillera and western end of the Pyrenees and even across the Basque Mountain sector (*e.g.*, Corchón 2017; Corchón *et al.* 2007; Elorrieta and Tarrío 2016). The extent of Middle Magdalenian networks is also indicated by long-distance flint transport, as at Berroberría in northernmost (Atlantic watershed) Navarra, where, in addition to materials from the Basque coastal flysch outcrops, the transcordilleran outcrops of Navarra and Treviño, and those of Béarn and Chalosse extreme SW France), there are flints from Charente-Maritime (200 km north in western France) and even the famous Grand Pressigny source in Indre-et-Loire (>400 km north-northeast (Elorrieta and Tarrío 2016).

This cultural phenomenon is very distinctive and clearly related to the Middle Magdalenian of the French Pyrenees—the first significant post-LGM evidence of human occupation of the mountain chain. These distinctive portable art (presumably trade) items are absent in the rest of the Peninsula (even in the important, nearby, contemporaneous site of Abauntz in Navarra, although whose “level e” occupants [*c.* 16.4 cal kya] obviously had connections with Isturitz (based on portable art evidence such as antler burnishers with stylistically similar bison head images and the presence of five foot bones of saiga antelope [possibly transported attached to a hide], an animal found at this time in Aquitaine, but otherwise absent in Spain) and the French Basque Country (Utrilla 2004; Utrilla *et al.* 2010, 2013a, 2014a, 2014b). Abauntz, together with Fuente del Trucho was also a link between the Atlantic and Mediterranean sides of northern Iberia at the end of Oldest Dryas. Connections between the two coasts, logically via the Ebro corridor, are attested by the presence of Mediterranean shells (*Homalopoma sanguineum*, *Cyclope*, *Zonaria*) in Cantabrian sites, including in the Middle/early Upper Magdalenian of Tito Bustillo and Coimbre in Asturias) and the Middle Magdalenian of La Garma A (Cantabria) (Álvarez-Fernández 2002, 2006; Álvarez-Alonso *et al.* 2016). Connections between Abauntz and sites as far west as eastern Asturias are suggested by perforated horse hyoid bones with multiple engraved

lines like those found in La Güelga and Tito Bustillo (Menéndez 2003; Menéndez *et al.* 2005; Utrilla *et al.* 2014a, 2014b).

Sites of Middle Magdalenian (*i.e.*, before Bølling) age in Mediterranean Spain are very few. Cova Gran in Lleida has deposits dated between 17.8-16.0 cal kya (Mangado *et al.* 2010; Fullola *et al.* 2012). In Valencia, with a *hiatus* between the Initial and Upper Magdalenian, the most important site in this time range is Cendres cave, where an industry labelled Middle Magdalenian appeared at *c.* 17.8 cal kya and lasted until *c.* 18.8 cal kya. It is characterized by abundant backed, retouched and truncated bladelets, along with endscrapers (out-numbering burins) and the usual denticulates, notches and sidescrapers. Single-bevel base antler points and decorated wands are present, but no harpoons, which, as in Vasco-Cantabria and France, would appear in the Upper Magdalenian for which they are the marker artifact (Villaverde *et al.* 2012).

Old Castile has at least two rockshelter sites of Middle Magdalenian age: Vergara in Soria and the lower level of the huge Estebanvela rockshelter in Segovia just north of the Sierra de Guadarrama. The former has a single date of *c.* 17.2 cal kya and level VI in the latter has a pair of AMS dates of *c.* 17.5 cal kya (Cacho *et al.* 2012). Humans were once again able to survive on the northern meseta under cold conditions, in this case those of Greenland Stadial 2a. There is a lone site in Andalucía that has been shown to pertain to this period: El Pirulejo (Córdoba), whose level 4 dates to 17.4 cal kya and contains a decorated antler wand reminiscent of ones from the classic Middle Magdalenian of the north, with a dominance of burins and small flake tools (Cortés 2010; Cortés *et al.* 2014). It is noteworthy that the whole early Magdalenian is missing from the long sequence in Nerja Cave (Málaga) between the late Solutrean and Upper Magdalenian (Aura *et al.* 2014b) and the impressive Solutrean sequence in Ambrosio (Almería) represents the end of human occupation of the rockshelter (Jordá *et al.* 2014).

The Portuguese record for the period of the Middle Magdalenian (late GS2a) includes several radiocarbon dated levels at the open-air site of Cabeço do Porto Marinho, Caldeirão Cave level Eb, plus possibly some of the layers in Buraca Grande and Lapa do Suao (both caves also in Estremadura) (Zilhão 1997; Bicho and Haws 2012). The landscapes of GS2a (Oldest Dryas) were very steppic, with few trees (notably pines), although refugia for more thermophile taxa must have existed in the far south of the country, such as in the Algarve mountains and coastal zone. As is typical of the whole Portuguese Upper Paleolithic record, backed/retouched bladelets were particularly important in the mentioned sites, but flake tools were still important and local non-flint materials continued to be abundant

in the assemblages. An osseous industry is essentially absent.

Early (*i.e.*, Initial, Lower and Middle) Magdalenian subsistence during Oldest Dryas is relatively well-known, especially in Cantabrian and Levantine Spain, with additional data points in the Ebro Valley, Andalucía and Portugal. The density and detail of faunal studies are the greatest for Vasco-Cantabria, beginning with the classic 1972 and 1973 works of J. Altuna and L. G. Freeman, respectively. (For recent references that region, see for example: Straus and Clark 1986; Straus 1992; Altuna and Mariezkurrena 1996; Corchón *et al.* 2005; Menéndez *et al.* 2005; Marin-Arroyo 2009a, 2009b; Yravedra *et al.* 2010; López Quintana and Guenaga 2014; González Echeagaray and Freeman 2015, all with references.) It has long been known that the Cantabrian record is characterized by specialized hunting of red deer at sites along the coastal plain and in major interior valleys and of ibex in and near steep rocky slopes. Classic evidence comes from such sites as Las Caldas, La Riera, Coimbre, Altamira, El Juyo, El Rascaño, El Mirón, Santimamiñe, Ekain, Urutiaga. Some sites on steep rocky cliffs were highly dominated by ibex and others on the narrow coastal plain or on relatively broad valleys were characterized by the “wild harvesting” of red deer, to use L. G. Freeman’s term. Other sites located adjacent to both basic habitats, notably El Mirón, were co-dominated by both the caprids and cervids that were so important throughout not only Vasco-Cantabria, but also the whole of Iberia during the Late Upper Paleolithic. Long gone by this time are the archaic megafauna (rhinos, mammoths) and true woodland dwellers (roe deer, boar) are very rare. Bovines (bison and/or aurochs) and horse are present, but rare in most sites, as are small mammals (*e.g.*, leporids) and carnivores (notably wolf, fox, mustelids). However, continuing a trend already begun in such Solutrean sites as La Riera, the exploitation of marine mollusks, crabs, sea urchins and some anadromous (salmon, sea trout), estuarine and riverine fish increased (and would continue to do so in the Upper/Final Magdalenian, Azilian and Mesolithic). Human use of the litoral zone in the early Magdalenian also included the collection of amber and isolated teeth and bones of (presumably beached carcasses) seals and whales (Corchón *et al.* 2008). Other evidence of subsistence intensification (probably against the backdrop of high regional populations and even food stress) is the intensive smashing of bones as small as phalanges for marrow retrieval and even bone grease recovery by means of stone-boiling (*e.g.*, Altuna 1986; Nakazawa *et al.* 2009).

In Catalunya the prominence of horse continued in early Magdalenian archeofaunas. It is the main game species represented in Montlleó, followed by ibex, red

deer and bovines, as well as leporids, with evidence of intensive bone breakage as the last stage of carcass butchery (Mangado *et al.* 2010).

The Magdalenian faunas of Cendres Cave (Alicante) are overwhelmingly dominated by rabbit remains, but red deer is the most important large game species, followed by ibex, with traces of horse and various small carnivores, including lynx which was butchered by humans. The ungulate carcasses were intensively processed. There are also traces of seal in this coastal site (Villaverde *et al.* 2014). The Middle Magdalenian fauna of El Pirulejo is overwhelmingly dominated by rabbit, with some ibex (it is in a mountainous area of Córdoba, with pollen evidence for refugium stands of thermophile trees). The rabbits were heavily processed (broken, cut, burnt bones). There are traces of red deer, chamois, boar and small carnivores (Cortés *et al.* 2014).

The three Portuguese Lower/Middle Magdalenian sites with subsistence evidence are Vale Boi, Caldeirão and Suão (Bicho and Haws 2012). The mammalian faunal collection from Suão levels 7-9 is almost entirely composed of rabbit, with a few remains of red deer and boar and traces of aurochs, horse, and a caprid, plus small carnivores and wolf. There are birds and shellfish. Caldeirão level Eb is dominated by red deer followed by boar and then traces of a wide variety of other ungulates and small carnivores. Birds, fish and mollusks are also present. Vale Boi level 21 is dominated by remains of rabbits and red deer, followed by an unusual number of 51 horse and ass remains, plus traces of aurochs and small carnivores, plus mollusks-not as surprising as the shellfish in the other, non-coastal, sites, given Vale Boi's location near Cape St. Vincent.

In short, the subsistence base of early (*i.e.*, Initial, Lower and Middle) Magdalenian people throughout the Peninsula was quite diversified, although the core foods were almost always red deer and ibex in all environments. The Lower Magdalenian human from the burial in El Mirón Cave also attests the consumption of plants, including mushrooms, tubers and seeds, as well as fish (García-González *et al.* 2015; Power *et al.* 2015). However the “Red Lady's” main foods were ibex and red deer, plus occasional horse and chamois (Marín-Arroyo and Geiling 2015).

The early Magdalenian is, of course, best known as the period when Stone Age artistic activity was at its height-in terms of both portable and rupestral art, particularly in Cantabrian Spain. The sheer numbers of engraved objects and stylistically or radiocarbon-dated cave art figures that pertain to the Magdalenian as a whole overwhelm the entire Upper Paleolithic artistic record from the Iberian Peninsula (and undoubtedly from France as well). Clearly the socio-cultural importance of these kinds of expression, representing an overarching symbol system expressing humans' relations with

the natural world and with other humans, had grown to be central to existence within the world of Western Europe. However the surviving record is unevenly distributed among the main regions of human settlement during Oldest Dryas, with the vast majority of cave art sites and examples of portable art being from Cantabrian Spain, although El Parpalló in Valencia still has an extraordinary number (994) of engraved stone slabs in its two early Magdalenian horizons (and 439 more in the Upper Magdalenian), continuing its unique local tradition that had begun in the Gravettian (Villaverde 1994). While a significant share of the rock art of southern Spain and Portugal was probably made during the Gravettian and especially Solutrean, there may have been a drop-off during the Magdalenian, possibly in line with a reduction in the density of human populations in the post-LGM period. In contrast, the large amounts of art thought or proven to pertain to the early Magdalenian in Vasco-Cantabria is correlated with very high residential site numbers. Although we will never know “why” Paleolithic people made art, social, ideological, cybernetic-instructional, sympathetic-magical and aesthetic reasons may all have been involved and these may in part have been density-dependent, related to human population levels and needs for marking and managing identity, social interactions and territory, assuring subsistence and making sense of a world (especially the Franco-Cantabrian region) in which many hunting-based groups lived under still-glacial conditions.

González Sainz (2005) presents a very complete and useful overview of the chronology and development of Cantabrian cave art. He provides a detailed discussion of media (various kinds of painting *vs.* engraving), themes, conventions and “styles” to construct a credible framework. According to the available AMS dates on charcoal pigments assembled by González Sainz (see also Corchón *et al.* 2014), Initial and Lower Magdalenian age rock art exists in Peña de Candamo, Las Chimeneas, El Castillo and especially Altamira. With considerable temporal overlap (due in part to standard deviations), other images are dated to the Middle Magdalenian in Altamira, El Castillo, La Pasiega, Las Chimeneas, La Garma (all in Cantabria), Candamo, Covaciella and Tito Bustillo (all in Asturias). Most of the dated images are of bison, but a few are of horse and ibex, along with a few “signs”. Although some of the art is located in easily accessible sectors of caves sometimes near or adjacent to living sites (as in the front areas of La Garma, Altamira or Tito Bustillo), much is in deep, dangerous and presumably rarely visited galleries (as in those same caves), suggesting powerful (spiritual, ritual) reasons for activities that may have involved only limited members of society. This phenomenon is also characteristic of the Middle and Upper Magdalenian cave art in the French Pyrenees.

This leads into a brief consideration of the evidence for ritual activity in the early Magdalenian. The prime indicator of such is from El Mirón: the burial 19 cal kya in a shallow grave of a middle-aged woman with abundant application of non-local, specular hematite red ochre (perhaps both perimortem and later), the post-burial removal of the cranium and most long bones, the reburial of other bones, and the temporal and spatial association of engravings (including possible stylized hand images) on a large limestone block immediately in front of the burial that had fallen from the cave ceiling soon before the burial and that had begun to be covered over by later archeological deposits soon afterwards (see papers in Straus and González Morales 2015). This is the only known, largely complete Upper Paleolithic burial in the whole Peninsula except for the Lagar Velho Gravettian one. However, there are several other possible cases of secondary burial of human remains from other Magdalenian contexts, including Obermaier's famous "cranial cups" in the Lower Magdalenian of nearby El Castillo and the recently described remains from the Galeria Cisterna in Portugal (Trinkaus *et al.* 2011), and it squares with ample evidence of Magdalenian manipulation and burial of human remains in France and Germany (see Pettitt 2011).

Freeman and González Echegaray (1981; González Echegaray and Freeman 2015) long argued in the repeatedly occupied Lower Magdalenian site of El Juyo Cave that various structures such as mounds, lines of stones and pits, concentrations of different-color pigments, a modified rock they interpreted as a mask-like image (reminiscent of "mask" images in Altamira and El Castillo) could be interpreted as a "sanctuary" where some sort of ritual activity may have taken place. Minor rupestral art was also found within this site on the coastal plain near Santander. The karstic system of La Garma, Lower Gallery, contains two adjacent stone structures dated to the Middle Magdalenian with abundant ornaments, portable art objects of bone and stone, ochre, animal bones (including cave lion [Cueto *et al.* 2016]), etc., physically associated with engravings on the ceiling above, all also interpreted as having been the venue of some ritual activity deep within the cave (Arias 2009). Other possible examples exist and clearly ritual behavior was common both on the surface and in both easily accessible and hard-to-reach areas of the underground world of Magdalenian people throughout Iberian. Naturally, the structures in El Juyo and La Garma could also have had more banal functions, as daily life and ritual activity (the practical and the magico-religious) were no doubt not separated as they are in the modern, industrial world.

The record of possibly Magdalenian (*sensu lato*) cave art in the La Mancha, Levantine and Andalusian

regions of Spain is very meagre at best and essentially based on stylistic arguments. The sites include Taverna (Tarragona—the only one in southernmost Catalunya), El Niño (Albacete), Fosca (Alicante), Cabras and Arco (Murcia), none of which is a major art center. Some of the art in Ardales might be of Magdalenian age based on stylistic assessments (Cantalejo *et al.* 2006). The recently discovered Extremaduran sites of Minerva rockshelter (Badajoz) and Mina de Ibor cave (Cáceres), both with animal engravings, are tentatively attributed to the Early Magdalenian on stylistic grounds (Collado 2009). The Portuguese rock art record includes the first of the open-air sites to be discovered in Iberia, Mazouco on the Douro River which is stylistically attributed to the Middle or Upper Magdalenian. Several of the fine-line engraved Côa Valley bedrock outcrops are believed to be of generic Magdalenian age and there is a Magdalenian component in the also-Gravettian and Solutrean site of Fariseu both with loose engraved stone slabs in archeological context (Bicho *et al.* 2007; Aubry and Sampaio 2008; Bahn 2016, ch. 9, with references). The open-air sites of Siega Verde (Salamanca) and Domingo García (Segovia) in are also argued to include figures of Magdalenian (as well as earlier, *i.e.*, Solutrean and/or Gravettian) age (Bicho *et al.* 2007, with references; see also Balbín and Alcolea 2014). Controversially several of the cave art sites (or certain figures therein) of northern, upland New and Old Castile (notably the cave of La Griega in Segovia [Corchón 1997 *vs.* Alcolea and Balbín 2003]) have been assigned by some specialists to the Magdalenian, including specifically Middle Magdalenian in the adjacent cases of Los Casares and La Hoz (Guadalajara) (Bicho *et al.* 2007, with references).

8. THE TARDIGLACIAL AND THE LATE (UPPER/FINAL) MAGDALENIAN

The long (8200 yrs) Greenland Stadial 2, generally rigorous until the end (equivalent with Oldest Dryas) finally began to wane, heralding the onset of the Late Glacial Interstadial (= Meiendorf+Bølling+Allerød 1 and 2 = Greenland Interstadial 1). Palynological, anthracological, micro-mammalian, stable isotope, geomorphological and other proxies indicate warming (albeit fluctuating) climates that rose dramatically in GI 1e. The pines, junipers and birches that had survived during the stadial in limited stands even in many northern habitats, increased their coverage. And a wide variety of deciduous, thermophile trees that had survived in southern refugia began to expand, as steppe-tundra-heath landscapes were replaced by parklands with varying representations of trees (see Cuenca-Bescós *et al.* 2009; González-Sampériz *et al.* 2010,

both with references). Holocene conditions had still not been achieved and there were cooling downturns between each pair of temperate episodes, but, in retrospect, the corner had been turned toward the end of glacial conditions, despite the Younger Dryas episode that was yet to come (Aura *et al.* 2011; Bicho *et al.* 2011; Straus 2011). That the Late Glacial period was still relatively cold at times is dramatically attested by the presence of reindeer in both Vasco-Cantabria and Catalunya at several Upper Magdalenian sites (Altuna 1996; Álvarez-Lao and García 2010; Castaños 2014; Gómez-Olivencia *et al.* 2014). There were great differences in climate and vegetation between the Euro-Siberian and Mediterranean eco-zones, as there are today.

Presumably developed (at least in the Franco-Cantabrian culture area) from the “proto-harpoons” of the Middle Magdalenian, “true” harpoons, the diagnostic artifacts of the Upper Magdalenian, appeared around 16.3 cal kya (González Sainz and González Urquijo 2004; González Sainz and Utrilla 2005) and had already spread quickly over a very wide range by the time that Greenland Interstadial 1e (Bølling *sensu lato* or Meiendorf *sensu stricto*) had begun about 1.2 ky later. It is thus hard to argue that the first major, dramatic warming of the Tardiglacial *caused* this important invention, but it did represent yet another shift in weapons technology. For many scholars, the Upper Magdalenian had a second phase called the Final Magdalenian, still characterized by the presence of antler harpoons (now including more bilaterally barbed ones), but also increasing numbers of Azilian-like lithic micro-points and geometrically decorated bone artifacts. This Final Magdalenian did begin at the start of GI1 (“Meiendorf”) and sometimes continued into GI1b (middle of the traditional palynological “Allerød” interstadial, *c.* 13.3 cal kya), but there is both great technological and settlement continuity and inter-regional variation across this “boundary”, despite the shift to more temperate climate and generally more wooded landscapes.

In reality, besides stylistic variations such as between France and Cantabrian Spain (the latter including ones with a basal hole found alongside ones with a basal bulge, common in France), there were probably two different basic functional kinds of harpoons: actual harpoons designed to detach from the javelin or spear shaft and to be retrieved with a lanyard and barbed points that did not detach upon striking their target, but rather were used either singly at the ends of shafts or fixed in pairs or threes (as tridents), barbs facing inward, as fish spears (Julien 1982; González Sainz 1989; Langley *et al.* 2016). Although there has been some debate as to whether these barbed points/harpoons were used on terrestrial game or on fish, the latter hypothesis seems more likely, especially as

these weapon tips are usually found in sites near the seacoast or rivers with salmon. The morphologically distinctive barbed points of Mediterranean Spain (none with elements that would have facilitated attachment of a lanyard) actually seem to have appeared a bit earlier than in Cantabrian Spain, *c.* 16.8 cal kya at Tossal de la Roca and Cendres (Alicante). Nearly half the 47 known Mediterranean-style harpoons come from Cendres (Román and Villaverde 2012), while there are several Franco-Cantabrian-style, bilaterally barbed harpoons from the classic site of Bora Gran d'en Carreras in Girona (associated with some of the few reindeer remains to be found in NE Spain) (Fullola *et al.* 2012). Portugal is almost completely devoid of harpoons, except for a possible basal fragment of one with an attachment bulge (?) from Caldeirão Cave (Evora 2016). The concept of barbed point or harpoon may have replaced the “self-barbed points” (centrally flattened *azagayas* mounted on single-bevel tipped shafts) common in earlier Magdalenian periods (Pokines and Krupa 1997).

Late Magdalenian lithic assemblages are generally highly laminar and lamellar (*i.e.*, rich in blades and especially bladelets made on specialized conical or prismatic cores by either uni- or bipolar removal. Some assemblages are burin-rich (and these are generally less elaborate than those of contemporaneous sites in France), but many have especially large numbers of endscrapers and simple perforators also make up the normal “substrate” portion. “Archaic” tools (sidescrapers, denticulates and notches) made on flakes, sometimes of local non-flint materials, can be numerous in some assemblages. The use of backed bladelets as barb or cutting edge elements in composite projectile heads, as well as the use of lithic micro-points of various types was very prominent, making microliths the numerically dominant retouched artifacts in many assemblages, as was true also in many early Magdalenian assemblages. There can also be truncated bladelets and pointed blades in some assemblages (notably in Catalunya). Naturally, however, there is much variability of both functional and sampling nature among both sites and areas within sites in terms of the representation of microliths (*i.e.*, hunting-related artifacts) versus “domestic” or substrate tools. In addition to the harpoons, antler *azagayas* are very abundant in especially the Spanish sites (Corchón 1986; González Sainz 1989; Adán 1997; Villaverde *et al.* 2016), although they are few in Portugal (notably five in Buraca Grande, northern Estremadura) (Evora 2016). In popularity, there is a tendency toward round-section, (single or double) bevel-base *azagayas* in Late Magdalenian assemblages, versus a tendency toward quadrangular-section ones in the Lower Magdalenian. The points are often highly decorated, although the frequent oblique lines across basal bevels probably were functional “anti-slip” features to aid in solid hafting

to shafts or foreshafts. As in the Middle Magdalenian, there are some perforated antlers (*bastones de mando*) in the Cantabrian Upper Magdalenian.

The Late Magdalenian is characterized not only by high numbers of sites in the traditional regions of relatively dense Upper Paleolithic settlement (Vasco-Cantabria—where virtually every river valley between the Bidasoa in the east and the Nalón in the west has multiple sites of this period—and Catalunya/Levante) (González Sainz and González Urquijo 2004; Villaverde *et al.* 2012), but also by human expansion into the uplands of Castile and into Galicia (Straus *et al.* 2000a, 2000b). Radiocarbon-dated evidence of Middle and Upper Magdalenian presence has recently been found in Galicia: Covas de Valdavara and Eirós (Lugo) (Alonso *et al.* 2014; Lombrera-Hermida *et al.* 2014). Presumably, with increased survey and *sàge* archeology, more Magdalenian (and other Upper Paleolithic) sites will be found in non-karstic western Asturias, Galicia and northern Portugal, linking the cluster of sites in Estremadura with those of central Asturias. Already there is growing evidence of Upper Magdalenian (and Epi-Magdalenian) occupation of Old Castile, most notably at Estebanvela (Segovia) (Cacho *et al.* 2006; Cacho *et al.* 2012). This vast site contains pebbles with paired stacks of many parallel engraved lines that are virtually identical to ones from the Azilian in the Abri Dufaure (Les Landes), the Abri Pagès (Lot) and Rochedane (Doubs) in SW and NE France respectively (Cacho *et al.* 2012; Cacho *et al.* 2014). There are several other probable or certain Late Magdalenian sites in the Spanish interior: the caves of Oña (Burgos), la Dehesa del Tejado de Béjar (Salamanca) on the Northern Meseta and the shelters of El Palomar and El Molino del Vadico (Albacete, La Mancha) (Cacho *et al.* 2010).

The Cantabrian record includes, from east to west, such major sites as Aitzbitarte IV, Erralla, Ekain, Silibranka, Urtiaga, Santa Catalina, Lumentxa, Santimamiñe, El Valle, El Horno, La Chora, El Otero, El Rascaño, El Pendo, El Castillo, La Pila, Cualventi, La Riera, Cueto de la Mina, Collubil, Tito Bustillo, Entrefoces, Las Caldas, Sofoxó, La Paloma, plus many lesser-known or minor sites (González Sainz 1989; González Sainz and González Urquijo 2004). Non-cave sites (particularly hunting and flint-quarry camps)—once presumably numerous—are totally missing from the record.

The Ebro Basin mainly along its northern edge, from the interior Basque area/Navarra to western Lleida, but also a few sites in the upper Jalón valley in southern Aragón, witnessed a boom in site numbers relative to the early Magdalenian, with major sites being Arrilor, Atxoste, Zatoya, Abauntz, Chaves (particularly rich in antler artifacts), Forcas and others in Catalunya

(Utrilla *et al.* 2012; Utrilla and Mazo 2014). This string of sites parallels a dense linear distribution of Upper Magdalenian localities along the northern flanks and slopes of the French Pyrenees, from the Pays Basque and Chalosse to French Catalonia (Roussillon). As in the Cantabrian Cordillera and northern meseta of Old Castile, there are many high-elevation sites on both sides of the Pyrenees, continuing a trend that had begun in the Lower/Middle Magdalenian and that would continue in the Azilian. One can imagine that many open-air sites must once have existed on the Pyrenean slopes and in the Ebro Valley itself that are today respectively either eroded away or deeply buried by alluvium. The Late Magdalenian record in Catalunya includes a few sites in the northern part of the region: Bora Gran near the coast and French border in Girona (the only one with harpoons in this region), Parco on the edge of Pyrenean foothills in Lleida, Can Garriga on the coastal plain of Barcelona Province. Southern Catalunya (Tarragona Province) has several sites: Hort de la Boquera, Moli del Salt, Els Colls, Auferí, Boix, Mallada, etc. There are several other Catalán sites (old excavations with partial collections, small finds, etc.) generically attributed to the Magdalenian, but without radiocarbon dates or supposedly diagnostic lithic artifact types that would allow them to be placed in a particular phase (Fullola *et al.* 2012), something which is also very common in Vasco-Cantabria. The Late Magdalenian record from the Valencia region includes a few sites, generally rather close to the present coast: notably Matutano, Cendres, Tossal de la Roca and Santa Maira. Andalusian sites attributed to the Upper Magdalenian are rather few: Nerja, Pirulejo and possibly Gorham's Cave (Gibraltar) (Aura *et al.* 2011). The Portuguese Upper Magdalenian includes several levels in the extraordinary site of Picareiro Cave near Fátima, as well as Cabeço do Porto Marinho, Buraca Grande, Lapa dos Coelhos, Lapa do Suão and possibly Caldeirão (Zilhão 1997; Bicho *et al.* 2006; Bicho *et al.* 2011; Bicho and Haws 2012). The Final Magdalenian, in the near-absence of diagnostic osseous artifacts, intergrades fairly imperceptibly into the Epi-Magdalenian across Younger Dryas and Preboeal (temporally equivalent to the Azilian in Cantabrian Spain and Microlaminar Epipaleolithic in Mediterranean Spain), always with abundant backed bladelets.

Late Magdalenian subsistence throughout Iberia continued to be dominated by the hunting of red deer and ibex in different, often adjacent habitats. In Vasco-Cantabria this was overwhelmingly true, although chamois was important in some sites (*e.g.*, Erralla, Aitzbitarte IV), while horses and bovines usually played small roles in human subsistence based on meat, fat, organs and marrow. True woodland ungulates only begin to make significant appearances in ar-

cheofaunas at the end of the Magdalenian (Altuna and Mariezkurrena 1996; Marín 2010). There are several sites (*e.g.*, El Rascaño, Bolinkoba, Collubil, Ermitia) that were highly specialized in the slaughter of ibex in the Cantabrian Mountains (as in the French Pyrenees) (Straus 1987b). Hunters at other sites located on the ecotone between broad, low valleys and high, steep, rocky slopes (*e.g.*, El Mirón [Marín 2010] and adjacent El Horno [Costamagno and Fano 2006]) preyed roughly equally on both key ungulate prey. Carcasses were heavily processed. There was a (counter-productive) trend toward the killing of relatively large numbers of juvenile game that is probably an indicator of food stress along with the significant exploitation of marine molluscs and fish (especially anadromous salmonids) among Late Magdalenian people as at La Riera (Straus and Clark 1986). Recent excavations in Santa Catalina, a small cave in the present day sea cliff of eastern Vizcaya have yielded some of the most diverse, interesting, detailed faunal studies since the 1970s work in La Riera. The former site has a sequence of Upper and Final Magdalenian and Azilian levels (Berganza and Arribas 2014). As noted earlier, all the levels in Santa Catalina (even the Azilian-as at the twin sites of Duruthy and Dufaure on the northern edge of the French Basque Country) have reindeer remains. But red deer is by far the dominant game species, along with significant amounts of ibex and chamois, plus small amounts of roe deer, boar, and traces of horse, bovine, bear, hare, wolf and small carnivores. Unique among northern Atlantic Spanish sites, seal remains are consistently present and in numbers that are more than one or two (50 in total in Upper/Final Magdalenian levels). There are also a handful of whale remains in the same levels (Castaños 2014). Presumably beached seals were killed and dead whales (or, more likely their bones) were scavenged/collected. The exploitation of littoral resources is amply indicated by large quantities of limpets, topshells and periwinkles (plus many other mollusks, as well as sea urchins and some barnacles and crabs) especially in the Final Magdalenian horizon (Gutiérrez Zugasti 2014; Vázquez and Rosales 2014). The ichthyofaunas are especially impressive and indeed unique for their magnitude and diversity in the Cantabrian record: dominated by salmonids (especially in the Upper Magdalenian), there are also sardines (particularly in the Final Magdalenian), cod (and various flatfish such as sole etc. (especially in the Upper Magdalenian), all presumably taken along the sea shore and in the nearby estuary of the Lea River (Roselló and Morales 2014). Bird remains are also very abundant (especially in the Final Magdalenian) and include marine and terrestrial species, with ample butchery and cooking evidence for human use in subsistence (and presumably for feathers) (Elorza 2014;

Laroulandie 2014). It would seem likely that humans had nets at least by this time. Naturally, the proximity of Santa Catalina to the Tardiglacial coastline (9 km to the -100 m isobath) is one important reason for the unusually large amounts of marine resource remains, but the character of its archeofaunas is also a clear indicator of subsistence intensification, which this author, as well as G. A. Clark (*e.g.* Straus and Clark 1986; Straus 1992) and others, have long argued, was fundamentally driven by population pressure in this geographically very confined region, squeezed between the ocean and the Cordillera backed by the high tablelands of Castile.

Harpoons are very rare far from the coasts in the interior of the Ebro drainage (one each in Bolichera (near another Final Magdalenian site, Peña del Diablo in southern Zaragoza Province) and Abauntz [Utrilla *et al.* 2010]). The site of Abauntz (Navarra), a major, multipurpose residential base camp in the Middle Magdalenian, became a short-term hunting camp near which red deer and horses were killed in late spring and where hunters left behind three stone blocks on which they engraved images of deer, ibex, horses, an anthropomorph and a possible map (Utrilla *et al.* 2009, 2010). The rockshelter of Forcas I on the southern edge of the Pyrenees in Huesca contains four Upper and Final Magdalenian levels (Utrilla and Mazo 2014). These are overwhelmingly dominated by rabbit remains, but most of these are the results of natural death in the site (not human capture and consumption). Otherwise, the limited ungulate game assemblages are dominated by red deer, with small numbers of ibex and chamois, plus traces of horse and boar, as well as fox and wildcat (Blasco and Castaños 2014).

In Catalunya there are faunal data from only a few Late Magdalenian sites. The recent excavations in Cova del Parco, at the ecotone between the Pyrenean foothills and the Ebro Basin in Lleida, with levels C14-dated to the Upper and Final Magdalenian, containing many stone-filled flat and basin hearths, and including scalene triangles among its bladelet-rich lithic assemblages, have yielded ungulate faunal assemblages almost completely composed of ibex (Fullola *et al.* 2012). This is also true of some other Catalan sites of the period (*e.g.*, l'Hort de la Boquera, Auferí), while in other sites, especially in northern Catalunya, horse was a main prey (together with several reindeer at Bora Gran). Red deer is the dominant species in most southern Catalan sites. At Bora Gran (Girona) there is also evidence for the hunting of bustards and other birds (Fullola *et al.* 2012). Rabbit remains are overwhelmingly dominant and clearly butchered in Molí del Salt (Tarragona), where there are also red deer, ibex and boar remains (Vaquero and Alonso 2014).

The Late Magdalenian level of Volcán del Faro Cave on the southern coast of Valencia, excavated in

the 1960s, yielded a fauna dominated by lagomorphs, red deer and horse, plus small amounts of aurochs, boar and birds (Davidson 1972). The basal level of Coves de Santa Maira (Alicante) dates to the Final Magdalenian and yielded ibex, red deer and traces of horse, along with rabbit (Aura 2014). The Upper Magdalenian horizon in Cova de les Cendres (Alicante) has masses of butchered rabbit remains (including many in a hearth), together with red deer (especially juveniles), plus traces of ibex, horse, seal, and small carnivores (Villaverde *et al.* 2014). The Upper and Final Magdalenian of Tossal de la Roca (Alicante) are also overwhelmingly dominated by rabbit remains, with ibex and red deer still being the main sources of meat (Cacho and Jordá 2014). The four Upper Magdalenian levels in Cova Matutano (Castellón) include some heavily dominated by rabbit (plus some hare) remains, but there are also remains of red deer (sometimes abundant), plus ibex, horse, hedgehog, birds (sometimes abundant and diverse), marine molluscs and fish (to the extent that in one level terrestrial fauna are scarce in comparison) (Olaría 2014).

The most complete subsistence information from an Andalusian Late Magdalenian site comes from Nerja Cave (Málaga) on the edge of steep, rocky hills that plunge down to the modern shore. There is a dramatic increase in marine fauna *vis à vis* the already relatively marine-rich Solutrean levels. In the Tardiglacial the shore was 4-3 km from the cave (versus 6-5 km during the LGM). There are mollusks, fish (notably members of the Gadid family) terrestrial and aquatic birds (including the now-extinct great auk, a cold-water flightless bird), fish and some (presumably beached) dolphin and whale remains, as well as whale barnacles which are indirect proof of human consumption of at least one right whale, an Ice Age inhabitant of the Mediterranean (Álvarez-Fernández *et al.* 2014; Aura *et al.* 2016). The osseous industry includes not only harpoons, but also gorges (bi-pointed objects presumably used in line-fishing). Milling stones and large amounts of seal remains appear later, in the Epi-Magdalenian (Younger Dryas). The ungulate fauna is dominated by ibex, followed by red deer (Aura and Jordá 2014b). Humans were focusing on the slaughter of nannies and their newborns and young. Edible nut-bearing piñon pine is present among the archeobotanical remains (along with oak, indicating the relatively temperate climate) (Aura *et al.* 2010). Other Late Magdalenian sites along the shore of the Bay of Málaga include Hoyo de la Mina and the Humo shelters, with evidence of marine resource exploitation. In the interior of Andalusia at Pirulejo cave (Córdoba), the Upper Magdalenian level is overwhelmingly dominated by rabbit remains, with ibex followed by red deer, and traces of boar being the only ungulate game, although there are butchered and

burnt lynx bones. Grinding stones are present (Cortés *et al.* 2014).

Estebanvela, at the northern foot of the Central Range of Castile in Segovia, yielded Late Magdalenian faunal assemblages numerically dominated by rabbits. Ibex (represented by many young animals and presumably inhabiting the steep slopes) is the most important ungulate, followed by horse (on the high rolling plains around the site), with small numbers of red deer, chamois, roe deer, and boar (the latter two animals indicating the existence of some wooded areas), and small carnivores including lynx. Remains of trout have also been found. Birds and various fruits and nuts (represented among the charcoals) may also have been eaten, although there is no proof of consumption (Cacho *et al.* 2014).

The use of a variety of plant foods (nuts such as acorns, piñones, berries and fruits including wild strawberries and olives, tubers and greens would have been available in the landscapes around Late Magdalenian sites in central and southern Portugal) and grinding stones have been found at Cabeço do Porto Marinho and Vale Boi (Bicho and Haws 2012). Rabbits were massively killed at Picareiro, Caldeirão and Suão. The principal ungulate prey at all sites is red deer, with consistent small numbers of boar and occasional traces of chamois and aurochs. Bird, fish and mollusks are also consistently present (Davis 2002; Bicho and Haws 2012). Both the rabbit and red deer were heavily butchered and processed at Picareiro, where many remains are found in large hearths. Red deer carcasses were transported more or less whole from their likely habitat on the valley floor up to this mountainside (540 m above sea level) cave where they were butchered. The fish include sardines and shad, possibly brought to the site from the relatively distant Late Glacial coast as trail food (Bicho *et al.* 2006).

The emphasis on rabbit exploitation in the Mediterranean eco-zone of Iberia (whose origins went as far back as the Middle Paleolithic, albeit on a small scale) has been stressed by Hockett (Hockett and Bicho 2000; Hockett and Haws 2002) and Jones (2015). It and the growing evidence of shellfish collection, fishing, scavenging or killing of beached seals, slaughter of even young red deer and ibex (with their mothers), systematic bone marrow and grease extraction, and likely use of plant foods (suggested by the presence of grinding stones in some sites) are indicative of further subsistence intensification in the Late Glacial period throughout the Peninsula. The heavy use of the fast and prolifically reproducing rabbit (by trapping, snaring, driving, warren-digging) in the Mediterranean eco-zone might also signal lessened post-LGM ungulate biomass than in the more humid Euro-Siberian eco-zone, especially in northern Atlantic Spain. It might

also hint at over-kill of red deer and ibex, even by Magdalenian populations in the southern regions despite being of far lower density than were the populations in the North. A process long underway in Iberia, the “Broad Spectrum Revolution” was an Upper Paleolithic phenomenon that preceded the Pleistocene-Holocene climatic transition and that was probably the result of multiple factors, including environmental changes and imbalances between regional human populations and big game availability, as presaged by research at La Riera Cave (Straus and Clark 1986) and systematically reviewed and analyzed for both Iberia and southern France by Jones (2016).

Despite the ecological differences that partially distinguished the subsistence patterns of northern versus eastern and southern Iberia, the basic similarities in lithic and osseous technology, rupestral and portable art and the evidence of transport (down-the-line trade) of exotic/non local objects (flints, seashells) argue for a general, high-level unity of a Late Magdalenian culture based on networks of social relationships among regional bands. Excellent recent examples of the long-distance circulation of flints include the archeo-petrographic work of Tarrío (2006) in the Vasco-Cantabrian and western Pyrenean regions and of Sánchez de la Torre (2015) linking sites in Catalunya (Parco, Montlleó) and Aragón (Forcas, Alonsé) with outcrops on both sides of the Pyrenees, where, by the time of the Tardiglacial, ice sheet retreat has opened many passes. Mediterranean mollusk shells occur in small numbers in Cantabrian Late Magdalenian sites (Álvarez-Fernández 2006). Marine shells (Atlantic and/or Mediterranean) used as beads are numerous in the Late Magdalenian levels of Estebanvela in the center of the Peninsula, reinforcing the evidence from the engraved pebbles that the people at this remote site were linked (directly and indirectly) across mesetas and mountains with distant bands in both Iberia and France (Jordá 2006; Cacho *et al.* 2014).

The Upper Magdalenian continued to include cave art as an important activity, concentrated in sites along the Cantabrian coast. There are peculiarities distinctive of this final period including stylized images of long-horned ibex in frontal view in portable as well as rupestral art. Other images of animals are rich in anatomical details, as in the Middle Magdalenian. Direct AMS dates on charcoal drawings place at least some of the images in Tito Bustillo, Llonín, El Castillo, La Pasiega, Las Monedas, Urdiales, La Cullalvera and possibly Ekain in the Upper or Final Magdalenian (González Sainz 2005). Strong arguments for Late Magdalenian cave art have been made for sites like Santimamiñe near Guernica in Vizcaya (González Sainz and Ruiz Idarraga 2010). Horses are supposedly more abundant than bison in the last Magdalenian cave art and there

is a convention for M-shaped internal division of the images (Ruiz-Redondo 2014). Some of the cave art of the Castilian mesetas (Penches, La Griega, Los Casares, La Hoz, El Niño, etc.) may be of Magdalenian age. This may also be the case with some of the open-air figures at Côa and Siega Verde, although there are divergent views on the dating of these and other sites, since so much is dependent on stylistic comparisons with less than unequivocally dated cave art in Vasco-Cantabria and France (*e.g.*, Alcolea and Balbín 2003, 2007).

The portable art (including the prolific decoration of utilitarian objects such as *azagayas*, so-called *bastones de mando* (which were possibly shaft straighteners) —like the famous ones from Cueto de la Mina, El Castillo, Cualventi, El Rascaño, El Valle, and El Pendo—, and harpoons) of the Vasco-Cantabrian Late Magdalenian, like that of the Lower and Middle phases, is extraordinarily rich both quantitatively and qualitatively (the latter, admittedly, judged from our aesthetic perspective). Extraordinarily detailed figures of animals are portrayed on bones and stone plaquettes from such sites as Collubil and La Riera (Asturias) and Ekain (Guipúzcoa) and on an albatross long bone from Torre (Guipúzcoa) (Corchón 1986). These pieces are very similar to ones from French Pyrenean sites, such as La Vache (Ariège). Different from the naturalistic animal-themed art which ended abruptly in Cantabrian Spain with the Final Magdalenian, but as at Estebanvela, there are several Cantabrian spatula-like flat bone “pendants” with linear barbed-wire markings that transcend our temporal-cultural distinction between Final Magdalenian and Azilian at sites like Rascaño, Piélago, La Chora, San Juan and Los Azules (González Sainz 1988). The Final Magdalenian/Epipaleolithic of Tossal de la Roca (Alicante) yielded a spatulate bone pendant with complex geometric decorations suggestive of notational activity (D’Errico and Cacho 1994).

Indeed the artistic tradition of Vasco-Cantabria on both portable and rupestral surfaces is closely similar to that of the Late Magdalenian of the French Pyrenees. As in the Middle Magdalenian, there was clearly a dense network of fairly frequent social relations between individuals and bands living in these two ecologically (Euro-Siberian, high-relief, $\pm 43^\circ$ North latitude, ibex-rich) related, but economically distinct (red deer *vs.* reindeer game-dominant, coastal *vs.* interior) regions. There is no longer any apparent “Basque gap” in cave art (mainly Magdalenian in likely age) between the French Pyrenees and Cantabria, with many discoveries having been made in very recent years—most spectacularly Armintxe in coastal Vizcaya, with a panel of animal engravings including two lions (Garate 2018; González Sainz and López Quintana 2018).

The human bands in the “Basque crossroads” (as Alvaro Arrizabalaga and María José Iriarte call

it) were also in close relationship with those of the Ebro Valley, and those had dealings with Catalanian groups. The Catalanian Late Magdalenian societies were linked both with Vasco-Cantabria and Aquitaine via the Ebro (see *e.g.*, Utrilla 1992, 1997) and with the eastern French Pyrenean region (*e.g.*, El Parco, Bora Gran with its reindeer and Franco-Cantabrian-style harpoons). From southern Catalunya to Málaga, based on the distinctive “Mediterranean” barbed points, there was a partially different technological and economic tradition. In both northern Atlantic and Mediterranean Spain marine resource exploitation increased in Late Magdalenian times and would continue to do so in the Azilian/Epimagdalenian (as indicated by La Riera, Santa Catalina, Nerja, etc.). On the other hand, the mesetas of central Spain probably had far lower human population densities than the coastal regions and those “Castilian” bands maintained contacts in the Late Magdalenian with the Franco-Cantabrian and even wider worlds (including the Mediterranean coast), as indicated by Estebanvela. Portugal shared the rabbit-rich economy of the east coast of Iberia, along with core dependence on red deer and ibex-game species that may have been less productive in the Mediterranean environments than in Atlantic ones, thus necessitating major supplementation in human diets by prolifically fertile, though fat-poor leporids. While many Tardiglacial sites may be undersea now due to a broad coastal shelf in many sectors, there are hints of the probable importance of marine resources in the overall Magdalenian subsistence of Portugal from Vale Boi and from some (later) Epimagdalenian sites in Estremadura and Alentejo. The Portuguese bands were inevitably far-removed from both Cantabrian and Levantine Spain and the social connections may have been more infrequent and tenuous. Thus their technologies continued long traditions of backed bladelet dominance versus poverty in osseous artifacts and in portable art works. Recent discoveries in Galicia (*e.g.*, Alonso *et al.* 2014; Lombera-Hermida *et al.* 2014) and increased research related to the open-air rock art concentrations in the Duero Valley of both Portugal and Spain and in Spanish Extremadura (see papers in Balbín 2008) should help elucidate the nature and intensity of ties between Portuguese Magdalenian groups and those of the rest of the Peninsula.

9. THE PLEISTOCENE-HOLOCENE TRANSITION: AZILIAN AND MICROLAMINAR EPIPALEOLITHIC

It has become clear that the technological transitions between the classic Late Magdalenian and the Epi-Magdalenian cultures of Vasco-Cantabria (and Aquitaine)

—the Azilian with harpoons— and the Mediterranean and Lusitanian regions —the Laminar Epipaleolithic without harpoons— took place unevenly during Allerød *sensu lato* and that they continued across the Younger Dryas and into the Preboreal phase of the Holocene. In the absence of harpoons (both in Vasco-Cantabria and elsewhere), the “distinction” between Final Magdalenian and Epi-Magdalenian amounts to archeological semantics in the opinion of this author. The (discontinuous) amelioration in climate and reforestation of Iberian landscapes had already been underway during the last millennia of the Magdalenian culture. Allerød conditions may have brought about a tipping point in human-land relations with repercussions in technology and belief systems, while basic settlement and subsistence trends continued across the changes that even Younger Dryas and Preboreal brought in admittedly attenuated form to the Iberian Peninsula.

The Azilian of Vasco-Cantabria developed under the background of continued growth of mixed deciduous woodlands, rising sea level, disappearance of mountain glaciers and the extinction of the last reindeer. The development of the woods was briefly interrupted by Younger Dryas (GS1: 12.9-11.7 cal kya), whose effects at any rate were attenuated throughout the Peninsula. It was admirably synthesized by the late Fernández-Tresguerres (2004), who excavated one of the longest, richest sequences of this period, Los Azules Cave (Asturias) (see also Straus 2011). What follows is derived mainly from these syntheses with their references. The Azilian represents a continuation of the Final Magdalenian with a simplification of both lithic and osseous technologies. There are fewer types of both stone and antler artifacts; less elaboration in the manufacture of harpoons, now with flat rather than round sections (some with basal holes or bulges for lanyard attachment, others without); generally very small retouched stone implements (thumbnail and flake endscrapers, backed bladelets and micropoints, but only rarely geometric microliths—an exception being El Piélago in Cantabria). Portable art is virtually absent and there are a total of only five engraved (with bands of oblique lines) harpoons at the beginning of the Azilian at three Asturian sites: Los Azules, La Lluera and Oscura de Ania. There are a few bi-pointed bone points that were probably fish gorges (at Los Azules, as well as at El Perro near the mouth of the Asón in eastern Cantabria). There is a continuing trend for increased use of local flints and probably now many more artifacts (including perhaps projectile points) were being made of wood. Most Azilian levels (*e.g.*, the ones in Cueto de la Mina, Cueva Morín, El Pendo, El Castillo, El Mirón, Santimamiñe, Ekain) are far thinner and poorer than underlying Magdalenian ones), suggesting lower populations, shorter stays or both.

However, there are a few major, multi-layer Azilian sites besides Los Azules, for example La Pila, Piélago I and II, El Valle (all in Cantabria), Santa Catalina (Vizcaya). Site numbers are high and most are caves that had also been used in the Magdalenian, although there are a few “new” sites, mainly located in the high montane zone and even on the other side of the Cordillera in Burgos, León, and the interior Basque provinces (*e.g.*, Portugain, Antón Koba, Urratxa, Pikandita, La Uña, Nispera. and the Ojo Guareña karstic complex as indicated by late-dated rock art) continuing the trend of (re-) occupation of the Northern Meseta.

Subsistence in the Cantabrian Azilian (see *e.g.*, Straus and Clark 1986) again emphasized the hunting of red deer and—in steep, rocky montane *loci*—ibex, but the woodland-dwelling roe deer and boar became much more frequent, along with chamois in some sites, plus traces of horse, bovines. Reindeer, as noted above, survived into the Azilian as shown by numerous finds in Santa Catalina (and the southern Chalosse sites of Duruthy and Dufaure) (see Altuna 1999). Marine mollusks are abundant in Azilian levels in several sites, notably La Riera, El Perro, La Pila, Santa Catalina and Ekain. Fish (especially salmonids) are present in many sites, including Los Azules and Santimamiñe (López Quintana and Guenaga 2014). Sea urchins and crabs were also exploited, and, at interior sites like Piélago, land snails (also found at several roughly contemporaneous sites in the Pyrenees). The subsistence record from Santa Catalina has added to the evidence of extensive use of marine resources (mollusks, fish, birds and possibly scavenged seals) to supplement the red deer, roe deer, boar and small numbers of ibex, chamois found in the Azilian layer (Berganza and Arribas 2014). This growing focus on the coast for some Azilian sites presaged the near-abandonment of the interior and the intensive exploitation of the resources of the shore and estuaries during the succeeding Asturian culture and eastern Cantabrian-Basque Mesolithic, when Magdalenian-derived Azilian lithic and osseous technologies largely disappeared, despite the continuation of a “tradition” of individual human inhumation in caves that straddled the Azilian and Mesolithic periods (*e.g.*, Los Azules, Tito Bustillo, Gasparin, Los Canes, La Braña, El Toral, J[aizkibel] 2).

Sites without Azilian harpoons but of similar age have been excavated in the trans-Cordilleran upper Ebro Basin areas of Navarra: Zatoya and Abautz. The sites of Berniollo and Atxoste in Alava (with a level rich in backed bladelets that dates to the Preboreal [Alday 2014]), Legunova, Peña 14 and Peña del Diablo in Zaragoza, Forcas I in Huesca also have Microlaminar (*i.e.*, non-geometric microlith) Epipaleolithic industries pertaining to Younger Dryas and, in some cases, the periods immediately before and/or after that short colder, drier

event (Utrilla *et al.* 2010; Aura *et al.* 2011; Soto *et al.* 2016). However, the Epimagdalenian levels in most of these sites are quite poor in finds, especially compared to some of the Magdalenian levels. Zatoya (Barandiarán and Cava 1989) is an exception with regard to the relative richness of its post-Magdalenian levels. The limited subsistence information includes archeofaunal data from Zatoya Level 11b, dominated by red deer, but with substantial quantities of boar, ibex and chamois, plus small numbers of roe deer, bovine and horse remains (attesting to reforestation). Note that the underlying Late Magdalenian contained a trace of reindeer (Mariezcurrera and Altuna 1989). In contrast, the so-called Azilian of Forcas is overwhelmingly dominated by rabbit remains (plus a few red deer bones) (Blasco and Castaños 2014). The archeofauna from undated terminal Magdalenian/Azilian/Microlaminar Epipaleolithic level in Angel 1 (Teruel) is made up of 80% ibex + chamois remains (Utrilla *et al.* 2017), not surprising given the site’s very steep, rocky surroundings.

Early Epipaleolithic sites are also relatively scarce in Mediterranean Spain, where post-glacial woodlands were becoming established under more humid conditions (*e.g.*, Cacho *et al.* 1995). The most spectacular evidence of Finiglacial human occupation of the high Catalan Pyrenees is from the *c.* 13.6 cal kya (one assay) basal level of La Balma de la Margineda at nearly 1000 m in Andorra. This level does have microlithic triangles, along with an equal number of backed micropoints and a smaller number of backed bladelets, along with numerous endscrapers. As in the other pre-Neolithic levels, the mammalian fauna is (predictably) overwhelmingly dominated by ibex (Guilaine *et al.* 1995). South of Margineda at over 1150 m a.s.l. in the PrePyrenees foothills of Lerida is the similarly dated site of Balma Guilanyà with a lithic industry called “Azilian” but without harpoons (Martínez-Moreno and Mora 2009).

Moli del Salt in Tarragona has a Microlaminar (*i.e.*, non-geometric) industry of terminal Pleistocene age (13.7–12.8 cal kya) and several engraved schist and limestone slabs with simple animal images similar to ones from other early Holocene sites in Catalunya notably Sant Gregori de Falset also in Tarragona (Vaquero and Alonso 2014). Also in the coastal zone of Tarragona, the site of Picamoixons, dated to about 11 cal BP, yielded a lithic industry combining microlaminar and flake-based components (García Catalán *et al.* 2009).

In the Valencia region there are the dated sites of La Roureda, Els Diablets and Matutano in Castellón. The first site (*c.* 13.2 cal kya) is overwhelmingly dominated by backed bladelets and micropoints, together with truncated blades, notches/denticulates and endscrapers. The site has a stone pavement and, though in the interior, yielded a scallop shell (Román 2010).

Matutano has yielded zoomorphically engraved pebbles as in Moli del Salt, many backed pieces, relatively abundant antler and bone tools and weapon tips, and evidence of subsistence based on red deer, plus fish, mollusks and birds, especially partridge (Olaria 2014). Also dating to this period are Santa Maira and Tossal de la Roca in Alicante, while in Murcia there is a newly excavated site, Finca de Doña Martina, and, further south in Mediterranean Andalusia (Málaga), Nerja Cave (Aura *et al.* 2011). Level I at Tossal de la Roca (Interior) Level I has a lithic assemblage dominated by backed and retouched bladelets plus small endscrapers, together with a couple of bone needles and an awl. The mammalian fauna in this high, steep, rocky venue is overwhelmingly dominated by rabbit remains of essentially human agency, with ibex being by far the most significant ungulate (with small numbers/traces of red deer, boar, chamois and horse). Partridges were also occasionally killed and eaten. Eel and other fish are present in trace quantities. Santa Maira, also located in a high, montane setting, has a level (4) that straddles the Younger Dryas-Preboreal boundary and that has evidence of the development of deciduous oak Mediterranean woodlands, with increasing presence of roe deer and boar among the game species, in addition to ibex, red deer and some horse, as well as the omni-present rabbit. A variety possible plant foods (oak acorns, mountain ash berries, vetch seeds) have also been recovered. The lithic industry is characterized by many bladelets and endscrapers, together with a few bone awls and needles and stones with evidence of ochre grinding (Aura *et al.* 2011; Aura 2014). Doña Martina, a rockshelter at the base of a vertical cliff, has a small assemblage of lithic retouched pieces, half of which are backed bladelets, almost the only other tools being endscrapers (with two geometric microliths and a few burins and notches/denticulates) (Román *et al.* 2013). Nerja “Stage 7” straddles the Pleistocene-Holocene boundary, with a fast-approaching shoreline. Its cultural material is called “Epi-Magdalenian”, but characterized here by many expedient flake tools, plus cobble macroliths and grinding stones. There are bi-pointed “gorges” and other osseous projectiles and awls. The layer in question is a shell midden made up of periwinkles and bivalves (including *Pecten*) together with many remains of fish, marine birds (including the great auk), abundant monk seals, together with ibex and smaller amounts of red deer plus boar and of course rabbit. There are also perforated shell ornaments (Aura *et al.* 2011; Aura and Jordá 2014b).

The Epi-Magdalenian is scarcely represented in the extant archeological record of the Spanish interior, despite the existence of rock art sites (notably the c. 13 cal kya-dated art of Palomera Cave/Ojo Guareña, Burgos) that are partly ascribed to the end of the Last Gla-

cial in both Old and New Castile. As mentioned above, there are a few archeological sites on the south side of the the Cantabrian Cordillera. The existence of Allerød and Younger Dryas levels in Estebanvela (Segovia), however, must mean that there are many more sites yet to be discovered and/or destroyed by erosion or buried by colluvium or alluvium if they were in the open air, something made possible by more temperate conditions at least before and after Younger Dryas. Levels II and I of Estebanvela are rich in retouched/backed blades, followed by points and short endscrapers; they also have yielded bone needles. There are large pit hearths filled with fire-cracked rocks (possibly earth ovens). Like the underlying Upper Magdalenian Levels III and IV, Levels II and I also yielded flat-faced shale stones with parallel series of engraved lines—a longstanding local decorative tradition. The mammalian game animals are dominated by rabbit, with ibex, horse and smaller numbers of red deer, chamois, roe deer and boar (Cacho *et al.* 2006; Cacho *et al.* 2012; Cacho *et al.* 2014). Perhaps continuing excavations in the Cueva Mayor in the Sierra de Atapuerca (Burgos) will eventually clarify the existence of Upper Paleolithic occupation in this favored area of the northern Meseta, since there is already a date of c. 20.3 cal kya, albeit with no clear cultural association, from under a long post-Paleolithic sequence (Carretero *et al.* 2008).

There is great continuity among backed/retouched bladelet-rich, pre-Geometric Mesolithic industries across the Pleistocene-Holocene boundary in Portugal, making the Final Magdalenian/Epipaleolithic distinction fairly arbitrary in the absence of diagnostic artifacts such as the Azilian harpoons of Cantabrian Spain. There was momentary reversal of Allerød reforestation and reappearance of wooded steppe-like landscapes during the colder, drier climate of Younger Dryas, followed by a swift recovery and the appearance of near-modern Mediterranean vegetation types in Preboreal/Boreal (Bicho *et al.* 2010; Bicho *et al.* 2011). The shores approached their present positions by the end of this transition period, and are marked by the presence of shell middens (*e.g.*, Magoito north of the mouth of the Tagus in southern Estremadura, Pedra do Patacho at the mouth of the Mira in Alentejo) in some cases dating as far back at the terminal Last Glacial. The “Late Tardiglacial” assemblages lack harpoons (or any other antler/bone points). Other open-air sites with non-geometric Epipaleolithic components are numerous, particularly in the sand-filled interior basin of Rio Maior (Estremadura), notably several *loci* at Cabeço do Porto Marinho and Carneira. There are also sites at Côa, where some of the rock art at Faia is thought to date to the Epipaleolithic. Several cave sites include levels pertaining to the Pleistocene-Holocene transition period: Picareiro, Suão, Caldeirão, Casal Papagaio and Coelhos, all in Estremadura. The rockshelters in the

Bocas gorge near Rio Maior and Vale Boi at the SW tip of Algarve also have materials of this age, and there is a lake basin site in Algarve: Lagoa do Bardeal. At sites with abundant, local, good-quality flint (e.g., Rio Maior), bladelets (raw, retouched and backed and backed micro-points) can be consistently present, but geometric microliths do not really begin to be numerically significant until the Preboreal, increasing greatly thereafter. Bladelets could be made of quartz when necessary. Flakes and flake tools can be very numerous, especially in sites lacking local flint, where quartzite and other materials were used. The shell middens are very poor in artifacts, especially formal retouched tools. The middens are made up of cockles, clams, limpets, mussels, periwinkles and fish bones. Fish and marine mollusks are also present in some of the cave sites. In addition to the abundant rabbits, the ungulate game upon which human subsistence was significantly based included red deer, roe deer, boar, aurochs, horse, plus on occasion chamois and ibex. The highly diversified diets of the Epipaleolithic in Portugal definitely presaged the subsistence of the makers of the great Boreal and Atlantic-age Mesolithic middens along the estuaries of the Mira, Sado and Tagus (Muge) rivers (see Manne and Bicho 2009).

The Paleolithic in Iberia finally came to an end in the Preboreal/Boreal period, with the development of a variety of Geometric Microlithic and Macrolithic Mesolithic hunter-gatherer-fisher “cultures” that survived up until the arrival/adoption of Neolithic food production economies and technologies. This great transformation occurred first along the Mediterranean coast and then beyond the Strait of Gibraltar, all the way from Catalunya to Algarve. But then it penetrated lightly populated areas of the interior. The last region to adopt a modified form of Neolithic subsistence and lifeways was the Euro-Siberian ecozone of the northern Atlantic Cantabrian coast, some 6500 cal kya, fittingly in the Atlantic palynological period. A million years of genus *Homo* foraging had concluded.

10. CONCLUSIONS

Toward the end of MIS 3 two different, but inter-fertile populations of genus *Homo* coexisted on the Iberian Peninsula for a length of time that is still uncertain, in large part because of the lack of well-dated Neandertal and Cro-Magnon remains in the critical period between about 45-35 cal kya. The displacement and ultimately the demographic success of the latter at the expense of the former subspecies took place against the backdrop of relatively benign, albeit fluctuating, climatic conditions. If the various kinds of Aurignacian technology (including the distinctive and completely

innovative osseous points, blades and bladelets) were exclusive to *H. sapiens sapiens* and the Mousterian complex (though obviously not individual tool types such as sidescrapers, denticulates or notches) was exclusive to *H. sapiens neanderthalensis*, then the latter, perhaps in dwindling numbers, survived in southern Iberia after “retreating” from or dying out in the Euro-Siberian ecozone of Vasco-Cantabria and Catalunya. Despite all their “human-like” qualities and capacities, it remains strikingly the case that Neandertals do not seem to have habitually engaged in archeologically durable symbolic activity (rock or portable art, personal decoration). The new populations —perhaps somewhat larger than Neandertal one— importantly marked territories, signaled presence and identity, recorded and disseminated information, shared beliefs and their art and ornamentation give us hints of the complexity of their relationships among one another and with nature, most specifically the animals upon whose lives and deaths they depended. But the amounts of artistic activity in Aurignacian Iberia paled in comparison to what was going on at least in southern France and SW Germany in late MIS 3. Research in this fascinating time period is in critical need of discoveries of human remains of both populations in impeccably dated contexts. Continued re-dating of existing late Middle Paleolithic contexts (such as that of Gorham’s Cave, Gibraltar), with the application of the most rigorous pretreatment methods, is of vital importance to work out whether and for how long the two subspecies may have actually co-existed and interacted (socially, sexually) or avoided one another in the various regions of Iberia, both north and south. Unlike in Middle Paleolithic times, humans seem to have begun to take control of favored caves from the cave bears and large carnivores. But there are few noticeable changes in subsistence *vis à vis* the Mousterian *i.e.*, there are still larger ungulates, including some archaic taxa, that were either killed or scavenged, generally without a clear red deer or ibex specialization or much use of small resources such as rabbits, mollusks or fish, possibly due to low population levels and a relatively benign interstadial climate (with more available plant foods?).

The Gravettian, though no doubt developed out of Aurignacian cultures, was the first Upper Paleolithic techno-complex or culture to occupy the entire Iberian Peninsula —all the way down to Cape Saint Vincent— although the densities of sites are far greater in the Cantabrian, Levantine, Andalusian and Lusitanian coastal regions than in the interior. This period coincided with the onset of MIS 2—the Pleniglacial. Hence the scarcity of sites on the high tablelands of the Iberian hinterland could be due to the relative harshness and resource poverty of those areas compared with the coasts, but both erosion and deep burial, plus a

historic relative lack of research could all be factors. However it is worth noting that Mousterian and Acheulean sites (probably mostly interstadial or interglacial in age) abound in the interior. During these not yet worst climatic conditions, it is perhaps not surprising that Gravettian open-air sites are beginning to be found in the Basque Country and Portugal, while such “unsheltered” sites are missing or rare during the subsequent Last Glacial Maximum and (in the north) Oldest Dryas. Clearly, Iberian Gravettian people were in contact with the wider European world, as indicated by peculiar aspects of lithic and osseous technology (*e.g.*, Gravette points, Noailles burins, Isturitz sagaies), ritual burials (Lagar Velho), and hand-prints in cave art, even if the “Venus” figurine phenomenon does not seem to have crossed the Pyrenees. Specialized hunting—particularly of ibex and rabbit—begins to be evidenced in certain sites, an incipient sign of hard times climatically and demographically, though nothing like what was being faced by Pavlovian and other Gravettian peoples on the North European Plain at this time.

When the LGM crisis of extreme cold and aridity came, the human range in Western Europe contracted to southern France and Iberia. There is an explosion of site numbers both in the north and—most remarkably—in the south (*e.g.*, Andalusia, Portuguese Estremadura). Specialized, reliably effective weaponry (Solutrean stone points, atlatl), with stylistic variations on a common technology that suggest regional band territories. High levels of craftsman- or artisan-ship were dedicated to stone knapping (selection and procurement of the best materials, occasional use of heat-treatment, invasive ribbon pressure and percussion retouching), with somewhat less emphasis than in Aurignacian or Magdalenian times on antler/bone working. There was otherwise considerable continuity in “substrate” tools. Concentrated in favored areas with the most shelter (caves, abrigos), fuel, water, food and toolstone, Solutrean settlement of the Peninsula (and France) was characterized by clusters of sites (but with only a few truly major hubs) and other areas with low densities or no traces of human presence. Some areas (*e.g.*, Galicia, the mesetas, the Madrid basin, Extremadura) were probably inhabited at low levels and/or crossed, especially during more moderate climatic episodes within the LGM. Humans reacted to difficult conditions not only with deadly weaponry (including the spear-thrower), but also with subsistence intensification: both situational specialization and overall diversification. The slaughter of red deer and ibex, which were to become Iberian hallmarks in most regions for the rest of the Paleolithic, was augmented by collection of marine mollusks, littoral, estuarine and riverine fishing and, in Mediterranean regions, rabbit trapping, den-ambushing or driving. Portable art was relatively scarce, except for

the extraordinary case of the engraved stone slabs in El Parpalló, and distinctive rock art traditions established probably in Gravettian times both in open-air (*e.g.*, Côa) and cave contexts continued, with a particular florescence in Andalusia. Clearly more field research (survey and testing) needs to be done in the apparently “empty” regions of the interior and Galicia, and between the caves in most of the coastal zones.

As climatic conditions began to improve slightly in Oldest Dryas, first in France and somewhat later in Iberia, people locally began to abandon Solutrean lithic weapon tips. With considerable continuity in settlements, subsistence and basic technology, some of the succeeding industries in Spain came to be dominated by local non-flint raw materials, often with many flake tools but associated with antler *azagayas*. Generally known as Archaic or Initial Magdalenian (but, at least at Parpalló, sometimes called by the name “Badegoulian” when there are many racettes), this phenomenon is “best” (albeit still poorly) known in northern Spain, while traditionally the Solutrean-Magdalenian transition in Levantine Spain has been referred to as “Solutreo-Gravettian” because of the presence of many backed blades/bladelets/points and “Mediterranean” shouldered points. The Lower Magdalenian *sensu lato* is geographically more widespread, but artistically and technologically distinctive in the Cantabrian region, with large numbers of sites including such major residential hubs as El Castillo, El Juyo, Altamira, El Mirón, Santimamiñe, *et al.* The Cantabria-centered “band territory” defined by deer scapulae decorated with striation-engraved hind images is definitely a more or less bounded regional phenomenon. Other manifestations of human settlement during late Oldest Dryas exist in Mediterranean Spain and Portugal, but there are hints of possibly lower human populations there than in the Solutrean, especially compared to northern Atlantic Spain. Evidence of subsistence specialization, that included “wild harvesting” of red deer and ibex, as well as of rabbits (in Mediterranean regions), marine mollusks, and some use of other aquatic (and avian) resources, is notable and in some cases dramatic.

In Vasco-Cantabria, the until recently poor, but now increasingly rich Middle Magdalenian record is displaying evidence of more intensive relationships with contemporary groups in the French Pyrenees (where settlement boomed) and Aquitaine in the waning centuries of Oldest Dryas and early in the Bølling interstadial *sensu lato*. The wealth of rupestral and portable art suggesting frequent human links in a dense social network is a hallmark of this period. From Las Caldas in central Asturias to Isturitz in Pays Basque and even to/from the Mediterranean coast, there was transport and trade in non-local flints, shells, distinctive ornaments and other osseous artifacts, and

a clear traffic in ideas of art (shared symbols, canons of style, etc.), despite major forager economic differences among the lands of the reindeer, the red deer, the ibex and the rabbit. Cantabria and Asturias were home to major, long-term residential sites and great cave art “sanctuaries”, as was the case along the adjacent northern flank of the Pyrenees. The Ebro Valley (as in earlier periods, especially the Solutrean) played a major role in Magdalenian communications, but some regions, notably Andalusia and southern Portugal, while still part of the Magdalenian world *sensu lato*, were quite remote from what was going on in the Franco-Cantabrian region with tenuous, long-distance links and perhaps lower population levels. The differences between the Euro-Siberian and Mediterranean eco-zones were ever more marked in this *histoire de la très longue durée*.

As temperatures rose, glaciers disappeared and reforestation spread from south to north, there continued to be at least three Iberian worlds in the Upper/Final Magdalenian: Vasco-Cantabria closely connected (in terms of portable and rupestral art and artifacts) with SW France albeit with its own regional style of harpoons; Mediterranean Spain (minus Girona) also with its own distinct harpoon style; and Portugal, poor in osseous industry but continually rich in bladelets. From all of these core areas, some human groups once again moved up onto the tablelands of Castile and La Mancha, extraordinary proof of which is the vast rockshelter site of Estebanvela in Segovia, as well as (probably) some of the cave art *loci* of these regions. Contacts were made over long distances via seasonal rounds, individual visits (“walk-about” as among the Australian Aborigines), multi-band aggregations with feasting and gifting, and indirectly via down-the-line exchanges (like the hxaro trade of the southern African “Bushmen” or the “Kula rings” of the Trobriand Islanders), ultimately connecting Old Castile with Burgundy and the coasts of the Cantabrian and Mediterranean Seas. In addition to the intensive slaughter of red deer and ibex (sometimes including the ultimately counter-productive killing of many juvenile animals), foragers on the peripheries of Iberia increasingly turned to the resources of the shores and rivers on a regular basis, as spectacularly attested by La Riera and Santa Catalina in the North, Nerja in the Southeast and incipient midden sites in Portugal, possibly for a combination of climatic and demographic reasons. The abrupt end of representational rupestral and portable art came against the backdrop of major ecological changes.

Continuing its regional distinction and relationship with Aquitaine, the sharp temperate, cold and temperate oscillations of the Pleistocene-Holocene transition were lived in Vasco-Cantabria by humans with what

archeologists call the Azilian culture, again characterized by distinctive harpoons and a simplified version of Late Magdalenian lithic technologies. Meanwhile, in Mediterranean Spain and Portugal (both without harpoons or much else in terms of osseous industry or portable art), lithic industries were dominated by backed bladelets. Coastal resources, a growing frequency of woodland ungulates, rabbits in the Mediterranean zones and probably plant foods, increasingly complemented the usual ibex and red deer. Again the story of the Iberian interior remains to be fully written, if in reality it was not as sparsely inhabited as the present archeological record would seem to suggest.

There are major constants in the long history of the Iberian Upper Paleolithic: three relatively, but differently resource-rich coastal regions (Cantabrian, Lusitanian and Mediterranean) surrounding a mostly high, relatively resource-poor interior; two profoundly different and persistent eco-zones, Euro-Siberian and Mediterranean; omnipresent, but varying degrees of social contact and mutual cultural influence between the two wings of the Franco-Cantabrian region and between the continental and peninsular portions of Catalonia, despite significant differences in geography and principal game species; a fundamental avenue of Atlantic-Mediterranean contact via the Ebro Corridor south of the Pyrenees. For hundreds of thousands of years small, perhaps relatively isolated groups of Neandertals and their ancestors, *H. heidelbergensis* had dealt with and generally thrived in these environments in relatively simple ways. Then the “modern” humans who displaced them adapted over some 30,000 years to both the rich and the poor lands of Spain and Portugal at locally higher population densities and in culturally ever more complex and sophisticated ways, despite major challenges, until wheat, barley, sheep, goats and cattle provided a new, more sedentary way of life when the conditions for such a revolutionary change made it necessary and/or convenient, either early—in the Mediterranean eco-zone or late—in the Atlantic one.

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