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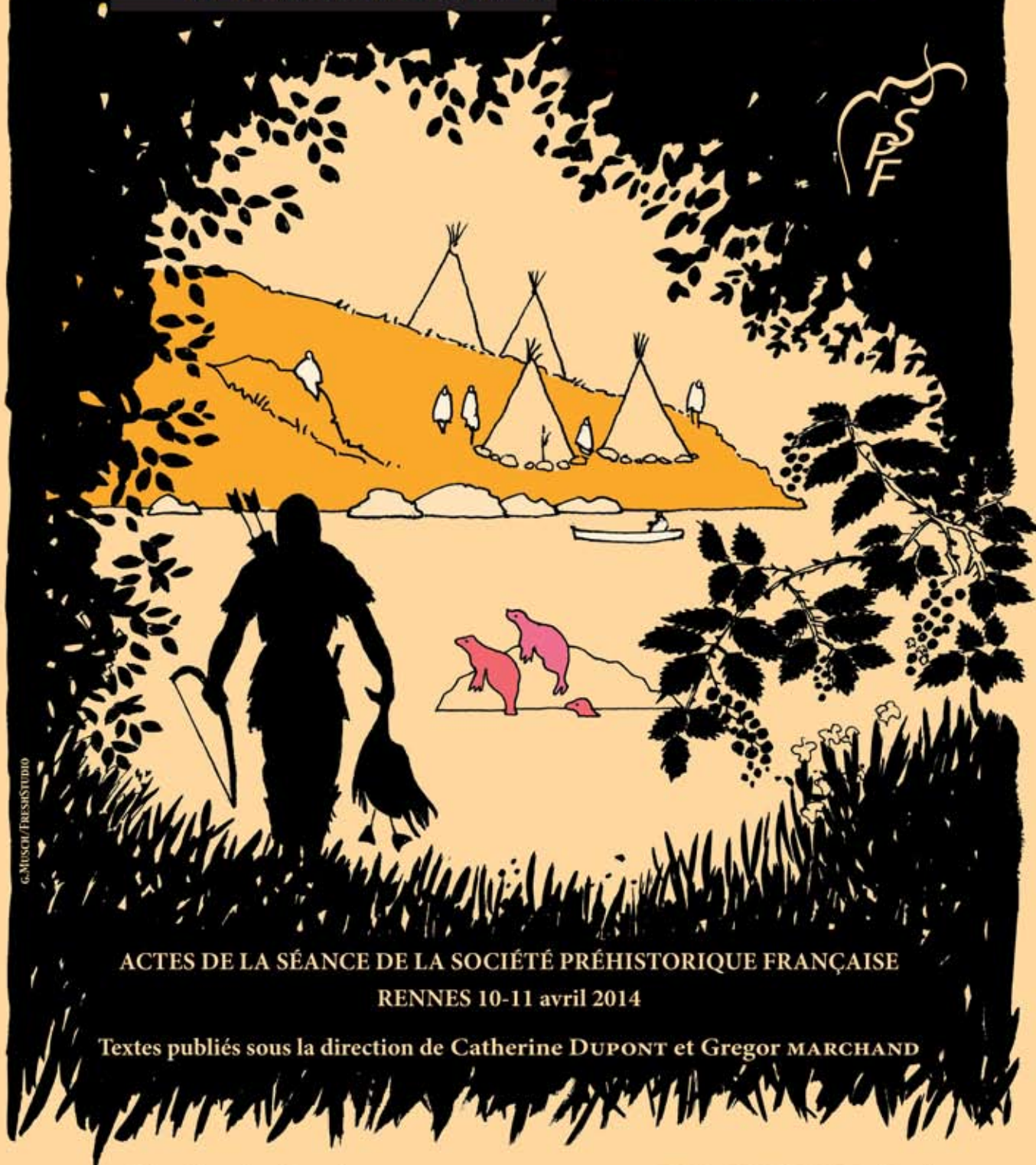
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ARCHÉOLOGIE DES CHASSEURS-CUEILLEURS MARITIMES

DE LA FONCTION DES HABITATS
À L'ORGANISATION DE L'ESPACE LITTORAL

ARCHAEOLOGY OF MARITIME HUNTER-GATHERERS

FROM SETTLEMENT FUNCTION
TO THE ORGANIZATION OF THE COASTAL ZONE



ACTES DE LA SÉANCE DE LA SOCIÉTÉ PRÉHISTORIQUE FRANÇAISE

RENNES 10-11 avril 2014

Textes publiés sous la direction de Catherine DUPONT et Gregor MARCHAND

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6

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SOMMAIRE/CONTENTS

Remerciements / Acknowledgements	7
Catherine DUPONT et Gregor MARCHAND — Les chasseurs-cueilleurs maritimes entre terre et mer, entre diversité et complexité / Maritime hunter-gatherers between land and sea, between diversity and complexity	9

PREMIÈRE PARTIE LES CHASSEURS-CUEILLEURS MARITIMES DU PLEISTOCÈNE

Jean-Marc PÉTILLON — Life on the Shores of the Bay of Biscay in the Late Upper Palaeolithic: towards a New Paradigm / Vivre au bord du golfe de Gascogne au Paléolithique supérieur récent : vers un nouveau paradigme	23
Véronique LAROULANDIE, Mikel ELORZA ESPOLOSIN et Eduardo BERGANZA GOCHI — Les oiseaux marins du Magdalénien supérieur de Santa Catalina (Lekeitio, Biscaye, Espagne) : approches taphonomique et archéozoologique / Seabirds from the Upper Magdalenian of Santa Catalina (Lekeitio, Biscay, Spain): Taphonomic and Zooarchaeological Approaches	35
David CUENCA-SOLANA, Igor GUTIÉRREZ-ZUGASTI and Manuel R. GONZÁLEZ-MORALE — Shell Tools and Subsistence Strategies during the Upper Palaeolithic in Northern Spain / Outils sur coquille et stratégies de subsistance pendant le Paléolithique supérieur dans le nord de l'Espagne	59
J. Emili AURA TORTOSA, Jesús F. JORDÁ PARDO, Esteban ÁLVAREZ-FERNÁNDEZ, Manuel PÉREZ RIPOLL, Bárbara AVEZUELA ARISTU, Juan V. MORALES-PÉREZ, María José RODRIGO GARCÍA, Ricard MARLASCA, Josep Antoni ALCOVER, Paula JARDÓN, Clara I. PÉREZ HERRERO, Salvador PARDO GORDÓ, Adolfo MAESTRO, María Paz VILLALBA CURRÁS and Domingo Carlos SALAZAR-GARCÍA — Palaeolithic - Epipalaeolithic Seapeople of the Southern Iberian coast (Spain): an overview / Chasseurs-cueilleurs maritimes du Paléolithique-Épipaléolithique de la côte sud de la péninsule Ibérique (Espagne) : une synthèse	69
Garry MOMBER, Lauren TIDBURY and Julie SACHELL — The submerged lands of the Channel and North Sea: evidence of dispersal, adaptation and connectivity / Les zones submergées de la Manche et de la mer du Nord : indices de peuplement, d'adaptation et de connectivité	93

DEUXIÈME PARTIE LES CHASSEURS-CUEILLEURS MARITIMES DE L'Holocène

Cyrille BILLARD et Vincent BERNARD — Les barrages à poissons au Mésolithique : une économie de prédation ou de production? / The Mesolithic Fishing Weirs: an Economy Based on Foraging or on Production?	113
Ana Cristina ARAÚJO — The Significance of Marine Resources during the Early Mesolithic in Portugal / L'importance des ressources marines pendant le Mésolithique ancien au Portugal	127
Mariana DINIZ — Between Land and Sea: Assessing Hunter-Gatherer Subsistence Practices and Cultural Landscapes in Southern Portugal during the Final Mesolithic / Entre terre et mer: débattre des pratiques de subsistance et des paysages culturels des chasseurs-cueilleurs du Mésolithique final dans le Sud du Portugal	145

Pablo ARIAS, Miriam CUBAS, Miguel Ángel FANO, Esteban ÁLVAREZ-FERNÁNDEZ, Ana Cristina ARAÚJO, Marián CUETO, Carlos DUARTE, Patricia FERNÁNDEZ SÁNCHEZ, Eneko IRIARTE, Jesús F. JORDÁ PARDO, Inés L. LÓPEZ-DÓRIGA, Sara NÚÑEZ DE LA FUENTE, Christoph SALZMANN, Jesús TAPIA, Felix TEICHNER, Luis C. TEIRA, Paloma UZQUIANO and Jorge VALLEJO — Une nouvelle approche pour l'étude de l'habitat mésolithique dans le Nord de la péninsule Ibérique : recherches dans le site de plein air d'El Alloru (Asturies, Espagne) / A New Approach to the Study of Mesolithic Settlement in the Northern Part of the Iberian Peninsula: Research Carried Out at the Open Air Site of El Alloru (Asturias, Spain)	159
Ana Catarina SOUSA and António M. MONGE SOARES — Continuity or Discontinuity? The Exploitation of Aquatic Resources in the Portuguese Estremadura during the Atlantic Period: the São Julião and Magoito Shell Middens as Case Studies / Continuité ou discontinuité? L'exploitation des ressources aquatiques dans l'Estrémadure portugaise pendant la période atlantique : les amas coquillers de São Julião et de Magoito comme études de cas	191
Dominique BONNISSENT, Nathalie SERRAND, Laurent BRUXELLES, Pierrick FOUÉRE, Sandrine GROUARD, Nathalie SELLIER et Christian STOUVENOT — Archéocologie des sociétés insulaires des Petites Antilles au Mésoindien : l'enjeu des ressources à Saint-Martin / Archaeoecology of the Island Societies during the Archaic Age in the Lesser Antilles: the Issue of Resources in Saint-Martin	213
Claire HOUMARD — L'exploitation technique des ressources animales des premiers peuples de l'Arctique de l'Est canadien (env. 2500 BC - 1400 AD) / The Technical Exploitation of Animal Resources among the Early Arctic People in Eastern Canada (c. 2500 BC - 1400 AD)	261
Grégor MARCHAND, Catherine DUPONT, Claire DELHON, Nathalie DESSE-BERSET, Yves GRUET, Marine LAFORGE, Jean-Christophe LE BANNIER, Camille NETTER, Diana NUKUSHINA, Marylise ONFRAY, Guirec QUERRÉ, Laurent QUESNEL, Rick SCHULTING, Pierre STÉPHAN et Anne TRESSET — Retour à Beg-er-Vil. Nouvelles approches des chasseurs-cueilleurs maritimes de France atlantique / Beg-er-Vil Revisited. New Methodological approaches of the maritime hunter-gatherers in Atlantic France	283

TROISIÈME PARTIE DES PÊCHEURS DANS UN MONDE D'AGRICULTEURS

Sophie MÉRY, Dalia GASPARINI, Gautier BASSET, Jean-François BERGER, Adrien BERTHELOT, Federico BORGI, Kevin LIDOUR, Adrian PARKER, Gareth PRESTON et Kathleen McSWEENEY — Mort violente en Arabie : la sépulture multiple d'Umm al Quwain UAQ2 (Émirats arabes unis), VI^e millénaire BC / Violent Death in Arabia: the Multiple Burial of Umm al Quwain UAQ2 (United Arab Emirates), 6th Millennium BCE	323
Vincent CHARPENTIER, Jean-François BERGER, Rémy CRASSARD, Federico BORGI, Philippe BÉAREZ — Les premiers chasseurs-collecteurs maritimes d'Arabie (IX^e-IV^e millénaires avant notre ère) / Early Maritime Hunter-Gatherers in Arabia (9th – 4th Millennium before the Current Era)	345
Robert VERNET — L'exploitation ancienne des ressources du littoral atlantique mauritanien (7500 - 1000 cal. BP) / The Ancient Exploitation of Resources on the Mauritanian Atlantic Coast (7500 - 1000 cal. BP)	367
Alexander N. POPOV and Andrey V. TABAREV — Lords of the Shell Rings: Boisman Neolithic Culture, Russian Far East / Seigneurs des anneaux sur coquilles : la culture néolithique de Boismanskaya, Extrême-Orient russe	393
Paul WALLIN — The Use and Organisation of a Middle-Neolithic Pitted Ware Coastal Site on the Island of Gotland in the Baltic Sea / Fonction et organisation d'un site côtier de la culture à Céramique à Fossettes du Néolithique moyen sur l'île de Gotland dans la mer Baltique	409

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De la fonction des habitats à l'organisation de l'espace littoral
Archaeology of maritime hunter-gatherers.
From settlement function to the organization of the coastal zone*
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Life on the Shores on the Bay of Biscay in the Late Upper Palaeolithic: towards a New Paradigm

Jean-Marc PÉTILLON

Abstract: Since the beginning of the 2000s, the classic picture of Pleistocene hunter-gatherers as exclusively 'inland hunters' is gradually changing thanks to a positive reassessment of the role of seashore resources. This article provides an updated picture of this question, concentrating on one case study: the outskirts of the Bay of Biscay during the Middle and Late Magdalenian. The evidence of coastal exploitation is reviewed and shows that several types of activities were recurrent and intensive enough to be documented in a number of sites and to yield abundant archaeological remains spanning a long time period: the use of molluscs as food on the Cantabrian coast and the use of their shells as raw material for personal ornaments that circulate widely into the inland; the use of cetacean teeth and bones to manufacture a variety of objects circulating mostly in the northern Pyrenean range. The use of other resources (invertebrates other than molluscs, fish, birds, sea mammals as alimentary resource, algae, maybe drifted pumice) is documented but seems more occasional. Taken together, this evidence allow us to suggest the probable existence, at least in the Middle and Late Magdalenian on the southern outskirts of the Bay of Biscay, of a specific seashore economy established on a narrow coastal strip that is now all but submerged. Evidence from the eastern coast of the bay is much rarer, probably because of the greater distance of the sites from the Paleolithic coast but also maybe because of the presence of a coastal desert in the Landes. The possible existence of specific coastal equipment is discussed (Cantabrian harpoon heads?). These data are briefly put in a broader chronological and geographic perspective and their implications for our conception of the Magdalenian hunter-gatherers and the transition from Pleistocene to Holocene hunter-gatherers are discussed.

Keywords: Bay of Biscay, Magdalenian, coastal hunter-gatherers, coastal resources, molluscs, marine fish, marine birds, sea mammals, harpoons.

Résumé : Depuis le début des années 2000, une réévaluation du rôle des ressources littorales a progressivement changé la vision classique selon laquelle les chasseurs-collecteurs pléistocènes étaient exclusivement des chasseurs de l'intérieur des terres. Cet article présente un tableau actualisé de cette question, en se concentrant sur une étude de cas : la périphérie du golfe de Gascogne pendant le Magdalénien moyen et récent. Les indices d'exploitation des ressources côtières sont passés en revue et montrent que plusieurs types d'activités apparaissent suffisamment récurrentes et intensives pour être attestées dans plusieurs sites et avoir livré des vestiges archéologiques abondants couvrant une longue période de temps : l'utilisation alimentaire des mollusques sur la côte cantabrique, et l'utilisation de leurs coquilles comme matière première pour la fabrication d'éléments de parure qui circulent très largement à l'intérieur des terres ; l'utilisation des dents et des os de cétacés pour la fabrication d'objets variés qui circulent essentiellement le long du versant nord-pyrénéen. L'utilisation des autres ressources (les invertébrés autres que les mollusques, les poissons, les oiseaux, les mammifères marins en tant que ressource alimentaire, les algues, peut-être la ponce flottée) semble plus occasionnelle. Pris dans leur ensemble, ces indices permettent de suggérer l'existence probable, au moins au Magdalénien moyen et récent sur la marge sud du golfe de Gascogne, d'une économie spécifiquement littorale se développant le long d'une étroite bande côtière aujourd'hui presque entièrement submergée. Les données provenant de la côte est du golfe sont beaucoup plus rares, probablement à cause du plus grand éloignement des sites par rapport au rivage paléolithique, mais aussi peut-être à cause de la présence d'un désert côtier dans les Landes. L'existence possible d'un équipement spécifiquement côtier (les têtes de harpon cantabriques ?) est discutée. Ces données sont brièvement replacées dans un contexte chronologique et géographique plus large ; puis, leurs implications pour notre conception des chasseurs-collecteurs magdaléniens et de la transition entre chasseurs-collecteurs pléistocènes et holocènes sont discutées.

Mots-clés: golfe de Gascogne, Magdalénien, chasseurs-collecteurs littoraux, ressources littorales, mollusques, poissons marins, oiseaux marins, mammifères marins, harpons.

BETWEEN THE 1970s and the 1990s, hunter-gatherers in Pleistocene Europe have been viewed mostly as inland hunters, living essentially from the optimal exploitation of the most profitable food source: large ungulates. Although already in the 1980s some authors pinpointed evidence of an intensification of the use of seashore resources in the course of the Upper Palaeolithic (Straus and Clark, 1986), this evidence was largely neglected: seashore environments remained perceived by most as less productive and usually avoided by hunter-gatherers. According to this ‘inland paradigm’, the shift to a more intensive exploitation of the seashore occurred only when large land game became insufficient to provide for subsistence needs, either because of human demographic growth or because of a diminution of ungulate biomass (this last evolution being itself a consequence of environmental change and/or overhunting by human groups). In Europe this shift would correspond to the transition between the Palaeolithic and the Mesolithic.

However, since the beginning of the 2000s, this traditional picture is gradually changing thanks to new archaeological discoveries and the reassessment of ancient assemblages. J. M. Erlandson was among the first to announce this paradigmatic change in a programmatic publication (Erlandson, 2001)—a paper from which most of the ideas in the present introduction are actually drawn. Erlandson argued for the ancient age of human coastal adaptation, stressing that the current archaeological record was biased by the flooding of most key sites during the recent marine transgressions and calling for a renewal of research in that direction. And indeed, in the subsequent following years this seminal article was followed by a number of publications by many authors that revised upwards the importance of seashore resources for Pleistocene hunter-gatherers. The aim of the present article is to provide an updated image of this question, centring on one case study: the outskirts of the Bay of Biscay during the Magdalenian.

Emerging at the recent end of the Upper Palaeolithic, the Magdalenian is one of the last major expressions of the Western European Pleistocene hunter-gatherer cultures, immediately preceding the Final Palaeolithic cultures of the Late Glacial and the beginning of the Mesolithic. Documenting coastal adaptations at that period is thus a key point to decide if the intensive exploitation of seashore resources by the Mesolithic groups is a complete novelty or is inherited from a more ancient tradition. In this perspective, the shore of the Bay of Biscay is one of the prime locations to investigate since it borders two major regions of Magdalenian settlement: the Cantabrian Mountains and its Western Pyrenean extension to the south and the Aquitaine Basin to the east.

SEASHORE PALEOGEOGRAPHY OF THE GULF OF BISCAY: AN OVERVIEW

The name ‘Bay of Biscay’ refers to the part of the Atlantic Ocean which is today limited to the east by

the French Atlantic coast, from the western tip of Brittany to the Basque Country, and to the south by the Spanish Cantabrian coast, from the Basque Country to Galicia. In the Upper Palaeolithic the outline of this oceanic seashore was of course very different from what it is today. The Middle and Late Magdalenian, that yielded most of the archaeological evidence discussed below, are dated respectively to 19,000–16,500 cal. BP, contemporary with the He1/Oldest Dryas, and to 16,500–14,000 cal. BP, contemporary with the end of the He1 and the GIS-1e/Bølling (Langlais, 2010). Both phases thus take place during a period when the oceans were at one of their lowermost levels in the last glaciation, c. –120 m for the Middle Magdalenian phase and c. –100 m for the last part of the Late Magdalenian phase (see discussion in Langlais, 2010, p. 19). However, the lateral effect of this sea level change is markedly different between the southern and the eastern coasts of the bay (fig. 1). On the southern coast the continental shelf is very narrow, in places extending only 12 km from the seashore, and this steep bathymetry means that the lateral transgression of the seashore since the Pleistocene is fairly limited, c. 10–20 km. But the continental shelf widens to the north along the French coast, from c. 50 km off the coast of the Landes to more than 150 km off the shore of Brittany. As a result, in the northern half of the bay the current seashore lies between 50 and 120 km east of its supposed location during the Magdalenian. This situation has, of course, important consequences for the archaeological visibility of Magdalenian coastal occupations: while in Cantabrian Spain it is possible to excavate sites that were less than 15 km away from the coast in Magdalenian times (e.g., Álvarez Fernández, 2011, p. 331; Berganza et al., 2012), in Atlantic France, especially north of the Landes, the sites that are today the closest to the ocean were still more than 100 km away from it during the Magdalenian. Furthermore, in Atlantic regions north of the Loire River—i.e., in Brittany—evidence of Magdalenian occupations is altogether very scarce (Naudinot, 2010; Marchand, 2014, p. 160). Together these limitations result in a sharp south-to-north decrease of the archaeological potential for documenting Magdalenian coastal occupations along the bay.

Furthermore, the nature and intensity of Palaeolithic coastal occupations is likely to have been influenced by the characteristics of the coast itself. In this perspective the Landes eolian deposits appear as a prominent geographic feature. Recent work in this part of France has shown that a periglacial sandy desert lay there during most of the Upper Palaeolithic (Bertran et al., 2013; Sotgiu, 2014). This desert extended along the seashore on the exposed continental shelf. Sandy material was then transported far inland by the prevailing winds blowing from the northwest. We must thus consider that, during the period investigated here, a cold desert occupied the southeast extremity of the Bay of Biscay and extended over a nearly 200 km long, low-lying sandy coast. The probable incidence of this feature on human seashore occupations will be discussed below.

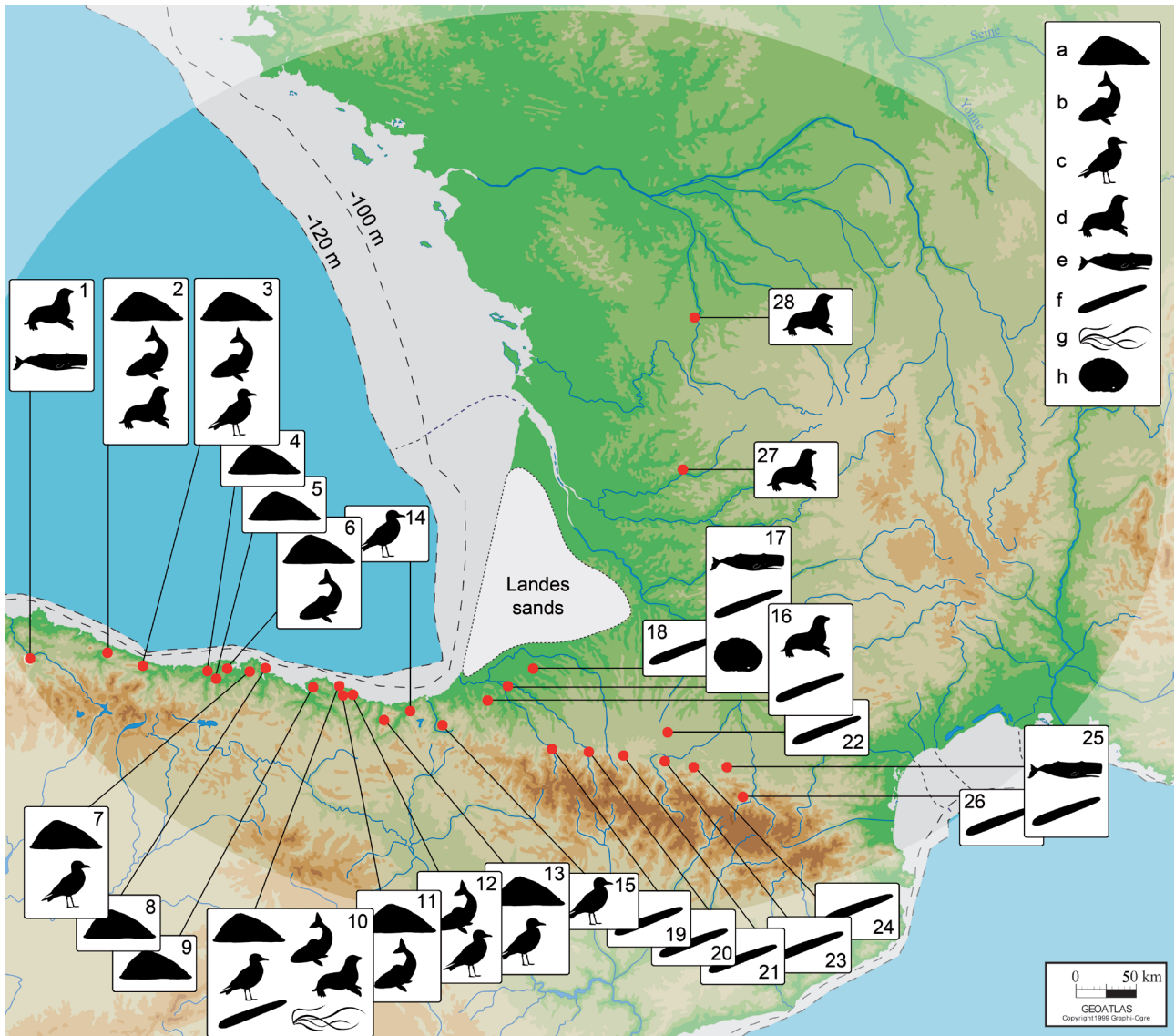


Fig. 1 – Magdalenian sites that yielded evidence of seashore resources on the outskirts of the Bay of Biscay. Sites with perforated shells from Atlantic species are not shown; a: alimentary use of invertebrates; b: remains of strictly marine fish; c: remains of marine birds; d: seal bones and/or teeth; e: cetacean teeth; f: whale bones or objects made of whale bone; g: indirect evidence of algae collecting; h: drifted pumice (?). 1: Las Caldas; 2: Tito Bustillo; 3: La Riera; 4: Altamira; 5: El Juyo; 6: La Pila; 7: La Garma; 8: La Fragua; 9: Santimamiñe; 10: Santa Catalina; 11: Lumentxa; 12: Laminak; 13: Erralla; 14: Torre; 15: Berroberria; 16: Isturitz; 17: Duruthy; 18: Brassempouy; 19: Espalungue and Saint-Michel à Arudy; 20: Les Espélugues; 21: Lortet; 22: Grotte des Harpons at Lespugue; 23: Gourdan; 24: Le Tuc d’Audoubert; 25: Le Mas d’Azil; 26: La Vache; 27: Raymonden; 28: La Marche. Coastlines at –100 m and –120 m after Langlais, 2010.

Fig. 1 – Sites magdaléniens ayant livré des indices de ressources littorales en périphérie du golfe de Gascogne. Les sites ayant livré des coquilles perforées d’origine strictement atlantique ne sont pas figurés ; a : utilisation alimentaire des invertébrés ; b : restes de poissons strictement marins ; c : restes d’oiseaux marins ; d : os et/ou dents de phoque ; e : dents de cétacé ; f : os de cétacé ou objets en os de cétacé ; g : indice indirect de collecte d’algues ; h : pierre ponce flottée (?). 1 : Las Caldas ; 2 : Tito Bustillo ; 3 : La Riera ; 4 : Altamira ; 5 : El Juyo ; 6 : La Pila ; 7 : La Garma ; 8 : La Fragua ; 9 : Santimamiñe ; 10 : Santa Catalina ; 11 : Lumentxa ; 12 : Laminak ; 13 : Erralla ; 14 : Torre ; 15 : Berroberria ; 16 : Isturitz ; 17 : Duruthy ; 18 : Brassempouy ; 19 : Espalungue et Saint-Michel à Arudy ; 20 : Les Espélugues ; 21 : Lortet ; 22 : Grotte des Harpons à Lespugue ; 23 : Gourdan ; 24 : Le Tuc d’Audoubert ; 25 : Le Mas d’Azil ; 26 : La Vache ; 27 : Raymonden ; 28 : La Marche. Lignes de côte à – 100 m et – 120 m d’après Langlais, 2010.

EVIDENCE OF THE EXPLOITATION OF COASTAL RESOURCES

A number of previous publications have inventoried evidence of coastal resources found in Magdalenian

sites (e.g., Poplin, 1983; Sonnevile-Bordes and Laurent, 1983; Cleyet-Merle, 1990; Cleyet-Merle and Madelaine, 1995; Serangeli, 2002 and 2003; Álvarez Fernández, 2006 and 2011; Corchón and Álvarez Fernández, 2008; Pétilon, 2008 and 2013; Fano et al., 2013). However, some of these publications are now ancient and need updating,

while others are centred on a single type of evidence or on only one part of the region considered here. The present overview must thus be seen as a complementary, updated, brief synthesis of these publications (fig. 1). Contrary to other works, depictions of marine animals, either in rock art or in portable art, are not included here (with one exception: see below). This work was indeed deliberately centred on documenting the economic aspects of the exploitation of seashore resources, without considering the status that marine fauna might have held in the Magdalenian imaginative and symbolic world.

Invertebrates

Along the Bay of Biscay, the use of marine invertebrates as food is documented only on the Cantabrian coast; data are here summarized mostly from E. Álvarez Fernández (Álvarez Fernández, 2011) to which the reader is referred for more details.

The consumption of marine molluscs—mostly the common limpet (*Patella vulgate*) and the common periwinkle (*Littorina littorea*)—is documented in four assemblages from the Early Magdalenian (Altamira 1 and 2, La Riera 18-20, El Juyo 9-4 and Erralla V), one from the Middle Magdalenian (Tito Bustillo 1) and four from the Late Magdalenian (La Garma A N–O, La Riera 26–21, La Pila IV, La Fragua 4); the Late and Final Magdalenian assemblage of Santa Catalina III–II must also be added to the list (Berganza et al., 2012, p. 178). In all cases the fairly large number of individuals, with a MNI ranging from 145 in Erralla to more than 13,000 in El Juyo, seems to indicate a regular collecting activity.

Remains of sea urchins are less common and found only in four assemblages from the Late Magdalenian: Santimamiñe 33, La Pila 1, Lumentxa and La Garma A N–O. Only in the latter assemblage are the remains abundant enough to indicate a deliberate, regular exploitation. Similarly, crustaceans are documented only through crab remains found in a few assemblages from the Early Magdalenian (Altamira and El Juyo) and the Middle Magdalenian (Tito Bustillo); in Altamira at least, the nature of the remains—four claws from two adult crabs—suggests intentional gathering by human groups.

Besides their alimentary use, marine molluscs were also used as raw material for the manufacture of personal ornaments. In southern France and northern Spain, perforated shells from strictly Atlantic species, thus were certainly gathered on the shore of the Bay of Biscay (unless we consider a less parsimonious hypothesis of transportation from more remote parts of the Atlantic seashore), and are commonly found in assemblages of personal ornaments since the beginning of the Upper Palaeolithic. The Magdalenian sites that yielded perforated shells from these species are too numerous to be listed here (Taborin, 2004; Álvarez Fernández, 2006), but some of them are up to several hundred kilometers away from the Atlantic coast as it stood in the Magdalenian: orthodromic distances are up to c. 250–300 km (for Saint-Rémy-sur-Creuse, Vienne) or 350–400 km (for La Crouzade, Aude: Taborin, 1993).

Scarce occurrences of Atlantic shells are even known from Magdalenian sites further north, up to the Paris Basin (Étiolles: Taborin, 1993 and 2005) and the German Rhineland (Wiesbaden-Igstadt, Munzingen, Gnirshöhle: Álvarez Fernández, 2001). In these cases the two closest sources of supply on the Atlantic coast are either the northern part of the Bay of Biscay or the mouth of the Channel River, both at orthodromic distances c. 500–600 km (for Étiolles) or 800–1,000 km (for the German sites).

Fish and birds

Again, evidence of the alimentary use of marine fish and birds is restricted to the Cantabrian coast and has been reviewed by Álvarez Fernández (2011).

With the exception of a single piece from the Middle Magdalenian in Tito Bustillo, remains of exclusively marine fish—i.e., excluding diadromous species such as salmonids and anguillids—are known only in the Late Magdalenian (La Riera, Santa Catalina, La Pila, Laminak II, Lumentxa). When specified, the number of bones in each site is often low, e.g., four in La Riera, and twenty-six in La Pila (Le Gall, 1998). Their anthropic origin is not always ascertained: in Laminak II, E. Roselló and coworkers (Roselló et al., 1994) suggest that most remains of marine fish are the result of a natural accumulation. However, in the Magdalenian levels of Santa Catalina (levels II and III), the large number of fish bones recovered include several strictly marine species: Atlantic cod (*Gadus morhua*), wrasse (*Labridae*), mackerel (*Trachurus* sp.), sea bream (*Sparidae*) and cod (*Gadidae*). Their presence is attributed to seashore fishing activities, perhaps of seasonal nature; the use of nets is suggested only for the Azilian (level I) because the mean size of the fish captured diminishes compared to the Magdalenian (Berganza et al., 2012).

Bones of marine birds are very scarce in the Early and Middle Magdalenian (Erralla and La Garma GI, respectively) but become more frequent in the Late Magdalenian (Santa Catalina, Torre, Laminak II, La Riera, Berroberría). However, here again the number of remains per site is usually low and these bones sometimes do not bear anthropic marks (this is the case in Berroberría). The only exception is Santa Catalina where the two Magdalenian levels yielded together a large number of bones attributed to coastal and pelagic birds and bearing butchering traces (Berganza et al., 2012; Elorza, 2005–2006; Elorza Espolosin, 2014; Laroulandie, 2014; Laroulandie et al., this volume). They are especially abundant in level III (Late Magdalenian) and their importance decreases in level II (Final Magdalenian); species diversity is high, with more than a dozen taxa including a variety of seaducks and Charadriiformes. For the two marine taxa best represented – the great auk (*Pinguinus impennis*) and seagulls (*Laridae*) – it was possible to reconstruct the processing sequence of the animals by the human groups, including the use of certain elements in the bone industry.

Seals

Seal remains are documented in 6 Magdalenian sites around the Bay of Biscay. In 3 cases, these remains are pierced teeth, sometimes found in sites remote from the seashore: one perforated canine (grey seal, *Halichoerus grypus*?) in La Marche (Poplin, 1983, p. 91); two perforated seal canines (*Phoca* sp.) in the Middle Magdalenian of Isturitz (fig. 2, nos. 1 and 2; Passemard, 1924, pl. VI); and one perforated lower post-canine tooth of grey seal (*Halichoerus grypus*) in the Middle Magdalenian of Las Caldas (Corchón and Álvarez Fernández, 2008; Corchón et al., 2008, p. 292). The mandible of harp seal (*Pagophilus groenlandicus*) found in the Late Magdalenian of Raymondén (Sonneville-Bordes and Laurent, 1983, p. 72) might also be related to the ‘ornaments’ category (fig. 2, no. 3). It is indeed tempting to interpret this isolated element, found with five teeth still in place in the mandible bone, as a reserve of blanks for the manufacture of personal ornaments similar to those of Isturitz or Las Caldas.

The only two sites where seals are documented by something else than dental or mandible remains are Tito Bustillo (two talus bones in the Late Magdalenian, mentioned in Álvarez Fernández, 2011) and Santa Catalina. This latter site yielded the largest assemblage of seal remains known in the Palaeolithic of Atlantic Europe: eighty-one bones, seventy-nine of which come from the Magdalenian levels II–III and attest to the capture of at least 7 individuals (Berganza et al., 2012).

Another artefact must be mentioned as perhaps indirectly documenting the exploitation of seals. An antler half-round rod (*baguette demi-ronde*) found in the Late Magdalenian of Mège shelter (Dordogne) is engraved with a series of figures that Sonnevill-Bordes and Laurent convincingly interpret as describing the different steps of seal butchering (fig. 3; detailed demonstration in Sonnevill-Bordes and Laurent, 1983, p. 76-78; original drawing by Breuil in Capitan et al., 1906). Element 3 would represent the complete seal, perhaps already wounded or captured; element 1 would show the upper view of a seal butchered and fixed to the ground (from top to bottom: head cut off, body cut open by a ventral longitudinal slit, caudal part flattened with the hole of the anus stretched out); element 2 would represent the skinned posterior part of the animal with a detailed view of the limbs. If this interpretation is correct, for the Magdalenian groups the seal would have been an animal common enough to have developed a specific butchering pattern for it. Although this remains of course speculative, the level of detail and precision visible in the Mège engraving suggests at least a certain familiarity of the carver with the situation depicted rather than the representation of an uncommon event involving an animal seldom encountered.

Cetaceans

As in the case of the seals, remains of cetaceans in Magdalenian sites are rare and often come in the form of



Fig. 2 – Examples of seal remains found in Magdalenian context. 1 and 2: perforated seal canines (*Phoca* sp.), Isturitz (Saint-Martin d'Arberouge, Pyrénées-Atlantiques, France), layer Eo (Middle Magdalenian), Passemard collection, musée d'Archéologie nationale (MAN 77152 and 77159); 3: unmodified fragment of seal mandible (*Pagophilus groenlandicus*), Raymondén (Chancelade, Dordogne, France), Late Magdalenian, Hardy collection, musée du Périgord (photo of no. 3 V. Laroulandie).

Fig. 2 – Exemples de vestiges de phoque retrouvés en contexte magdalénien. 1 et 2 : canines de phoque (*Phoca* sp.) perforées, Isturitz (Saint-Martin d'Arberouge, Pyrénées-Atlantiques, France), couche Eo (Magdalénien moyen), collection Passemard, musée d'Archéologie nationale (MAN 77152 et 77159) ; 3 : fragment de mandibule de phoque (*Pagophilus groenlandicus*) non modifié, Raymondén (Chancelade, Dordogne, France), Magdalénien récent, collection Hardy, musée du Périgord (cliché du n° 3 V. Laroulandie).

teeth—unmodified, perforated or carved. In the Middle Magdalenian layers of Duruthy, three unmodified teeth of middle-sized toothed whales (*Odontoceti*, among which maybe *Globicephala melas* and *Delphinapterus*: Poplin, 1983, p. 91) were identified. The Middle Magdalenian layers of Las Caldas yielded three teeth of long-finned pilot whale (*Globicephala melas*) with an unfinished bipolar perforation and three unmodified teeth of unspecified delphinids (Corchón and Álvarez Fernández, 2008;



Fig. 3 – Carved half-round rod made from antler (*baguette demi-ronde*), Mège shelter (Teyjat, Dordogne, France), Late Magdalenian, Bourrinet collection, musée d'Archéologie nationale (MAN 50541 and 50550). The two fragments do not refit but are very likely from the same object. 1, 2, and 3: details (see description in text).

Fig. 3 – *Baguette demi-ronde* gravée en bois de cervidé, abri Mège (Teyjat, Dordogne, France), Magdalénien récent, collection Bourrinet, musée d'Archéologie nationale (MAN 50541 et 50550). Les deux fragments ne se raccordent pas mais proviennent vraisemblablement du même objet. 1, 2, 3 : détails (voir description dans le texte).

Corchón et al., 2008, p. 295–298). In the same layers, a perforated sperm whale tooth (*Physeter macrocephalus*) decorated with the engraved figures of a bison and a cetacean was discovered (Corchón and Álvarez Fernández, 2008; Corchón et al., 2008, p. 298–301). The only similar artefact known to date is the sperm whale tooth from the Magdalenian of Mas d’Azil, perforated and carved in the shape of a pair of ibex (fig. 4; Poplin, 1983).

Besides dental remains, other artefacts document the use of cetacean bones in the osseous industry. The large bison contour cutout (*contour découpé*) from the Middle Magdalenian of Isturitz was recently identified as being carved out of a blank taken from a whale skull (pers. comm. F. Poplin cited in Rivero, 2014, p. 265). The use of whale bone to manufacture weapons and tools—projectile points, foreshafts and wedges—is documented by 109 artefacts from twelve Magdalenian sites on the northern side of the Pyrenees (Pétillon, 2008 and 2013). Their higher frequency in the Western Pyrenees and their absence in the eastern part of the chain strongly suggest that they were manufactured on the shore of the Bay of Biscay and then transported from west to east into the inland. Their number and chronological distribution—second half of the Middle Magdalenian and first half of the Late Magdalenian, c. 17,500–15,000 cal. BP—show the existence of a production consistent and abundant enough to regularly supply a network of ‘recipient sites’ during a long period. It is worth noting that an implement made of whale bone was also identified in the Late Magdalenian of Andernach-Martinsberg in the Central Rhineland in Germany (Langley and Street, 2013). Although it cannot be ascertained that the artefact originates from the Bay of Biscay, in any case, it was found c. 1,000 km from all closest possible supply sources: the coast of the Bay of Biscay, the mouth of the Channel River and the Mediterranean seashore.

In the current state of knowledge, evidence of the alimentary use of cetaceans is only indirect and restricted to two sites. In the Middle Magdalenian of Las Caldas, the presence of a fragmentary whale barnacle (*Coronula diadema*), a crustacean commonly found embedded in the skin of large cetaceans, probably indicates the transport of whale skin, blubber and perhaps meat from the coast to the site (Corchón et al., 2008, p. 301–303). In the Late and Final Magdalenian of Santa Catalina, forty-one fragments of vertebrae and ribs from large cetaceans also indicate the transport of whale bones, and perhaps meat, from the coast to the settlement (Berganza et al., 2012, p. 177).

None of the authors who investigated the exploitation of cetaceans in the Magdalenian suggest the existence of active whaling. In all cases the parsimonious and far more likely hypothesis is the scavenging of stranded animals. This does not necessarily mean that this activity was economically unimportant: Smith and Kinahan estimate that, for prehistoric hunter-gatherers living near the shore of Saint Helena Bay on the western coast of South Africa, the scavenging of stranded whales might have counted for more than one third of the diet (Smith and Kinahan, 1984, p. 96). The regular exploitation of the

blubber and meat of stranded whales by hunter-gatherers is also documented in other continents, for example in southern Patagonia (Bove, 1883, quoted in Lefèvre et al., 2003, p. 113).

Other resources

Although perhaps less significant, two other types of seashore resources exploited during the Magdalenian must be included in this survey.

In the Final Magdalenian of Santa Catalina, the presence of one mollusc taxon without alimentary interest, *Rissoa parva*, suggests the collecting of algae and their transportation to the site since these animals usually live between the rhizomes of large kelps (Berganza et al., 2012, p. 178–179).

Finally, the last artefact that must be mentioned in this overview is a 6.5 cm long pumice polisher, probably used in the manufacture of bone needles, found in reworked sediments in the Duruthy shelter but most likely pertaining to the Middle or Late Magdalenian. A recent textural study and geochemical analysis of this object (Dachary et al., 2012) has shown that it is made of a rhyolitic pumice whose composition does not match the potential pumice sources known in Western Europe (i.e., the Massif Central pumice). Although the exact provenience of the material remains so far unknown, the authors suggest that it might come from an eruption on an island or a continent bordering the North Atlantic and have drifted through flotation to the shore of the Bay of Biscay where hunter-gatherers would have collected it.

DISCUSSION

To the south: a specific coastal economy

At the end of this overview survey, the picture of seashore exploitation during the Magdalenian appears quite contrasted. Two types of activities are recurrent and intensive enough to be documented in a number of sites and to have yielded abundant archaeological remains spanning a long time period:

- The use of molluscs for food on the Cantabrian coast, and the use of their shells as raw material for personal ornaments that circulated far into the inland, up to 300–400 km, with rarer occurrences up to 500–1,000 km.
- The use of cetacean teeth and bones to manufacture a variety of objects (ornaments, carvings, tools and projectile tips) circulating mostly in the western and central parts of the northern Pyrenean range.

By contrast, the use of other resources (invertebrates other than molluscs, fish, birds, sea mammals as food resource, algae, maybe drifted pumice) seems more occasional or rare.

However, there are several reasons to qualify this last statement. First, the diversity of evidence from coastal resources shows that all of these were known by the Magdalenian groups and that all were exploited, even if not



Fig. 4 – Carved and perforated sperm whale tooth, Mas d’Azil (Ariège, France), Middle or Late Magdalenian, Piette collection, musée d’Archéologie nationale (MAN 47257).
 Fig. 4 – Dent de cachalot sculptée et perforée, Mas d’Azil (Ariège, France), Magdalénien moyen ou récent, collection Piette, musée d’Archéologie nationale (MAN 47257).

always systematically. Second, the rare occurrence of certain types of remains, especially fish bones and bird bones, is likely related, at least in part, with preservation conditions and/or with inadequate recovery techniques during old excavations (e.g., no systematic water screening). Third, the lack of evidence of some activities in certain regions might be only apparent and due to gaps in the current state of our knowledge; e.g., objects made of whale bone have not yet been systematically searched in the osseous industry assemblages from Cantabria, leaving open the question of whether this particular production might also be present to the west of the Pyrenees. And above all, it is important to stress that all the evidence of seashore exploitation that is currently available to us is only an inland echo of a more coastal lifestyle. Even the Cantabrian sites that appear today closely connected to the ocean were usually at least 10–15 km away from it in Magdalenian times, and this distance is enough to drastically reduce the archaeological visibility of coastal activities. Quoting ethnographic sources, Erlandson writes: “Study of modern coastal hunter-gatherers suggests that they rarely travel more than about 5 or 10 km from a home base to gather foods (...). When they do hunt or forage further afield, the skeletal remains of shellfish, fish, or sea mammals are often not transported back to a residential base. In most situations, therefore, sites located more than about 5–10 km from an ancient shoreline are unlikely to contain substantial evidence for marine resource use. Distances of even 1 km or 2 km can dramatically reduce the density of aquatic faunal remains” (Erlandson, 2001, p. 301–302).

In this perspective the cave of Santa Catalina, with its unusually close proximity to the Palaeolithic coast—5 km—, fair bone preservation and modern excavation techniques, stands out as a key site: it is currently our only window on a coastal adaptation that was potentially more widespread in the Magdalenian, and might have had a more and more pronounced marine character as we get close to the seashore. Indeed, many activities evidencing the familiarity of humans with the coastal environment are documented only in this site: the collecting of kelps, a systematic marine fishing, regular capture of marine birds, active sealing and the transport of whale bones to the site are unknown in other Magdalenian sites. But there is no reason to think that Santa Catalina was the only site of its kind in Magdalenian times.

These arguments allow us to suggest the probable existence, at least in the Middle and Late Magdalenian on the southern outskirts of the Bay of Biscay, of a specific seashore economy established on a narrow coastal strip that is now completely submerged. All coastal resources were known and used and, in several cases, the production was regular and intensive enough for certain non-alimentary products (shell beads, objects made of whale bone) to diffuse widely into the inland.

To the east: the silent coast

Most of the evidence discussed in this survey comes from the Cantabrian Mountains and their Pyrenean

extension. By comparison, evidence of coastal activities from the eastern shore of the bay, i.e., the current French Atlantic coast, is very limited. In the regions north of the Pyrenean-Cantabrian range, apart from the two seal remains in La Marche, Vienne, and Raymondén, Dordogne (see above), and several depictions of seals in portable art (Sonnevile-Bordes and Laurent, 1983 ; Seran-geli, 2003), personal ornaments made of marine shells are the only evidence of a link with the seashore.

The most obvious explanation for this contrast is of course the greater distance of the sites from the Palaeolithic shore (see above). If coastal adaptations ever existed during the Magdalenian off the French Atlantic seashore, these regions, but also their far hinterland up to several dozens of kilometres from the coast, are now under sea level. However, a supplementary reason can be advanced for the south-eastern coast, corresponding to the current Landes area. The presence of a desert in this part of the territory (see above) suggests that the corresponding part of the coast was sandy, low-lying, devoid of any major rivers and opening into a barren hinterland. It might thus have yielded only a relatively low biomass and have been an unattractive setting for Magdalenian groups, very different from the rocky shores and estuaries that form the majority of coastal environments exploited in the Cantabrian Magdalenian (Álvarez Fernández, 2011). In this case, the scarcity of coastal evidence in the hinterland of the Landes shore would reflect a Palaeolithic reality and would be another expression of the repulsive character of this area for Pleistocene hunter-gatherers (Bertran et al., 2013).

Specific economy: specific techniques?

If economic strategies specifically adapted to the seashore existed in the Magdalenian, then the question arises whether this adaptation involved the development of particular technologies. Activities such as mollusc collecting or the scavenging of stranded animals do not require a specialized set of tools, and other forms of coastal predation, such as fishing, imply the use of an equipment that can be almost exclusively manufactured from perishable materials (fishing nets, fishing lines, etc.). Almost the only candidate for a specifically coastal piece of equipment that might have survived in the archaeological record is the harpoon, an implement that is usually linked to the exploitation of aquatic environments (e.g., Mason, 1900; Julien, 1982, p. 137–150).

The Late Magdalenian indeed yielded large numbers of antler barbed points, usually interpreted as detachable harpoon heads (Julien, 1982; Weniger, 1992, 1995, and 2000; Langley, 2013). Recent research, however, has questioned this functional hypothesis and has suggested that, given the morphology of their base, most Late Magdalenian barbed points might as well be fixed heads of ‘simple’ barbed projectiles. This latter type of weapon is not specifically associated with aquatic environments, and the precise function of these barbed points would thus be undecidable (Pétillon, 2009; Christensen et al., in

press; see also Weniger, 1995, p. 193–199; Julien, 1999 ; Julien and Orliac, 2004, p. 246–247).

There is, however, one subtype of Late Magdalenian barbed point that remains a likely candidate for the function of harpoon head: the one showing a lateral perforation on the base (fig. 5; Weniger, 1987). On ethnographic artefacts, this type with a perforated base can be found on both detachable harpoon heads and fixed barbed points, but Weniger demonstrated that the size of the perforations on the Magdalenian implements was closer to that of harpoon heads, at least according to his ethnographic reference sample (Weniger, 1995, p. 44, 53, 61, 100). It is worth noting that the geographic distribution of this subtype is limited to the Cantabrian coast—hence the name ‘Cantabrian type’ in Weniger’s typology—with frequencies highest in the Asturias and decreasing towards the eastern part of the coast (González Sainz, 1989, p. 245–246 and fig. 77).

In the present state of our knowledge, it is not possible to take this issue further, but it is nonetheless interest-

ing to stress the association between the ‘harpoon-like’ morphology of these implements and their strictly coastal distribution on the southern shore of the Bay of Biscay. If this association proved to be more than a coincidence, these Magdalenian barbed points with perforated base might represent one of the earliest archaeological evidence of the development of weaponry specialized in maritime environments. The confirmation of this hypothesis would require the finding of either a point of this type embedded in the bone of a marine animal, or its depiction in use on a painting or engraving.

Contextualization and final implications

The practices documented around the Gulf of Biscay during the Middle and Late Magdalenian have contemporary equivalents in other regions: evidence exists notably for the Magdalenian of the Spanish Mediterranean shore (e.g., Nerja: Cortés-Sánchez et al., 2008; Álvarez Fernán-

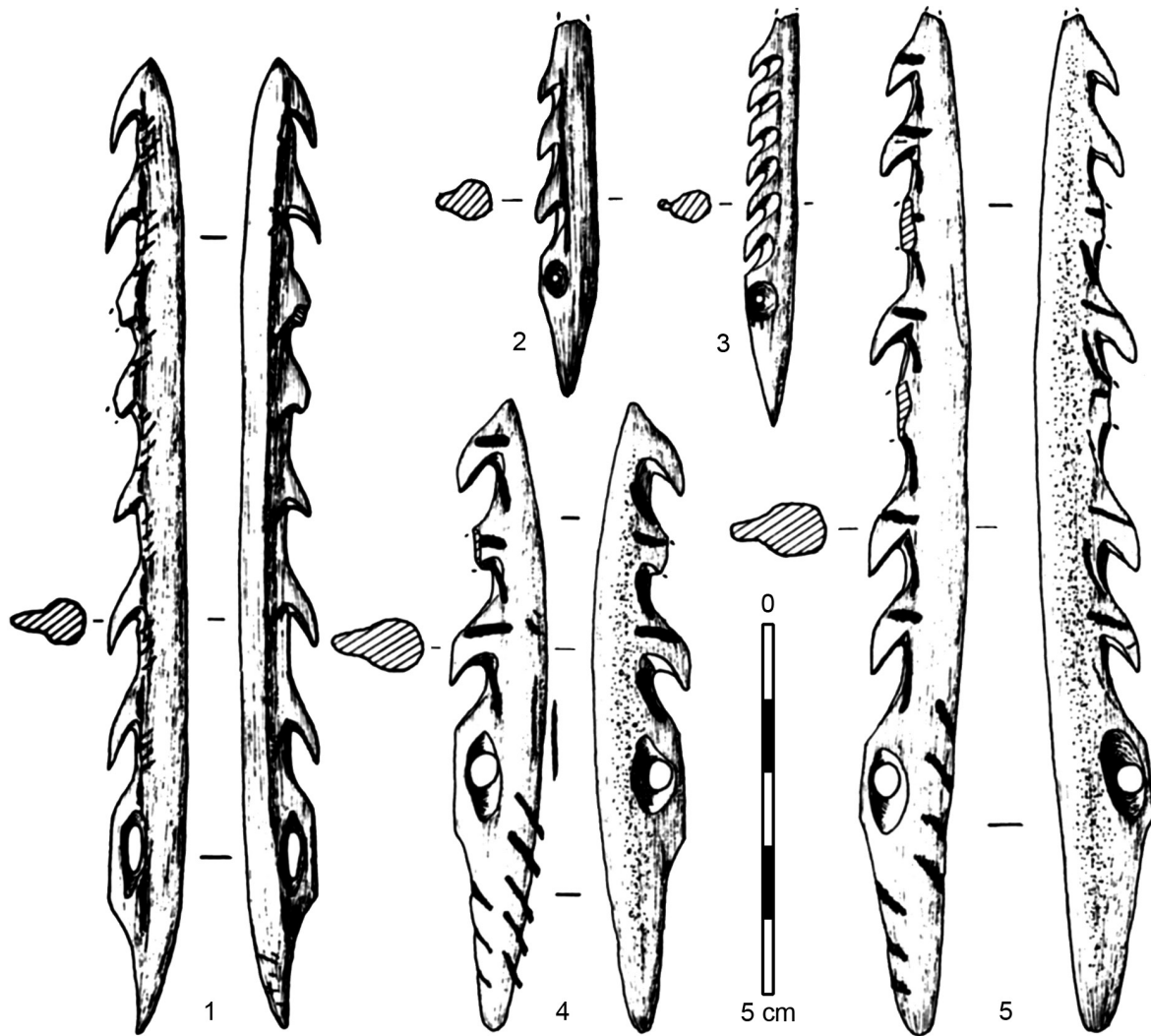


Fig. 5 – Magdalenian barbed points with basal perforation (‘Cantabrian type’). 1: La Pila, level 4.3; 2: El Valle; 3 and 4: El Pendo. All artifacts except for no. 1 are curated in the Museo de Prehistoria de Santander (after González Sainz, 1989).

Fig. 5 – Pointes barbelées magdaléniennes à base perforée (« type cantabrique »). 1 : La Pila, niveau 4.3 ; 2 : El Valle ; 3 et 4 : El Pendo. Toutes les pièces sauf le n° 1 sont conservées au Museo de Prehistoria de Santander (d’après González Sainz, 1989).

dez et al., 2014) and the Atlantic coast of Portugal (e.g., Bicho and Haws, 2008, p. 2172 and references therein). These practices also have earlier antecedents at the European scale: the occasional consumption of seashore fauna is documented in several Middle Palaeolithic sites (e.g. among recent overviews: Álvarez Fernández, 2010; Colonese et al., 2011, p. 89–90; Brown et al., 2011; Haws et al., 2011, p. 204–205; Steele and Álvarez Fernández, 2011); in the Early Upper Palaeolithic (Aurignacian and Gravettian), ornaments made of marine shells are frequently found at inland sites, although other evidence of the exploitation of seashore resources remains scarce (Álvarez Fernández, 2010; Haws et al., 2011; Castaños and Álvarez Fernández, 2012; but see Manne and Bicho, 2011); this evidence becomes more abundant in the Solutrean, while still being less rich and diverse than in the Magdalenian (Straus and Clark, 1986; Álvarez Fernández and Fernández García, 2012). It is not within the scope of this article to determine if this apparent intensification pattern reflects a progressive increase of seashore exploitation, or if this pattern is fundamentally biased by the heterogeneous nature of the archaeological record (i.e., from one period to another, variation of distances from the shore, uneven preservation of sites, unequal research effort invested, etc.).

However, in any case, the data presented in this study have implications at two levels. First, they must be fully included in our conception of the Magdalenian

hunter-gatherers. When trying to reconstruct the seasonal nomadic cycle of these populations, or their exchange networks, we must henceforth take into account the fact that the seashore and the exploitation of its resources were fully integrated into their lives, and played a more than occasional role in the organization of community life.

Second, these results have implications on the question of the transition from Pleistocene to Holocene hunter-gatherers. When discussing this issue, we must keep in mind that, at least in this part of Europe, hunter-gatherer coastal economies – the subject of many contributions in this volume – are not entirely a post-Pleistocene innovation but have their roots in the Ice Age.

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