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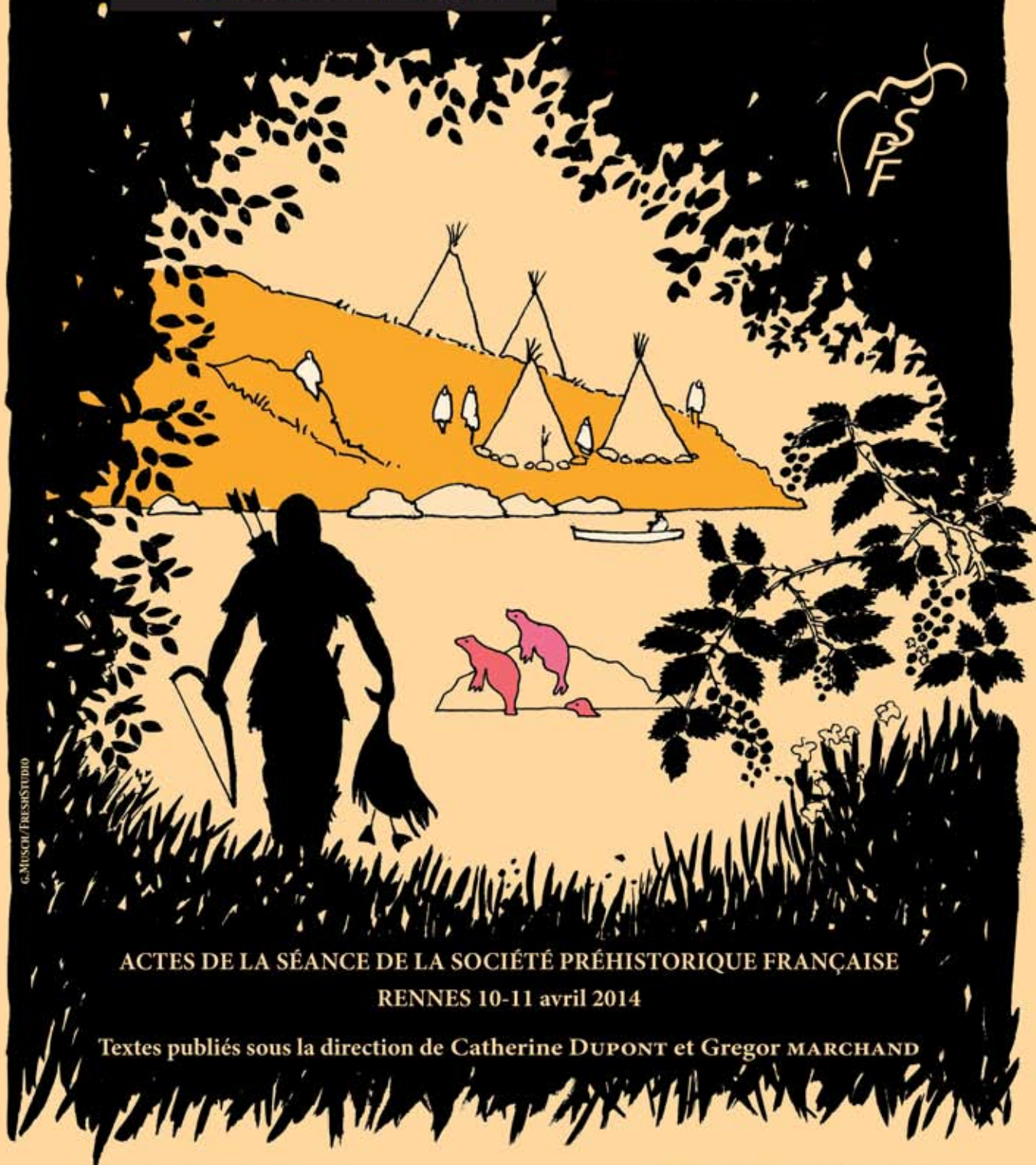
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ARCHÉOLOGIE
DES CHASSEURS-CUEILLEURS MARITIMES
DE LA FONCTION DES HABITATS
À L'ORGANISATION DE L'ESPACE LITTORAL

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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The Significance of Marine Resources during the Early Mesolithic in Portugal

Ana Cristina ARAÚJO

Abstract: In Portugal, marine resources were recovered from a small number of Palaeolithic sites, but sea-level rise prevents us from evaluating their significance for the subsistence of these societies. From the very beginning of the Holocene shellfish consumption is definitively established, playing a major role in the subsistence and social organisation of hunter-gatherer communities. Molluscs are abundant in the Early Mesolithic archaeological record (c. 11.2–8.5 ka cal. BP), even in sites located far from the ancient shoreline. The economic dependence upon marine resources seems to have structured the way of life of these communities and explains, first, the occurrence of shell-midden sites scattered along the coast of Estremadura, Alentejo and Algarve; second, the high level of human mobility, with people moving regularly between the coast and the interior and third, a possible social structure based on small family units. This article presents a snapshot in time (i.e. the Early Mesolithic) as regards the exploitation of marine resources and its involvement in other fields of human behaviour.

Keywords: Portugal, Early Mesolithic, marine resources.

Résumé : La présence de ressources marines est attestée dans quelques gisements datés du Paléolithique moyen et supérieur. Cependant, la modification de la ligne de côte et la submersion d'éventuels gisements accumulés au cours de ces périodes empêchent d'évaluer l'importance et le poids réel de cette composante dans le régime alimentaire des communautés paléolithiques. C'est donc à partir du début de l'Holocène que la consommation de fruits de mer est devenue récurrente et que les populations du Mésolithique ancien (env. 11200-8500 cal. BP) sont devenues définitivement dépendantes de ce type de ressource. Ces faits expliquent 1) l'apparition de gisements de type amas coquillier dans le registre archéologique des zones littorales et la présence systématique de vestiges liés à la consommation élargie de mollusques, même dans des endroits situés à des distances considérables de la ligne de côte fossile (de l'ordre de 30 à 50 km), 2) une très grande itinérance des groupes humains, qui se déplacent dorénavant entre les zones littorales et celles de l'intérieur des terres, au cours du cycle annuel et 3) une structure sociale basée très probablement sur de petites unités de type familial. Sur le littoral, ce sont les gisements de type amas coquillier qui caractérisent le registre archéologique de cette époque. La grande majorité correspond à des lieux consacrés à l'exploitation et à la consommation d'aliments d'origine aquatique, surtout des mollusques, et rares sont les cas qui documentent des vestiges liés à la pratique d'autres activités. L'éventail d'espèces d'origine marine consommées par ces premiers Mésolithiques inclut des bivalves, des gastéropodes, des crabes, des pouces-pieds, des oursins et des céphalopodes. Dans deux des amas coquilliers seulement, situés sur la côte de l'Estrémadure, le menu incluait un éventail très diversifié de poissons, en particulier des espèces de la famille des Sparidae.

La variabilité décelée dans la composition et la représentation relative des invertébrés marins entre les divers amas coquilliers reflète, avant tout, la spécificité biogéographique de chacun des lieux exploités : en Estrémadure (centre du Portugal), les espèces d'environnements sableux et vaseux comme la coque (*Cerastoderma edule*), le scrobiculaire (*Scrobicularia plana*) et la palourde (*Ruditapes decussatus*), dominent ; sur le littoral de l'Alentejo et de l'Algarve, la norme est nettement inversée, ainsi les espèces inféodées aux rochers, comme la monodonte (*Phorcus lineatus*), la moule (*Mytilus* sp.) et la patelle (*Patella* sp.) sont les plus exploitées.

La plupart de ces amas coquilliers a été accumulée au cours de séjours brefs et répétés, voués à l'exploitation des ressources marines des zones littorales.

Dans les terres intérieures – massifs calcaires de l'Estrémadure – il existe des sites de grotte et d'abri qui documentent des dépôts coquilliers, avec notamment des espèces marines. Au cours du Mésolithique ancien, ces sites étaient éloignés de la ligne côtière. Ce fait a évidemment eu des conséquences sur plusieurs plans, notamment sur les schémas de mobilité des communautés et sur l'étendue de leurs territoires économiques qui couvrirent dès lors les terres du littoral et de l'intérieur.

Mots-clés : Portugal, Mésolithique ancien, ressources marines.

PINPOINTING THE SUBJECT

THE CONSUMPTION of marine resources is recorded in archaeological sites since the Middle Palaeolithic, continuing throughout the Upper Palaeolithic but reaching its highest impact on human subsistence during the Mesolithic, as inferred by the number of shell midden sites available from this period (Araújo, 2009 and 2016). Unfortunately, the real contribution of this food component in the diet of Palaeolithic and Early Mesolithic groups, measured through stable carbon and nitrogen isotope analysis, is virtually unknown, given the scarcity of human bones existing for both periods. Conversely, this last component is very well represented in Late Mesolithic archaeology, with more than 400 human individuals recorded both in the Tagus (Muge and Magos; Cunha and Cardoso, 2002–2003) and Sado shell middens (Cunha and Umbelino, 1995–1997 and 2001). In the Tagus sites marine food played a major role in the Mesolithic diet, reaching 50% according to stable isotope values (Lubell and Jackes, 1988; Lubell et al., 1994), whereas in the Sado sites the contribution of this component was negligible, showing that terrestrial animals and plants were much more important in the subsistence of these Mesolithic groups (Cunha and Umbelino, 2001; Umbelino, 2006; Fontanals-Coll et al., 2014). Nevertheless, it is important to note that molluscs are nonetheless numerous in this later midden complex (Morais Arnaud, 1989 and 2000). Fish bones are also well represented by a variety of species and occur in a significant number at Arapouco, a site located downstream the Sado River (Morais Arnaud, 1989 and 2000; Gabriel et al., 2012 and 2013).

The evaluation of the role, number and significance of marine resources over time reveals major changes in human subsistence strategies at the transition to the Holocene, as has been repeatedly argued (e.g. Araújo 2009, 2011, 2015 and 2016; Araújo et al., 2014). In fact, molluscs became a common trait of the Mesolithic archaeological record, with shell middens occurring not only along the Atlantic coast, but also in locations further inland. During the Late Mesolithic the exploitation of marine resources became even more important considering both the high number of shell midden sites existing from this phase as well as the weight gained by this component in human subsistence demonstrated by stable isotope measures.

THE EXPLOITATION OF MARINE RESOURCES DURING THE PLEISTOCENE: BETWEEN THE REAL AND THE VIRTUAL

Figure 1 shows the location of two Palaeolithic sites where marine resources seem to have attained relatively great significance, if not intensively exploited, at least having acquired a level of archaeological visibility.

Figueira Brava (fig. 1a, no. 1), the most ancient one, is a cave presently located on the seashore (about 5 m above

mean sea level), near Sesimbra, on the southern slope of the Arrábida mountain. The site was initially excavated during the 1980s, under the direction of M. Telles Antunes (Antunes, 1991 and 2000a). A Mousterian occupation was radiocarbon dated to c. 35 ka cal. BP (Antunes and Cardoso, 2000) from two bulk samples of *Patella* shells, both recovered from bed C.2. A U-Th date obtained from a *Cervus elaphus* tooth yielded a result that is consistent with the former one (Antunes, 1991; Antunes and Cardoso, 2000). These results, however, should be considered as minimum ages according to J. Zilhão (Zilhão, 2012), who recently carried out new excavations, evaluating and radiocarbon dating (through AMS and U-Th), re-evaluating the Middle Palaeolithic identified at Figueira Brava and its geoarchaeological context.

Molluscs, mainly limpets (*Patella vulgata*; c. 42%) and mussels (*Mytilus galloprovincialis*; c. 24%), adapted to rocky substrates, and crabs (*Cancer pagurus* and some Decapoda; 8%) are the most common marine taxa recovered during the 1980s field work (Callapez, 2000). According to this author, these species were exploited for consumption. The Minimum Number of Individuals (MNI) of marine invertebrates is unknown, but 900 specimens belonging to thirty-six different species were recorded in the Middle Palaeolithic occupation of Figueira Brava (Callapez, 2000), not all necessarily exploited for consumption (some are clearly epibiotic species). Additionally, remains connected to the gathering (or hunting) of marine mammals—the ringed seal (*Pusa hispida*) and the common dolphin (*Delphinus delphis*)—were also identified, although their presence is very scarce (only two immature individuals, represented by a right ulna of a young ringed seal and by six vertebrae belonging to a dolphin; Antunes, 2000b).

The site also provided bones of terrestrial mammals (Antunes, 2000c) such as red deer (*Cervus elaphus*), wild goat (*Capra pyrenaica*), aurochs (*Bos primigenius*) and horse (*Equus caballus*)—certainly the most exploited and consumed animals taking into account the number of bones encountered. At the time of the Palaeolithic occupation of Figueira Brava, a plain existed between the cave and the sea, with sea-level positioned approximately 60 m below its present position (Antunes and Cardoso, 2000; Pais and Legoinha, 2000).

Despite the diversity of marine invertebrates recovered at Figueira Brava during the 1980s field work, it is difficult to estimate the real representation of this component within the anthropic deposits and its significance in the subsistence of Middle Palaeolithic groups. The current investigations, carried out under the supervision of J. Zilhão (Zilhão, 2012), will surely clarify many of the pending problems concerning the archaeology of this site.

At Vale Boi, a site located on the western coast of Algarve, near Vila do Bispo (fig. 1a, no. 2), an important Upper Palaeolithic sequence (containing Early Gravettian, Proto-Solutrean, Solutrean, and Magdalenian techno-complexes) has been excavated by N. Bicho since 2000 (e.g. Bicho, 2004; Manne and Bicho, 2009; Bicho

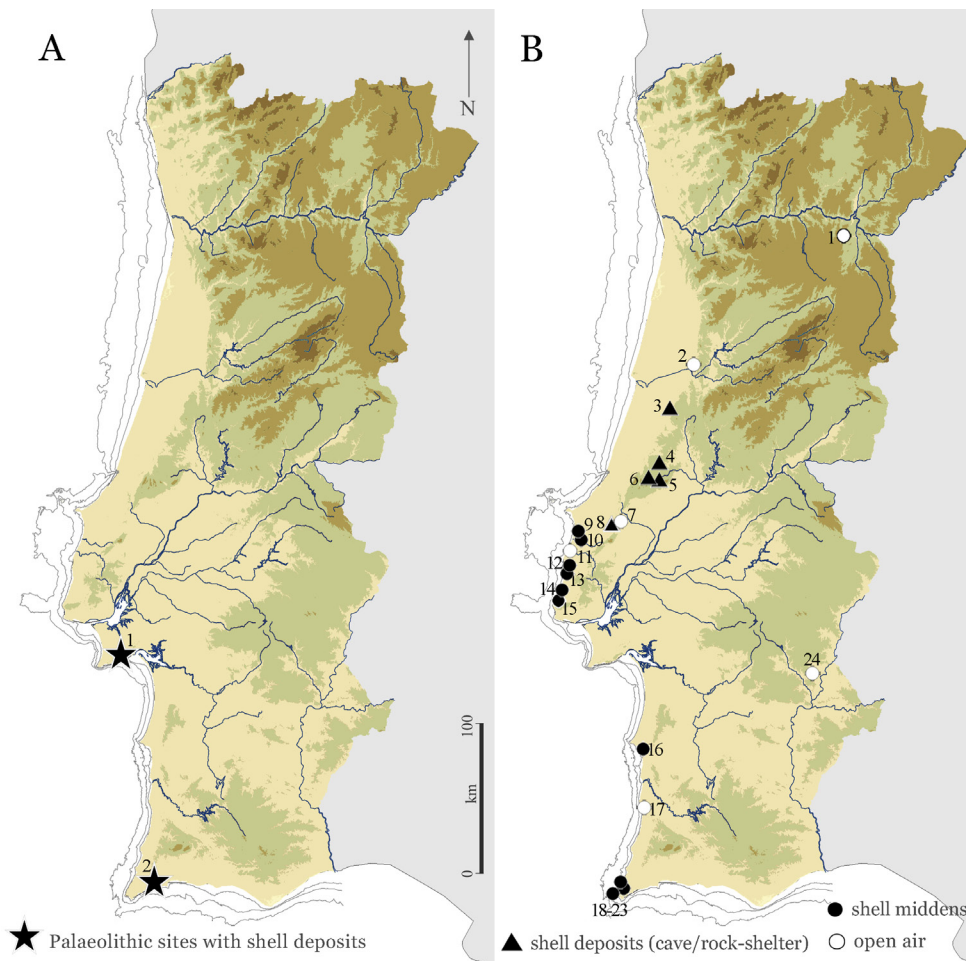


Fig. 1 – A: Pleistocene sites with marine resources; 1: Figueira Brava (Middle Palaeolithic); 2: Vale Boi (Upper Palaeolithic). B: Early Mesolithic settlements; 1: Prazo; 2: Vale Sá; 3: Buraca Grande; 4: Casal Papagaio; 5: Lapa do Picareiro; 6: Pena de Mira; 7: Areiro III; 8: Bocas 1; 9: Vale Frade; 10: Toledo; 11: Ponta da Vigia; 12: Cabeço do Curral Velho; 13: Pinhal da Fonte; 14: São Julião (loci A and B); 15: Magoito; 16: Oliveirinha; 17: Palheirões do Alegria; 18: Castelejo; 19–23: Barranco das Quebradas 1, 3, 4, 5 and Rocha das Gaivotas; 24: Barca do Xerez de Baixo (adapted from the map drawn by A.M. Costa).
Fig. 1 – A : sites du Pléistocène avec ressources marines; 1 : Figueira Brava (Paléolithique moyen); 2 : Vale Boi (Paléolithique supérieur). B : sites du Mésolithique ancien; 1 : Prazo; 2 : Vale Sá; 3 : Buraca Grande; 4 : Casal Papagaio; 5 : Lapa do Picareiro; 6 : Pena de Mira; 7 : Areiro III; 8 : Bocas 1; 9 : Vale Frade; 10 : Toledo; 11 : Ponta da Vigia; 12 : Cabeço do Curral Velho; 13 : Pinhal da Fonte; 14 : São Julião (loci A et B); 15 : Magoito; 16 : Oliveirinha; 17 : Palheirões do Alegria; 18 : Castelejo; 19–23 : Barranco das Quebradas 1, 3, 4, 5 et Rocha das Gaivotas; 24 : Barca do Xerez de Baixo (modifié d'après la carte dessinée par A. M. Costa).

et al., 2010 and 2013; Manne et al., 2012). Presently, the site is located 2.5 km from the coastline, overlooking a wide river valley that runs to the sea. The excavation area comprised three different sectors (Manne and Bicho, 2009; Bicho et al., 2010 and 2013; Manne et al., 2012): the terrace (located at the bottom, 10 m above the river bed), the collapsed rock shelter (located on top, near a 10 m limestone cliff) and the mid-slope area (located in between). Vale Boi is commonly considered a seasonal residential site (e.g. Manne et al., 2012; Bicho et al., 2013), with the main activities apparently being developed in different sectors at different times.

The Gravettian occupation, radiocarbon dated to c. 32 ka cal. BP and c. 26.5 ka cal. BP (Bicho et al., 2013), yielded a diversified range of lithic and faunal remains. Shellfish is present in all sectors of the site. Limpets (*Patella*

sp.) are the most common species, reaching about 95% (MNI = 1219; Bicho et al., 2013, p. 109, table 4) of the overall marine invertebrates. The other species, including the mussel (*Mytilus* sp.; MNI = 26) and the clam (*Ruditapes decussatus*; MNI = 13), are represented by a very small number of individuals (totalising a MNI of 69; Bicho et al., 2013, table 4). One non-identified fish vertebra and a single centrum of a vertebra, belonging to a small cetacean, were also recorded in the mid-slope sector (Bicho et al., 2013). It is suggested that during the Gravettian occupation of Vale Boi, 4–5 km separated the site from the seashore (Bicho et al., 2013).

The Solutrean is mainly represented at the rock shelter sector, which was used as a main living area (Manne et al., 2012, p. 85). The occupation is radiocarbon dated to ca 21 ka cal. BP and to ca 25 ka cal. BP (Manne et

al., 2012). Marine invertebrates were recorded, but in much smaller number (MNI = 490) (Manne et al., 2012, p. 88, table 4) than in the Gravettian occupation. Limpets (*Patella* sp.) remains the most represented species (MNI = 443, i.e. 90%), followed by the mussel (*Mytilus* sp.; MNI = 25) and the cockle (*Cerastoderma edule*, MNI = 11), the latter adapted to soft bottoms of sandy banks. Fish is not recorded in the Solutrean occupation of Vale Boi. As it is mentioned by Manne et al. (2012), the decrease in shell fish exploitation during this period is related to sea level retreat, estimated to ca – 120 m for the Last Glacial Maximum (Dias et al., 1997 and 2000; Dias, 2004). At this time, the Vale Boi site would have been 15–20 km distant from the seashore (Manne et al., 2012).

The Magdalenian occupation is poorly represented and preserved at Vale Boi (Bicho, 2004; Manne and Bicho, 2009; Manne et al., 2012). A radiocarbon date obtained from a tooth sample yielded a result of 19.2–18.6 ka cal. BP (Bicho and Haws, 2012), suggesting at least one early chronology within this cultural phase (Bicho and Haws, 2012; Manne et al., 2012). Marine invertebrates are almost non-existent (MNI = 4) and fish is totally absent (Manne and Bicho, 2009; Manne et al., 2012).

Besides shellfish, terrestrial mammals were also present throughout the Upper Palaeolithic sequence. Leporids and ungulates are clearly the most important taxonomic groups (e.g. Manne and Bicho, 2009; Manne et al., 2012; Bicho et al., 2013). The total number of identified specimens (NISP) is 13,763, corresponding to 73% leporids and 27% ungulates (Bicho et al., 2013; Manne et al., 2012). No major changes were observed regarding species representation along the Gravettian, Solutrean and Magdalenian occupations, but the number of specimens varies considerably from one to another (Manne et al., 2012). Diverse signs related to butchery activities (including grease rendering and marrow extraction) were also identified (Bicho and Manne, 2009; Manne et al., 2012; Bicho et al., 2013).

In Figueira Brava (FB) and Vale Boi (VB) marine resources were exploited, although not intensively, by Middle Palaeolithic (FB) and Upper Palaeolithic (VB) groups—as can be inferred from the MNI or NISP determined at both sites.

Apart from these, there are some (although still equivocal) references to the appearances of seafood items in a few other Palaeolithic contexts, however, occurring in a very small number. In contrast, ornaments made from marine molluscs are very frequent within several Upper Palaeolithic sites, with *Littorina obtusata/fabalis* identified as being the most important taxon (Da Veiga Ferreira and Roche, 1980; Zilhão, 1997; Chauvière, 2002; Vanhaeren and D’Errico, 2002; Bicho et al., 2003; Almeida et al., 2004 and 2007; Tátá et al., 2013).

Although few and scattered, the data presented above clearly reveal that Palaeolithic hunters maintained a close relation with the sea (e.g. Zilhão, 1997). Curiously, marine resources were represented in higher frequencies at Figueira Brava and Vale Boi during the periods in which sea level was more elevated and the coast line con-

sequently closer to these sites. In both cases, however, there seems to be a preferential exploitation focusing on the gathering of limpet (the most available species?). The other taxa were clearly marginal, as can be deduced from their low frequencies in the archaeological deposits. Fish remains are also negligible.

These are the published data from the Pleistocene. Sea level rise and probable flooding of the sites hinders us to evaluate how (and if) marine resources influenced on Palaeolithic settlement and subsistence strategies and the real significance of this food component in the diet of these societies.

However, as soon as the Holocene emerge, marine resources became ubiquitous in the archaeological record and from this moment on people relied heavily on the sea. This food component characterises Early Mesolithic archaeology (c. 11.2 to c. 8.5 ka cal. BP) and this feature together with other cultural solutions adopted or created by humans, justify a new (separate) moment in time. Accordingly, this Early Mesolithic phase is not conceived as a mere continuation of the Palaeolithic way of life entering the Holocene, but a period with its own identity (Araújo, 2016), the beginning of which coincides roughly with the Pleistocene–Holocene boundary.

SHELL MIDDEN SITES AND MARINE RESOURCE DIVERSITY DURING THE EARLY MESOLITHIC: A GENERAL VIEW

Figure 1b shows the mapping for the Early Mesolithic sites of Portugal. It is obvious that shell middens predominate within the archaeological record of this phase. Shell deposits with marine invertebrates (mainly molluscs and some crustaceans) were even found within caves and rock shelters located in areas further inland of Estremadura (central Portugal). Many of the shell middens presently located along the coast resulted from the intensive and repeated exploitation of shellfish, with other archaeological remains often being rare. They consequently correspond to sites almost exclusively devoted to gathering activities carried out in coastal areas.

Even if the outline of the past seashore is still vaguely known, especially for the period corresponding to the Early Holocene, it is commonly accepted (when combining data from various proxies deduced from sedimentology, micropaleontology, palynology, geochemistry, etc.; e.g. Queiroz, 1999; Cearreta et al., 2003; Freitas et al., 2003; Drago, 2005; Fletcher, 2005; Alday et al., 2006; Cabral et al., 2006; Cearreta et al., 2007; Fletcher et al., 2007) that sea level rose rapidly at the transition to the Holocene, from approximately – 40 m to – 20 m during the first two millennia (Dias et al., 1997 and 2000; Dias, 2004). Early Mesolithic shell middens are presently located along the Portuguese coast, but at the time of accumulation (during the Preboreal and Boreal chronozones) they were located at the bottom of river estuaries flowing into the Atlantic. According to their chronology, current

location and the geomorphology and geology of the adjacent littoral platform, these sites would have been located roughly between 7 km and 1 km from the sea, invariably close to the banks of a watercourse commonly containing a freshwater spring.

In these shell middens, the occupational sequences systematically start in the Early Mesolithic. In other words, these sites were previously unoccupied. In some cases, however, later human activities took place at the same location but, as a rule, adjacent to and not directly above anterior settlements (Araújo, 2011 and 2016; Araújo et al., 2014).

The diversity of marine invertebrates represented in these coastal middens varies according to the location and the environmental setting of the sites. Although some species were clearly more consumed than others—a fact not necessarily related to their greater or lesser availability—there is certainly a much wider range of marine invertebrates in these shell middens than in the Palaeolithic sites mentioned above.

On the coast of Estremadura, central Portugal (fig. 1b, nos. 9 and 10 and nos. 12 to 15), the main edible shellfish species consumed by Early Mesolithic groups were primarily the common edible cockle (*Cerastoderma edule*) and the peppery furrow shell (*Scrobicularia plana*) and, in lower frequencies, the mussel (*Mytilus* sp.), the European razor clam (*Solen marginatus*), the carpet shell (*Ruditapes decussatus*), the oyster (*Ostrea edulis*) and the thick topshell (*Phorcus lineatus*). Together with crustaceans—the goose barnacle (*Pollicipes pollicipes*) and the European green crab (*Carcinus maenas*)—all these taxa contributed to the Early Mesolithic menu (Morais Arnaud, 1994; Morais Arnaud and Pereira, 1994; Dupont and Araújo, 2010; Dupont, 2011; Araújo, 2016; Araújo et al., 2014; Dupont et al., in press). We should mention, however, that this assemblage of marine invertebrates was not present in all the shell midden sites of the Estremadura, although many reveal a great diversity of exploited species (not less than three or four), as it will be shown below.

The high frequencies of marine species stemming from sandy and muddy substrates in many of these open air shell middens of the Estremadura show that the river mouths, affected by tidal action, were the main habitats of shellfish collection. Species of rocky environments were also exploited to a greater or lesser extent depending on the sites.

In southern Portugal (Atlantic coast of Alentejo and Algarve; fig. 1b, no. 16 and nos. 18 to 23), in which rocky shores predominate, the main marine edible species collected by Early Mesolithic groups were the thick topshell (*Phorcus lineatus*), the limpet (*Patella* sp.), and the mussel (mostly *Mytilus galloprovincialis*). In addition, the common whelk/purpura (*Stramonita haemastoma*) and the goose barnacle (*Pollicipes pollicipes*) were exploited but in much smaller numbers (Silva and Soares, 1997; Soares and Silva, 2004; Carvalho and Valente, 2005; Carvalho, 2008; Valente, 2008, 2010 and 2014; Valente and Carvalho, 2009; Carvalho et al., 2010; Dean et al., 2011).

Changes in the relative abundance of marine invertebrates during the Early Mesolithic are difficult to determine and may be non-existent (if existent, they may have resulted from circumstantial factors difficult to control and to recognize using archaeological methods). However, if one extends the time span of the analyses from the Early Mesolithic to later periods, there is a trend on the coast of Estremadura towards a major representation of rocky substrate species over time—as shown by the later occupations identified at Magoito (fig. 1b, no. 15; Soares, 2003) and São Julião (fig. 1b, no. 14; Miranda, 2004)—although no accurate study regarding this particular topic is available.

In the Algarve, analyses that were carried out specifically to determine possible differences as regards the relative abundance of marine invertebrates from the Early Mesolithic to the Early Neolithic show that the exploited species remain more or less the same, but with two visible trends—top shells seem to have become less favoured in later periods as opposed to goose barnacles the number of which increased over time (Dean et al., 2011; Valente, 2014). According to these authors, marine invertebrates reflect local ecological availability, which is identical for all shell midden sites, with no data supporting selective cultural choices or overexploitation during the Mesolithic.

The mentioned trend of increased consumption of goose barnacles (Dean et al., 2011; Valente, 2014) in the Neolithic may, hypothetically, reflect ecological changes caused by increased ocean temperatures favouring this species availability.

Several shell midden sites document fire-cracked rocks and in a few cases structured fire-places were found, both interpreted as resulting from possible shellfish processing activities (e.g. Morais Arnaud, 1994; Valente, 2010 and 2014; Araújo, 2011; Dean et al., 2011). The extremely high degree of shell fragmentation – that characterises all the shell midden sites – may have resulted from taphonomic processes and human manipulation. Studies carried out by M. J. Valente (Valente, 2014) on shell breakage patterns and fire exposure of the Barranco das Quebradas shell midden complex (fig. 1b, nos. 19 to 22), revealed practices of intentional fracturing made on the more robust shell molluscs (*Stramonita haemastoma* and *Phorcus lineatus*)—to extract meat content—as well as indications of colour alteration due to direct contact with fire. This was also documented by C. Dupont (Dupont, 2011) for the Toledo shell midden (fig. 1b, no. 10), although fire marks appear in very low frequencies.

Fish is solely represented in two shell midden sites, both located on the coast of Estremadura (Gabriel, 2011; Araújo et al., 2014; Dupont et al., in press): Toledo and Vale Frade (fig. 2, nos. 9 and 10). As shown below, they differ substantially from the other shell middens located along the coast of Estremadura, Alentejo and Algarve—formed by multiple Early Mesolithic passages aiming at the gathering of marine invertebrates, mainly molluscs.

FOCUSING ON THE ESTREMADURA COASTAL RECORD

The two mentioned shell middens, Toledo and Vale Frade, yielded a wide range of species of marine invertebrates and fish (Dupont and Araújo, 2010; Dupont, 2011; Gabriel, 2011; Araújo et al., 2014; Dupont et al., in press), showing that different geomorphological environments (seashore, estuaries and brackish lagoons) were exploited by the Early Mesolithic groups with similar patterns of landscape use. In addition, both sites provided lithic industries (Araújo, 2011 and 2016; Araújo et al., 2014) and ornaments made from shells (Dupont, 2011; Araújo et al., 2014), as well as terrestrial fauna dominated by ungulates and leporids (Moreno García, 2011). The Toledo site also revealed features that were possibly related to food processing (Araújo, 2011 and 2016) and a few human bones (Gonçalves, 2011; Araújo et al., 2014).

The Toledo site is located 4 km from the present sea shore, near the banks of a small watercourse tributary to the Alcabrichel River (fig. 2, no. 10). The site is radiocarbon dated to 10.1–9.5 ka cal. BP. At the time of occupation it was more distant from the shore, but sea water entered further upriver favouring the formation of mollusc banks (Araújo, 2011; Trindade, 2011). At least twenty-four different species of Mollusca belonging

to three taxonomic classes were identified: ten gastropods, thirteen bivalves and one cephalopod (Dupont and Araújo, 2010, Dupont, 2011; Dupont et al., in press). The common cockle, the peppery furrow shell, the mussel, the European razor clam and the carpet shell were clearly the most exploited molluscs for consumption (table 1). Crustaceans are represented by three different edible crabs and also by goose barnacles (table 1). The European green crab had high frequencies (MNI = 32) and was certainly an important food source. These species and their ecological background show that different but complementary environments were part of the economic territory of the Toledo hunter-gatherer-fishers.

Vale Frade is located on the slope of a small valley situated 200 m from the seashore (fig. 2, no. 9). During the Mesolithic occupation (c. 9.9–9.3 ka cal. BP) the site was also located at some distance from the sea. Although the study of marine invertebrates is still preliminary, the mollusc component seems to be comparable to the one found at Toledo, but species of rocky substrate are more abundant (table 1).

The study of marine invertebrates recovered at both sites is still ongoing. The frequencies presented in table 1 only concern the specimens collected by archaeologists during the field work (i.e. the whole or the less fragmented specimens). As all the residues stemming from water sieving of the midden waste were kept for future sort-

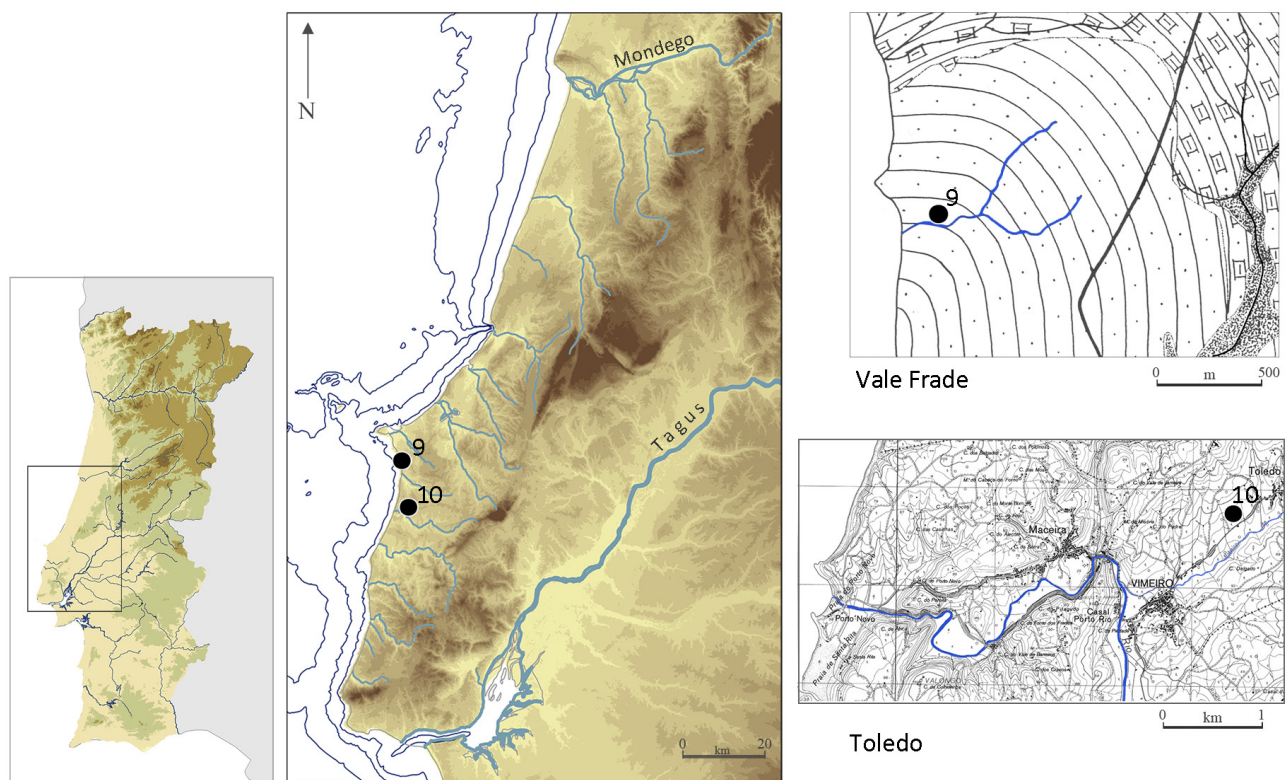


Fig. 2 – Location of the Vale Frade and Toledo shell midden sites, coastal Estremadura, Central Portugal (adapted from the map drawn by A. M. Costa).

Fig. 2 – Localisation des amas coquilliers de Vale Frade et Toledo, littoral de l'Estremadura portugaise (modifié d'après la carte dessinée par A. M. Costa).

TAXA	TOLEDO				VALE FRADE	
	NISP	%	W (g)	MNI	NISP	RR/W(g)
MOLLUSCS						
<i>Patella</i> sp.	12	0.1	18.09	9		++
<i>Phorcus lineatus</i>	7	0.1	16.37	7		++
<i>Gibbula umbilicalis</i>	1	< 0.1	0.5	1		
<i>Nucella lapillus</i>	1	< 0.1	1.55	1		
<i>Nassarius incrassatus</i>	3	< 0.1	0.46	3		
<i>Ocenebra erinaceus</i>	1	< 0.1	0.91	1		
<i>Ostrea edulis</i>	6	0.1	12.66	2		
<i>Mytilus</i> sp.	398	4.8	472.02	180		++
<i>Littorina littorea</i>	1	< 0.1	2.00	1		
<i>Diodora gibberula</i>	1	< 0.1	0.21	1		
<i>Barnea candida</i>	1	< 0.1	0.54	1		
<i>Pholas dactylus</i>	1	< 0.1	1.04	1		
<i>Pholas</i> sp.	1	< 0.1	2.31	2		
<i>Stramonita haemastoma</i>	75	0.9	434.61	17		
<i>Nassarius reticulatus</i>	55	0.7	83.38	54		
<i>Nassarius</i> sp.	2	< 0.1	0.54	2		
<i>Venus verrucosa</i>	1	< 0.1	6.00	1		
<i>Acanthocardia</i> sp.	1	< 0.1	5.78	1		
<i>Laevicardium crassum</i>	1	< 0.1	7.51	1		
<i>Pecten maximus</i>	1	< 0.1	8.78	1		
<i>Dosinia exoleta</i>	1	< 0.1	0.76	1		
<i>Solen marginatus</i>	1,118	13.5	1,042.12	129		+
<i>Cerastoderma edule</i>	5,856	70.8	5,878.23	3,282		+
<i>Ruditapes decussatus</i>	224	2.7	426.38	83		+++
<i>Scrobicularia plana</i>	500	6.0	521.03	432		++
<i>Sepia</i> sp.	1	< 0.1	1.17	1		
Indeterminable	6	0.1	4.72	2		
Total Molluscs	8,276	100.0	8,949.67	4,217		12,012.0
CRUSTACEANS						
<i>Pachygrapsus</i> sp.	6	9.1	1.62	4		
<i>Eriphia</i> sp.	1	1.5	0.57	1		
<i>Carcinus maenas</i>	59	89.4	18.08	32		
Total Decapoda	66	100.0	20.27	37	145	
<i>Pollicipes pollicipes</i>	205	–	66.29	59	–	
<i>Balanus</i> sp.	346	–	881.81	463	–	+
Total Cirripedia	551	–	948.09	522	–	
ECHINODERMS						
<i>Paracentrotus lividus</i>	1	–	1.00	1	–	–

Table 1 – Marine invertebrates from Toledo and Vale Fraide shell middens. For Vale Fraide, the frequencies presented in this table only concern the specimens collected by archaeologists during the field work (i.e. the whole or the less fragmented specimens). In bold the most represented species. NISP=Number of Identified Specimens; W(g) = weight in grams; MNI = minimum number of individuals. RR = relative representation (adapted from Dupont et al., in press).

Tabl. 1 – Invertébrés marins des amas coquilliers de Toledo et Vale Fraide. En ce qui concerne le site de Vale Fraide, les fréquences présentées dans ce tableau se rapportent exclusivement aux espèces prélevées par les archéologues lors des travaux sur le terrain (c'est-à-dire des spécimens entiers ou peu fragmentés). En gras, les espèces les plus représentées. NISP = nombre des restes déterminés; W (g) = poids en grammes; MNI = nombre minimum d'individus; RR = représentation relative (modifié d'après Dupont et al., sous presse).

TAXA	TOLEDO		VALE FRADE	
	NISP	%	NISP	%
Triakidae				
<i>Galeorhinus galeus</i>	14	14,0	–	–
cf. Triakidae	3	3,0	–	–
Muraenidae				
<i>Muraena helena</i>	1	1,0	1	2,7
Moronidae				
<i>Dicentrarchus labrax</i>	5	5,0	–	–
Carangidae				
<i>Trachurus trachurus</i>	2	2,0	1	2,7
Sparidae				
<i>Dentex</i> sp.	2	2,0	3	8,1
<i>Diplodus vulgaris</i>	10	10,0	–	–
<i>Diplodus</i> sp.	2	2,0	2	5,4
<i>Pagelus</i> sp.	1	1,0	2	5,4
<i>Pagrus pagrus</i>	2	2,0	1	2,7
<i>Pagrus</i> sp.	6	6,0	4	10,8
<i>Sparus aurata</i>	15	15,0	5	13,5
<i>Sparidae</i> indet.	10	10,0	10	27,0
cf. Sparidae	19	19,0	5	13,5
Mugilidae				
<i>Liza</i> sp.	1	1,0	–	–
<i>Chelon labrosus</i>	–	–	2	5,4
<i>Mugilidae</i>	6	6,0	1	2,7
Pleuronectiformes				
	1	1,0	–	–
Total identified	100	69,9	37	52,9
Not determined	43	30,1	33	47,1
TOTAL	143	100,0	70	100,0

Table 2 – Bone fish from Toledo and Vale Frade; NISP = number of identified specimens (adapted from Dupont et al., in press; Gabriel, 2011; Araújo et al., 2014; Sanchez, 1989). Tabl. 2 – Éléments du squelette des poissons des amas coquilliers de Toledo et Vale Frade; NISP = nombre de restes déterminés (modifié d'après Dupont et al., sous presse; Gabriel, 2011; Araújo et al., 2014; Sanchez, 1989).

ing, the final counting will be totally different. An initial counting carried out on two samples of sieved residues (both from layer B, the compact shell midden layer) from two different square metres (T43 and K13) yielded a MNI of 1768 and 758 respectively (Dupont, 2011).

Fish is represented by several taxa belonging to different family groups as Triakidae, Muraenidae, Moronidae, Carangidae, Sparidae, Mugilidae and the Pleuronectiformes order (table 2 and fig. 3; Gabriel, 2011; Araújo et al., 2014; Dupont et al., in press). They are all marine, except for the Mugilidae, which includes inshore species entering brackish lagoons and freshwater (Gabriel, 2011; Dupont et al., in press). Sparidae clearly predominate in both shell middens (Toledo: 67%; Vale Frade: 56%) and the most represented skeletal element is the vertebrae, followed by head bones and fins (fig. 4; Gabriel, 2011; Araújo et al., 2014; Dupont et al., in press). It is likely that this representation pattern reflects differential bone preservation, related to inherent features of each skeletal element, such as major or minor robustness, for instance. The presence of carbonate concretions appended to the surfaces of most of the fish bones hinder the identification of marks related to anthropic manipulation and to taphonomic processes, although some fragments show evidence for direct contact with fire (Gabriel, 2011; Araújo et al., 2014).

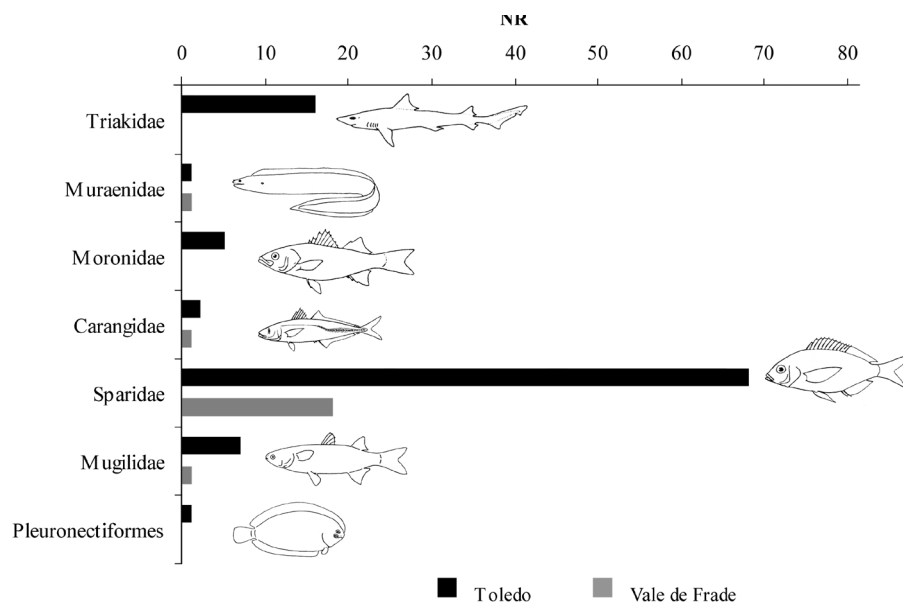


Fig. 3 – Fish taxa represented at Vale Frade and Toledo shell middens (Dupont et al., in press), NR = number of specimens (after S. Gabriel).

Fig. 3 – Taxons de poissons représentés dans les amas coquilliers de Vale Frade et Toledo (Dupont et al., sous presse), NR = nombre de restes (d'après S. Gabriel).

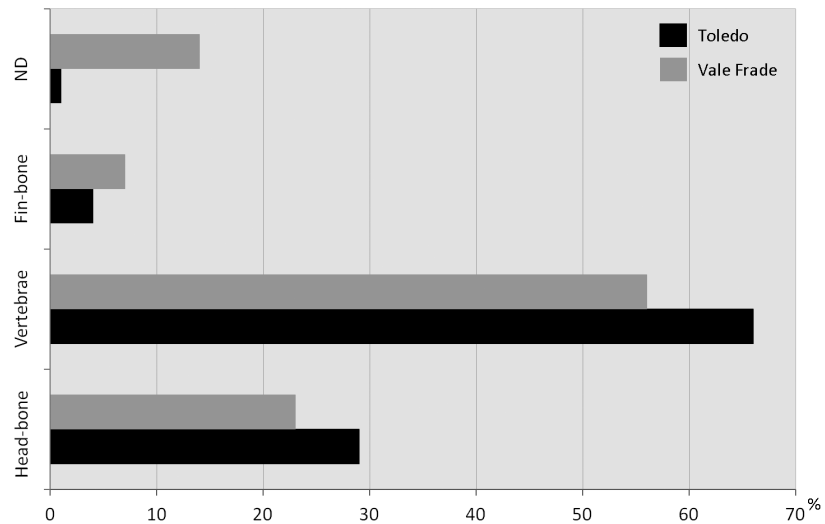


Fig. 4 – Relative representation of skeletal elements of fish bones recovered from the Vale Frade and Toledo shell middens, ND = not identified (adapted from Gabriel, 2011 and Araújo et al., 2014).

Fig. 4 – Représentation relative des éléments anatomiques du squelette des poissons des amas coquilliers de Vale Frade et Toledo, ND = non déterminé (modifié d’après Gabriel, 2011 et Araújo et al., 2014).

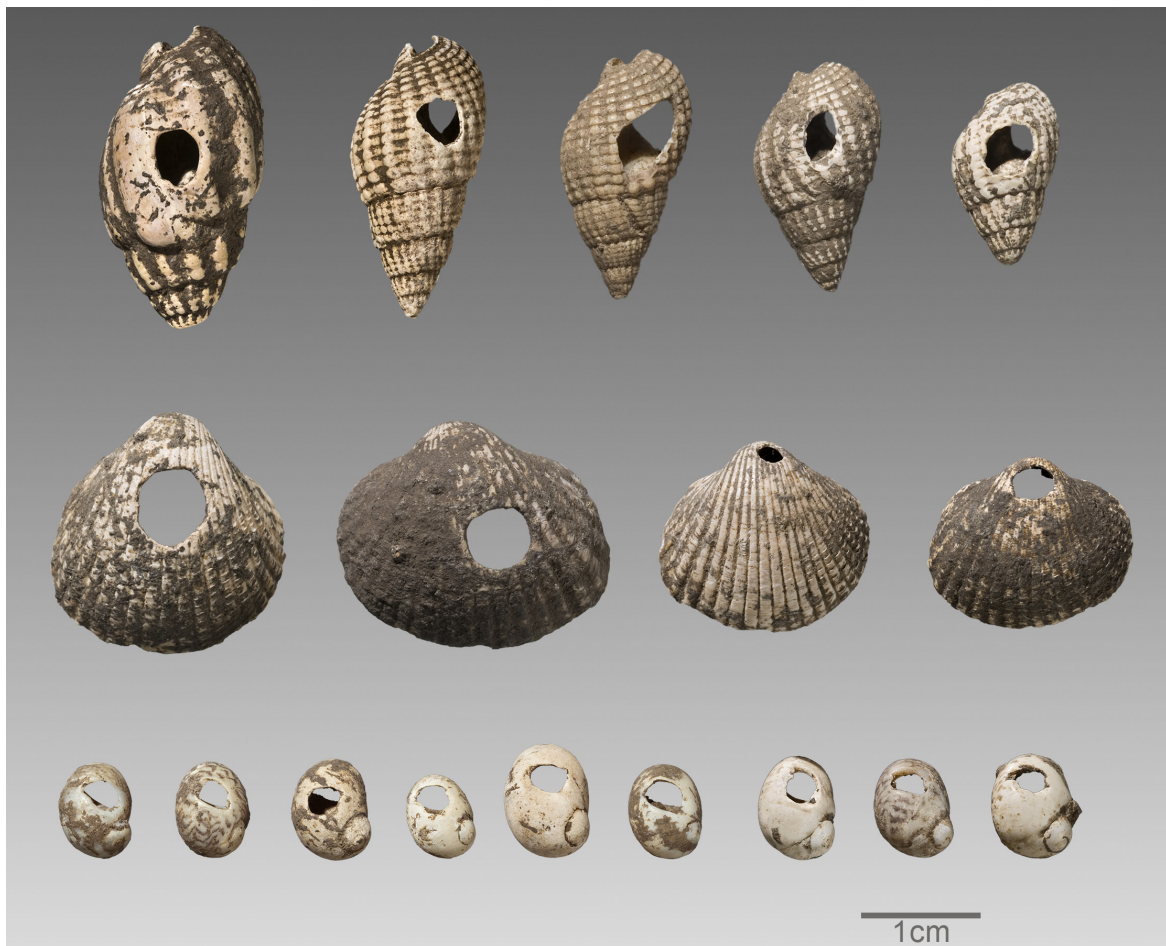


Fig. 5 – Ornaments made from shells; first row: *Nassarius reticulatus*, Toledo shell midden; second row: *Cerastoderma edule*, Toledo shell midden; third row: *Theodoxus fluviatilis*, Toledo and Vale Frade shell middens (after Dupont, 2011 and pers. comm., photographs J. P. Ruas).

Fig. 5 – Parures sur coquilles, première rangée : *Nassarius reticulatus*, amas coquillier de Toledo; deuxième rangée : *Cerastoderma edule*, amas coquillier de Toledo; troisième rangée : *Theodoxus fluviatilis*, amas coquilliers de Toledo et Vale Frade (d’après Dupont, 2011 et comm. pers., clichés J. P. Ruas).

TAXA	TOLEDO		VALE FRADE	
	NR	%	NR	%
MAMMALS				
Aurochs (<i>Bos primigenius</i>)	5	0,5	–	0,0
Red deer (<i>Cervus elaphus</i>)	22	2,2	2	1,4
Roe deer (<i>Capreolus capreolus</i>)	28	2,8	1	0,7
Wild boar (<i>Sus scrofa</i>)	135	13,6	4	2,8
Red fox (<i>Vulpes vulpes</i>)	10	1,0	3	2,1
Otter (<i>Lutra lutra</i>)	–	–	1	0,7
Wild cat (<i>Felis silvestris</i>)	2	0,2	1	0,7
Hare (<i>Lepus granatensis</i>)	51	5,1	2	1,4
Rabbit (<i>Oryctolagus cuniculus</i>)	619	62,1	106	75,2
Lagomorpha	90	9,0	2	1,4
Western hedgehog (<i>Erinaceus europaeus</i>)	23	2,3	1	0,7
Common mole (<i>Talpa occidentalis</i>)	2	0,2	–	0,0
Red squirrel (<i>Sciurus vulgaris</i>)	–	–	11	7,8
Southern water vole (<i>Arvicola sapidus</i>)	5	0,5	4	2,8
Lusitanian pine vole (<i>Microtus lusitanicus</i>)	4	0,4	–	0,0
Wood mouse (<i>Apodemus sylvaticus</i>)	–	–	1	0,7
Garden dormouse (<i>Eliomys quercinus</i>)	–	–	2	1,4
Total Determined	996	59,9	141	66,20
Large-mammal	75	11,2	2	2,8
Medium-mammal	171	25,6	9	12,5
Small carnivore	3	0,5	3	4,2
Micromammal	12	1,8	7	9,7
Not identified	407	60,9	51	70,8
Not detrermined Mammals	668	40,1	72	33,8
BIRDS				
Anseriformes	1	2,3	–	–
Anatidae	–	–	1	20,0
Tetraonidae	–	–	1	20,0
Red-legged partridge (<i>Alectoris rufa</i>)	9	20,5	–	–
Osprey (<i>Pandion haeliaetus</i>)	1	2,3	–	–
Wood pigeon (<i>Columba palumbus</i>)	29	65,9	3	60,0
Tawny owl (<i>Strix aluco</i>)	1	2,3	–	–
Jai (<i>Garrulus glandarius</i>)	1	2,3	–	–
Passeriformes	2	4,5	–	–
Total Determined	44	65,7	5	83,3
Not detrermined Birds	23	34,3	1	16,7
REPTILES				
Tortue (<i>Mauremys leprosa</i>)	41	74,5	–	–
Lizzard (<i>Lacerta lepida</i>)	14	25,5	–	–
Colubridae	–	–	2	100,0
Total Determined	55	94,8	2	100,0
Not detrermined Reptiles	3	5,2	–	–
AMPHIBIANS				
Common toad (<i>Bufo bufo</i>)	2	100,00	20	95,2
Western Spadefoot (<i>Palobates cultripes</i>)	–	–	1	4,8
Total Determined	2	–	21	95,4
ND Amphibians	–	–	1	4,6
TOTAL DETERMINED	1,097	61,3	169	69,5
TOTAL NOT DETERMINED	694	38,7	74	30,5
TOTAL ANALYSED	1,791	100,0	243	100,0

Table 3 – Other faunal taxa from the Toledo and Vale Fraide shell middens; NR = number of specimens (adapted from Moreno García, 2011 and Araújo et al., 2014).

Tabl. 3 – Autres taxons d'espèces animales des amas coquilliers de Toledo et Vale Fraide; NR = nombre de restes (modifié d'après Moreno García, 2011 et Araújo et al., 2014).

The ecological background of the Toledo and Vale Frade fish assemblages corroborates the pattern observed for marine invertebrates, demonstrating the exploitation of different but complementary biotopes: rocky and soft littoral bottoms, including the coast and the estuaries of the Alcabrichel River and the Vale Frade stream (Gabriel, 2011; Araújo et al., 2014; Dupont et al., in press). Ornaments made from shells (fig. 5) emphasize once again this same pattern: *Theodoxus fluviatilis* (n = 29) lives in freshwater environments, *Nassarius reticulatus* (n = 18) and *Cerastoderma edule* (n = 38) are marine species of sandy and muddy substrates (Dupont, 2011; Araújo, 2016; Araújo et al., 2014; Dupont et al., in press).

Assembling these data and the ones obtained from the study of other taxonomic categories as mammals, birds, reptiles and amphibians recorded at both sites (table 3; Moreno García, 2011; Araújo et al., 2014), the range of exploited species for consumption enlarges (albeit not all vertebrates were consumed, but were part of the local fauna) as well as the catchment areas ranged by these human communities.

The comparison of radiocarbon dates from both Toledo and Vale Frade shell middens reveals the existence of a clear overlapping between them, showing that at some point in time, during the Boreal, different groups or the same group occupied both sites, simultaneously or alternately. New ¹⁴C dates are, however, necessary to correctly evaluate this hypothesis. The diversity of archaeological remains uncovered at both sites suggest that they correspond to residential camps occupied intermittently during warmer periods of the year, as demonstrated by the study of the vertebrate faunas (Gabriel, 2011; Moreno García, 2011; Araújo et al., 2014).

The Early Mesolithic record from the littoral of the Estremadura comprises other shell midden sites (fig. 6). They all share the same location pattern already mentioned above, that is, proximity to the present seashore and watercourses. Although some variation exist between them, mainly related to the presence of other archaeological items besides molluscs (albeit invariably appearing in low frequencies), they correspond to sites dedicated to the gathering of marine resources. In fact, terrestrial faunas are almost absent (Pinhal da Fonte; fig. 6, no. 13, revealed some leporids; Araújo, 2016; Araújo et al., 2014) and lithic industries (when present) are mostly represented by small flakes and chips made from local raw materials of poor quality (Araújo, 2016; Araújo et al., 2014).

Figure 7 presents the radiocarbon dates available for these sites in a geographical and temporal order (Araújo et al., 2014). A careful inspection of this figure reveals that in the course of time distinct sites were occupied simultaneously and recurrently. On the coast north of Vale Frade no record from this period exists. However, remains from this chronology are represented in caves, rock shelters and open air sites located far inland (fig. 6; e.g. Morais Arnaud and Bento, 1988; Araújo and Zilhão, 1991; Zilhão, 1992 and 2004; Morais Arnaud, 1994; Bicho, 1995–1997 and 2000; Aubry et al., 1997 and

2005; Bicho et al., 2003; Araújo, 2009). Those sites, in which organic matter is preserved, systematically contain molluscs of marine species. The areas of collection of the marine resources recorded at these inland sites would naturally be the coastal region with the closest proximity. The previously mentioned void of Early Mesolithic remains in this section of the coast is caused, among other factors, by the accumulation of large Holocene sand deposits covering possible occupations. The degree of Aeolian activity and the amount of sand accumulation in the region have been demonstrated in several studies (e.g. André, 1996; André et al., 2009; Danielsen et al., 2012) and one example is the discovery of an *in situ* pine trunk dated to 370 ± 40 BP covered by c. 40 m of sand. Strong anthropic pressure suffered by the littoral fringe is also responsible for the destruction and mix up of remains connected to past human activities.

MARINE RESOURCES AND EARLY MESOLITHIC BEHAVIOUR

Piecing together the data existing for the early Mesolithic of both the coastal and the inland areas of Estremadura made it possible to design an organisational model for these societies, where marine resources seem to have played a key-role (Araújo, 2016).

The inland early Mesolithic records were identified in the interior of caves, rock-shelters and open air sites located in the limestone cliffs of Estremadura (Sicó, Aire and Candeeiros mountains) and adjacent fluvial basins (of the Tagus and the Mondego Rivers; fig. 6), some spanning the Pleistocene/Holocene boundary (e.g. Araújo and Zilhão, 1991; Zilhão, 1992 and 2004; Bicho, 1995–1997 and 2000; Aubry et al., 1997 and 2005; Bicho et al., 2003; Araújo, 2009). They have been interpreted as logistical sites related to hunting activities. As already mentioned, molluscs of marine species are systematically represented within these karstic contexts and in a few cases crab pincers were also recovered. Open air sites of residential character located in the lowland areas of the massifs, corresponding to the fluvial basins, did not preserve any organic material besides charcoal (e.g. Zilhão et al., 1995; Bicho, 2000).

The presence of marine items in such distant areas of the coastline, within the range of 40 km to 50 km, has several main archaeological implications (more substantiate arguments in Araújo, 2016):

1. People seem to have been dependent on this food resource, carrying shellfish to their inland dwellings. It remains unclear which technological solutions were devised for this transport as well as the past pathways followed by Early Mesolithic groups;

2. From this moment on, economic territories embraced different ecosystems—the littoral, the limestone massifs and the adjacent fluvial basins—which were sequentially exploited in a year-round manner. The human groups ranged over these different ecosystems

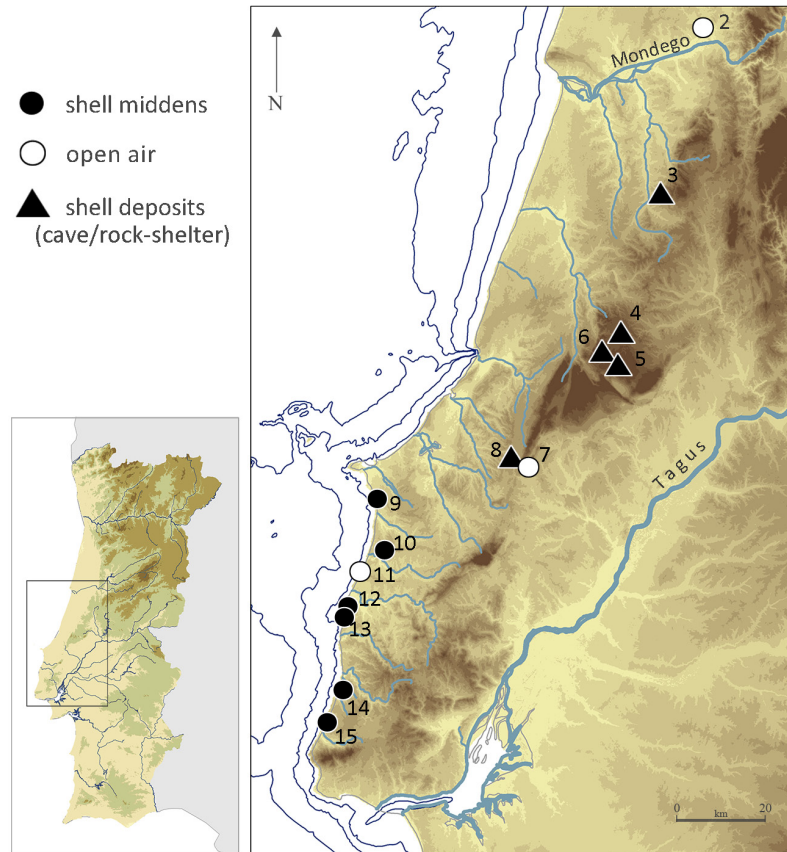


Fig. 6 – Location of Early Mesolithic sites identified in the Estremadura region (Central Portugal); 2: Vale Sá; 3: Buraca Grande; 4: Casal Papagaio; 5: Lapa do Picareiro; 6: Pena de Mira; 7: Areeiro III; 8: Bocas 1; 9: Vale Frade; 10: Toledo; 11: Ponta da Vigia; 12: Cabeço do Curral Velho; 13: Pinhal da Fonte; 14: São Julião (loci A and B); 15: Magoito.

Fig. 6 – Localisation des sites du Mésolithique ancien identifiés dans l'Estrémadure (centre du Portugal); 2 : Vale Sá; 3 : Buraca Grande; 4 : Casal Papagaio; 5 : Lapa do Picareiro; 6 : Pena de Mira; 7 : Areeiro III; 8 : Bocas 1; 9 : Vale Frade; 10 : Toledo; 11 : Ponta da Vigia; 12 : Cabeço do Curral Velho; 13 : Pinhal da Fonte; 14 : São Julião (loci A et B) ; 15 : Magoito.

both perpendicularly and parallel to the shoreline. This deduction is not solely based on the presence of marine resources in the inland karstic sites, but also on lithic raw material (flint) transported from the adjacent fluvial basins to these sites (Bicho et al., 2003);

3. Diverse types of sites were consequently formed and at each one, according to needs, people adapted or created different technological solutions (there are no recurrent standards, considering tool-types and reduction strategies) and modes of resource extraction;

4. This model of territory use—taking advantage of all the potential offered by the variety of ecosystems—imply a high level of human mobility and a social structure probably based on small family units.

This Early Mesolithic general characterisation—focusing on the role played by marine resources in the subsistence and social organisation of hunter-gatherer groups from the Estremadura—combines chronometric data (both intra- and inter-sites), site typologies and their archaeological contents, site-location and the surrounding environment (Araújo, 2016).

It should be mentioned, however, that these assumptions are based on and supported by the existing data, with limitations derived from few radiocarbon dates

still available, low number of sites (some partially destroyed) and sites deficiently excavated and published. This attempt to reconstruct possible types of Early Mesolithic organisation in Southern Portugal is hindered by the lack of data. In fact, at present, solely the logistical sites related to shellfish collecting are known, due to several factors like the unfamiliarity of the geomorphological models of site location/positioning/preservation, later Holocene sedimentation (which certainly hid remains of past human activities) and recent anthropic impacts, for instance.

FINAL REMARKS

Despite the biases that sea level rise may have caused in the Palaeolithic record with regard to marine resources, this component became structural in the lives of Early Mesolithic groups, not just concerning their subsistence, but also the manner in which the groups organised themselves. Palaeolithic hunter-gatherers consumed marine resources, as shown by the Mousterian of Figueira Brava and the Gravettian of Vale Boi (to circumscribe the

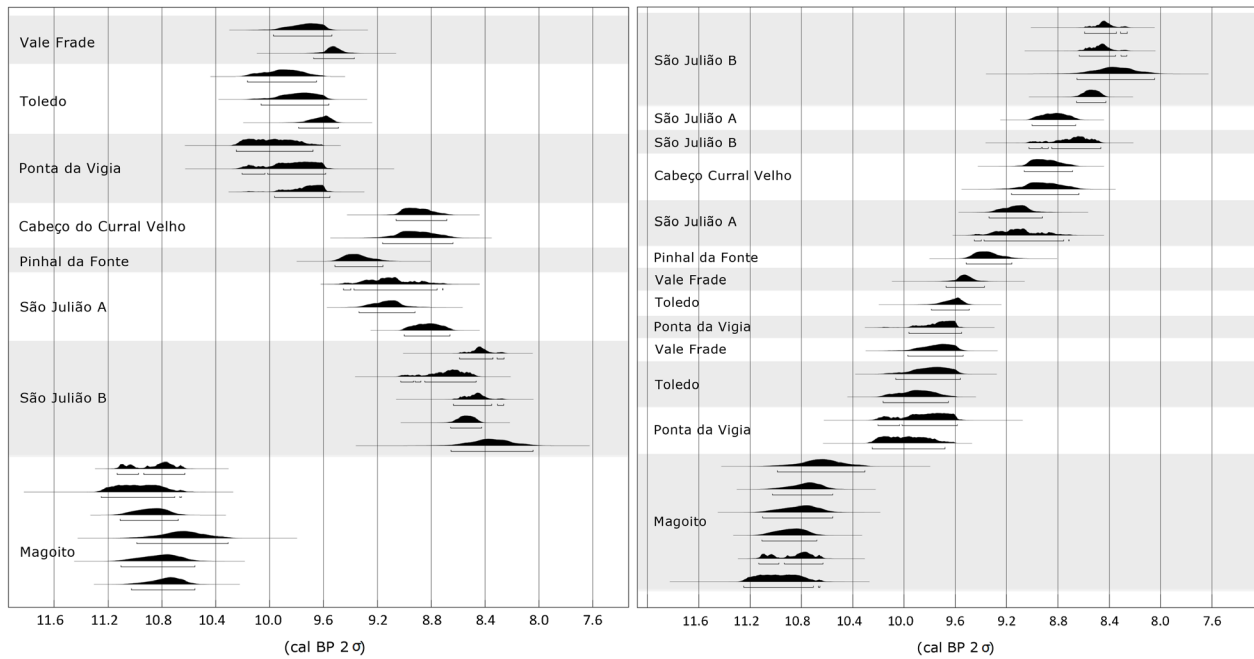


Fig. 7 – Radiocarbon dates (cal. BP) from Early Mesolithic sites located on the coast of Estremadura (central Portugal); calibrations were made using OxCal v. 4.2 (Bronk Ramsey, 2009) with intCal13 and Marine13 curves (Reimer et al., 2013), correction for $\Delta R = 95 \pm 15$ ^{14}C (Monge Soares, pers. comm.).

Fig. 7 – Datations ^{14}C (cal. BP) des sites du Mésolithique ancien situés sur la côte de l’Estrémadure (centre du Portugal), la calibration a été effectuée en utilisant le programme OxCal v. 4.2 (Bronk Ramsey, 2009) avec les courbes intCal13 et Marine13 (Reimer et al., 2013), correction du $\Delta R = 95 \pm 15$ ^{14}C (Monge Soares, pers. comm.).

subject to the Portuguese territory), the two sites located closer to the seashore during these periods of occupation. However, shellfish is represented in both low number and diversity, which seems to be more compatible with an occasional and opportunistic exploitation of this resource than an activity carried out in a systematic and regular manner.

The data suggest, considering both the number of specimens and species recorded and the time span covered by the Mousterian and the Gravettian occupations at one and the other site, that Palaeolithic groups intensively exploited two groups of vertebrates, leporids and ungulates (taking full advantage of all their meat, marrow and fat content, at least as regards Vale Boi) with a minor contribution of other animal taxa as birds, shellfish and fish. This interpretation of the available data does not withdraw the importance of both sites in the Iberian Palaeolithic archaeology.

Global warming and the subsequent sea level rise after the Last Glacial Maximum, although with oscillations caused by multiple climatic fluctuations, certainly impacted human, animal and plant populations. Consumption of marine resources became crucial in a scenario of high environmental instability, triggering innovative and successful forms of survival. The incorporation of sea food in the diet surely had earlier roots but the irexploitation only turned intensive and part of the behavioural pattern at the transition to the

Holocene. And the proof is that even in sites located at a considerable distance from the coast marine molluscs are systematically present. What led people to embrace this strategy, to turn towards an intensive exploitation of shellfish and consequently led to the adoption of a settlement pattern focused in the littoral and in the innermost areas of the Estremadura, still accessible from the coast?

Figure 1 reveals that the most interior areas of the country are almost void of Early Mesolithic records, a pattern that repeats itself during the later stage of the Mesolithic (c. 8.3–7.2 ka cal. BP). Taphonomic processes as such do not explain the unoccupied areas. These most inland regions were certainly exploited by Mesolithic groups on the occasion of logistical expeditions, as other authors have already pointed out (e.g. Zilhão, 1993; Carvalho, 2009). The great reliance upon marine foods may explain the settlement pattern of figure 1, thus reflecting the past reality. Future archaeological investigations may confirm or change this scenario.

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