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At the land's end: Marine resources and the importance of fluctuations in the coastline in the prehistoric hunter–gatherer economy of Portugal

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ABSTRACT

This paper focuses on the importance of aquatic resources in economy and subsistence strategies during the Middle and Upper Palaeolithic of Portugal. Modern theoretical biases in archaeology have led to a marginalization of marine resources and a dismissal of their use by Palaeolithic hunter–gatherers. Geological and archaeological data show that changes in the position of the coastline had a direct impact on the visibility of marine resources in the archaeological record. Marine regressions and transgressions have significantly altered the record of Pleistocene coastal settlement. Using recent studies on changes in upwelling intensity during the Last Glacial we offer a new perspective on Palaeolithic hunter–gatherer economy that emphasizes the importance of the coast as a focus of subsistence and settlement.

1. Introduction

The rarity of Pleistocene hunter–gatherer sites along the coasts of Western Europe led to a virtual consensus among archaeologists in the late 20th century that Palaeolithic people largely ignored this type of environment. Aquatic animals, especially molluscs, were perceived as fallback resources that people relied on to avoid starvation in times of terrestrial resource scarcity. Marine and estuarine economies, well-known from the Early Holocene, were seen as the result of technological "revolutions" and/or demographic pressure. The postglacial expansion of diet breadth visible in the archaeological record after global sea level rise was thought to suggest a new subsistence adaptation in human societies.

This 'Tardiglacial Paradigm' (Morales et al., 1998; Haws and Bicho, 2006), however, has begun to crumble in the face of new (and not so new) data, both archaeological (Stiner et al., 1999, 2000; Bailey and Milner, 2002; Stiner, 2003; Bicho et al., 2004) and ethnographical (Pálsson, 1988, 1991; Erlandson, 2001). Recently, Erlandson (2001) and Bailey and Milner (2002), among others, have demonstrated that the archaeological record may be strongly biassed against early coastal sites. In a few places, older Pleistocene sites exist in areas of steep bathymetry or uplifted continental margins. Where the older coastal deposits are visible, marine resources are frequently present in the subsistence of hunter–gatherers, complex or not (see also Bailey and Flemming, 2008; Erlandson et al., 2008). This reality has transformed the perspectives of many hunter–gatherer researchers (Parkington, 2001; Bailey and Milner, 2002; Bailey and Craighead, 2003; Bailey, 2004a,b; Parkington et al., 2004).

In this paper, we will focus on the importance of marine coastal resources in the Pleistocene economy and subsistence strategies of Portugal. We will also examine certain features related to the presence or absence of marine and estuarine resources in Portugal, namely the evolution of the coastline and the effects of upwelling, and their importance in understanding and predicting site location and subsistence economies during the Palaeolithic. Finally, we will present a new model of prehistoric coastal hunter–gatherer economies in Portugal.

2. Archaeological perspectives on marine resource use by Late Pleistocene hunter–gatherers

Binford (1968) noted that a diverse and complex set of changes took place in human societies at the end of the Pleistocene: human diet appeared to show a significant increase in the number of food resources, including aquatic resources; and the introduction or development of new techniques of hunting, food storage and processing allowed a more intensive use of plants and animals. Both changes led to new patterns of mobility, settlement systems and land use generally. Flannery (1969) labelled this dietary shift as the Broad Spectrum Revolution (BSR) (see Stiner, 2001, for an historical review). The beginning of agriculture in Southwest Asia was likewise seen as resulting from a set of conditions that included diversification of dietary resources and human population increase just prior to the Pleistocene–Holocene transition. This ecological

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disequilibrium was believed to be a consequence of climatic instability at the end of the Pleistocene compounded by population pressure (Cohen, 1977; Keeley, 1988).

With the adoption of a behavioural ecology focus by archaeologists (Winterhalder, 1981, 1986; Hill et al., 1987; Jochim, 1988; Kelly, 1995), marine animals, especially shellfish, came to be seen as marginal resources. These items typically rank lowest in economic models used to grade the importance of dietary resources because they provide a lower net energy return than terrestrial animals (or plants). In these energy-based foraging models borrowed from ecology, human foragers were not expected to harvest such low ranked items, regardless of their abundance, unless post-encounter return rates of higher-ranked ones decreased. This population–resource imbalance would occur either as a result of overharvesting or reduced availability due to habitat loss. Alternatively, hunter–gatherers might exploit shellfish as a means of risk-avoidance (Winterhalder, 1986; Kelly, 1995).

After the postglacial sea level rise, the appearance of coastal shell middens in many places around the world suggested a new subsistence strategy. These highly visible remains provide a stark contrast to the Pleistocene archaeological record, which is apparently devoid of such features. While recognizing the obvious fact that the postglacial transgression had inundated substantial portions of the continental shelf, many dismissed the likelihood of significant Pleistocene coastal settlement (see Bailey and Parkington, 1988). One reason for this was that the Pleistocene oceans were thought to be less productive due to lower global CO_2 levels. Deep waters off the exposed continental shelves were also thought to have limited coastal productivity (Perlman, 1980), and the instability of Pleistocene climate to have resulted in abrupt changes in sea level that might have precluded the development of lagoons, estuaries and tidal flats providing habitats for large shellfish communities (Schubel and Hirschberg, 1978).

A rather circular argument emerged from the perspectives outlined above: marine resources are marginal; if humans exploit them there must be population pressure on resources; few coastal Pleistocene sites exist; oceans did not become productive until the Holocene; sea level stabilized in the Holocene; many coastal sites appear in the Holocene; therefore coastal adaptations began in the Holocene as a result of population pressure on resources.

3. Exceptions to the rule

In a thorough review of aquatic adaptations, Erlandson (2001) concluded that the few coastal Pleistocene sites with evidence of marine resource exploitation share one feature: they are all located in areas of steep offshore bathymetry. This also seems true in Iberia: several places along the coast are marked by a steep bathymetry: Asturias and Cantabria, Eastern Andalucia and Gibraltar, and in Portugal the Western Algarve and the waters off Sesimbra and Nazaré. The Gibraltar Caves have yielded shellfish in Middle Palaeolithic occupations (Barton, 2000; Fa, 2008). Two Upper Palaeolithic sites, La Riera in Asturias and Nerja in Andalucia have evidence for marine resource exploitation (Jordá, 1986; Ortea, 1986), and in Portugal, the faunal assemblage from Figueira Brava includes shellfish, shore birds and marine mammals (Antunes, 2000a,b).

Although some of the shells and bones of marine mammals that occur in Middle Palaeolithic Iberian sites could have been accumulated by natural processes, the Upper Palaeolithic evidence appears to indicate human agency. The question that must be addressed is the degree of marine resource harvesting by Pleistocene people. If marine resources were exploited, how intensive was this effort and how important were they to overall subsistence? The limited evidence suggests a gradual increase in the importance of marine resources between the Middle Palaeolithic and the end of the Pleistocene. One site in particular, La Riera, has been used to address this issue.

Clark and Straus (1986) explained the Late Pleistocene use of marine resources in Late Upper Palaeolithic sites in Cantabria in Northern Spain as a result of subsistence intensification and diversification due to population pressure. Based on the archaeological record of La Riera, as well as other Cantabrian sites, they saw a clear record of increasing intensification over time, through diversification and specialization (Clark and Straus, 1986, p. 359). This process started in Early Solutrean times, some 20,000 years ago, with evidence of the following changes:

- The use of shellfish, mostly large estuarine limpets (*Patella vulgata*) in large quantities.
- Evidence of catastrophic red deer (and occasionally ibex) mortality profiles, suggesting hunting of large numbers of animals in a single event, probably resulting from new hunting techniques such as collective drives, surrounds or ambushes. This hypothesis was confirmed by the seasonality results, indicating that most animals were hunted in the same season.
- The presence of heavily fragmented ungulate bones, including phalanges, indicating intensive use of carcasses, probably with grease rendering techniques.

By the Late Solutrean and Magdalenian new indicators appeared:

- A broadening of the use of shellfish species to include both estuarine and exposed Atlantic shorelines (including *Patella intermedia*, *Littorina littorea*, and *Monodonta lineata*), increasing steadily up to Holocene times with the Asturian occupation, when a true shell midden was formed.
- The use of sea urchin and crab began in the latest Pleistocene with a rapid increase in their representation in the Holocene.
- Addition of new types of marine fish (sea bream and sole).
- Significant bird exploitation.

Clark and Straus saw these dietary changes as the result of stress on the resource base due to population expansion in the Cantabrian Region. The reduction in limpet (*P. vulgata*) size was thought to result from overexploitation thus confirming the idea of human population pressure (but see Bailey and Craighead, 2003, for an alternative view). The idea was explicitly based on Cohen's (1977) population pressure model, which expanded on the earlier work of Boserup (1965). Though the La Riera record did not meet all Cohen's criteria for the presence of "subsistence saturation" leading to the development of agriculture in Early Holocene times, it seemed clear to Clark and Straus that the Northern Spanish archaeological record was a perfect example of the BSR.

Two aspects should be noted from the publication. First, their view, though not explicitly stated, was that a human demographic expansion took place near the end of the Pleistocene, sometime in Magdalenian or Azilian times. However, as suggested by the number of sites per millennium (Clark and Straus, 1986, p. 362, Table 20.1), and by the earliest evidence of use of shellfish and salmonids, changes implying population growth took place much earlier, at the beginning of the Solutrean. Similar patterns have been found in other regions, such as the Pyrenees (Straus, 1991, 1992) and Mediterranean Spain (Aura et al., 1998; Morales et al., 1998; Cortés-Sánchez et al., 2008).

In Portugal, Bicho (1994, 1998) applied the Clark and Straus framework to the Late Pleistocene record. Using the available data, he argued for increasing intensification, through diversification and specialization across the Pleistocene–Holocene transition. The presence of aurochs at Bocas rockshelter (Fig. 1) and red deer