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Small faunal use during the Middle and Late Pleistocene of Portugal: a Nutritional Ecology Perspective

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ABSTRACT

Since the late 1990's Tony Marks has led excavations at the Galeria Pesada, the oldest well dated Paleolithic site known from Portugal. The Galeria Pesada contains a wealth of late Lower Paleolithic/early Middle Paleolithic artefacts, as well as thousands of faunal remains. The faunal remains consist of a diversity of large and small animals; among the latter are rabbits, hares, rodents, fish, reptiles, and birds. The large faunal remains principally consist of red deer and horse. The faunal remains suggest the presence of a highly productive environment near the cave between ca. 250,000 and 200,000 years ago. Nevertheless, the early human occupants of the Galeria Pesada did not appear to take advantage of this animal diversity when choosing their food base. Instead, they focused their hunting efforts on the large herbivores, virtually ignoring the leporids, fish, and reptiles. The decision to narrow their food niche to only one type of animal food would have increased infant and maternal mortality rates within these populations compared to those groups who choose to broaden their subsistence base to include a variety of game such as fish and birds along with the larger terrestrial herbivores. There is a tendency toward increasingly diverse diets at the onset of the Upper Paleolithic in Portugal, including the exploitation of smaller animals such as leporids and shellfish. This suggests that Upper Paleolithic populations in Portugal were in general healthier than the Neandertal populations that preceded them. This, in turn, may help to explain why Upper Paleolithic populations replaced the Neandertals in southwestern Iberia.

KEYWORDS

Nutritional ecology; Paleolithic; Portugal; Pleistocene

Research on the Paleolithic occupation of Portugal has increased rather dramatically over the past couple of decades. Those leading these efforts include Tony Marks, João Zilhão, Nuno Bicho, Luis Raposo, and Paul Thacker. As a result of their efforts, many others are currently engaged in a number of Paleolithic projects primarily located in central and southern Portugal. This is not meant to imply that the study of the Paleolithic occupation of Portugal began recently. Indeed, a number of researchers have excavated and reported on Paleolithic materials in Portugal since the latter 1800's (e.g., Delgado, 1867; Roche, 1951). But it is probably safe to say that studies that seek to answer more complex questions about human behaviour such as regional settlement or mobility patterns and their related effects on subsistence and toolstone procurement, as well as the effects of climate change on settlement and subsistence strategies in southwest Iberia, began in earnest with the pioneering work of archaeologists such as Tony Marks (e.g., Marks *et al.*, 1994).

For the past several years, I have been working with Tony Marks at the Middle Pleistocene cave Galeria Pesada, as well as with Nuno Bicho and Jonathan Haws at the Upper Paleolithic site Picareiro Cave, both located in central Portugal (Figure 1). These caves contain abundant lithic artefacts and thousands of faunal remains, the latter consisting of large samples of both large and small game. Galeria Pesada seems to have been occupied primarily during MIS 8 and perhaps MIS 6, sometime roughly between 250,000 and 200,000 years ago (T. Marks, personal communication, 2004). In contrast, humans intensified their use of Picareiro Cave during the late Magdalenian, between ca. 12,300 and 10,000 BP (Bicho *et al.*, 2000), although earlier and later occupations are also present. Combined with data from other caves and open-air sites such as Caldeirão (Zilhão, 1995), Pego do Diabo (Valente, 2000, 2004), Anecrial (Zilhão, 1995; Hockett and Haws, 2002; Almeida and Brugal, 2004), Foz do Enxarrique (Brugal and Raposo, 1999), Figueira Brava (Antunes, 2000), Lapa dos Coelhos (Almeida *et al.*, 2004), Lapa do Suão (Haws, 2004; Valente, 2004), and Val Boi (Bicho *et al.*, 2003; Stiner, 2003),

a more complete picture of Middle and Upper Paleolithic settlement and subsistence in central and southern Portugal from roughly 50,000 to 10,000 BP is emerging. Taken as a whole, these sites may reveal important differences in subsistence practices through time in Portugal. As a result, we may ask: "What might these differences mean for our understanding of past human behaviour in southwestern Iberia?", or more specifically, "Do these data inform on changes in mobility strategies, demographic trends, and health patterns during the Paleolithic occupation of Portugal?" In this paper I address the latter two questions about demographic trends and health patterns by comparing the subsistence data from the Galeria Pesada to those from the latter Middle Paleolithic and Upper Paleolithic sites just mentioned. My basis of interpretation is the nutritional ecology model that has been developing over the past several decades (Stini, 1981; Schwarz and Schoeninger, 1991; Jenike, 2001; Hockett and Haws, 2003, 2005).

I begin by briefly discussing the faunal remains recovered from the key sites mentioned above. Next, the essential components of the nutritional ecology model is described. The demographic and health-related effects of subsistence choice during the earlier and later phases of the Paleolithic in Portugal is outlined based on this model. I end by briefly mentioning some of the data gaps and future data needs in terms of building a greater understanding of diachronic health patterns and their related impacts on Paleolithic demography in southwest Iberia.

FOOD PREFERENCES AT THE GALERIA PESADA AND OTHER PALEOLITHIC SITES IN CENTRAL AND SOUTHERN PORTUGAL

The lithic assemblage from the Galeria Pesada is unique in southwestern Iberia, exhibiting a mixture of large and small bifaces that include hand axes and ovate-shaped bifaces, as well as backed knives and side scrapers (Marks *et al.*, 2002a, b). The preferred lithic raw materials used were quartzites and quartz, though flint was not entirely ignored. As mentioned above, these artefacts and associated faunal remains were deposited in the cave between about 250,000 and 200,000 BP before the cave was sealed.

Approximately 20,000 bone specimens were recovered from the Galeria Pesada (Marks *et al.*, 2002a, b). Of these, almost 13,000 were from rabbits and hares. The vast majority of leporid bones were from rabbits. Overall, small animal bones were extremely abundant, representing rabbits, hares, rodents, tortoises, fish and a variety of birds. Jean Philip-Brugal has also recorded over 2,000 faunal specimens from large game, principally from horses and red deer (Marks *et al.*, 2002a, b).

Despite the prevalence of a variety of small game available to human hunters during the Middle Pleistocene of central Portugal, there is little evidence that the occupants of the Galeria Pesada actively hunted and consumed these animals. The vast majority of the small game bones appears to have been deposited by raptors and small carnivores; this pattern seems consistent for the rabbit, reptile, fish, and bird bone assemblages. In contrast, large game such as horse and red deer were apparently consumed inside the cave, as a number of these bones exhibit stone tool cut marks and hammer percussion marks created by human action (e.g., Marks *et al.*, 2002b, Plate 1).

The Galeria Pesada therefore represents an important site for providing information on the food preferences of early Neandertals or late *H. heidelbergensis* in southwest Iberia. The site is not a specialized kill spot that only provides evidence for the killing of a single species such as horse or bison. Kill spots would have been some distance away from the cave, so food portions would have been brought back to the Galeria Pesada for consumption. Put another way, the cave likely served as a base camp rather than a kill locale. As a result, the diversity of animal foods brought into the cave for processing and consumption should be represented in the faunal remains recovered from the site. Given the diversity of animal resources available near the cave, a diversity of resource use should be apparent if these societies displayed the kinds of labor divisions seen in many contemporary hunter-gatherer groups in which women, children, and elders gathered small game resources near base camps while "prime-aged" men sought large game resources further away. Importantly, the abundance of a diversity of small game resources tells us a great deal about the productivity of the environment within which these people lived. As will be discussed in more depth below, in the study of prehistoric health patterns and demography it is as important to determine what foragers were not eating as it is to determine what they were eating. Faunal data from the Galeria Pesada suggest that a wide diversity of animal resources were available to humans within a short distance, including large and small terrestrial mammals, fish, birds, and tortoises. If the early Neandertal or late *H. heidelbergensis* populations in southwest Iberia were engaged in a non-specialized subsistence strategy in which they hunted and gathered all available resources, and if their societies were structured similar to ethnographic foragers occupying diverse, heterogeneous environments, then evidence for this broad-based diet should be reflected in the faunal remains recovered from the cave. Such a diverse subsistence strategy and related division of labor, however, are not documented at the Galeria Pesada.

Rather, it seems likely that foragers living 250,000 years ago in central Portugal did not eat rabbits, birds, fish and tortoises on a consistent basis. This probably was the case because they chose not to, rather than because they could

not catch these animals. That is a philosophical position, however, that is difficult to defend one way or the other. Researchers tend to fall into two camps on this issue: those that think that pre-Anatomically Modern humans had the ability to capture small game such as rabbits, birds, and fish on a consistent basis if they chose to, and those that think that to do so required specialized technologies beyond the mental capabilities of these early humans. My own view on this issue is that technological innovations such as nets and snares at that time would have increased the yield of animals procured, but would not have provided the means necessary for their capture in the first place. In other words, pre-Anatomically Modern humans probably had the capabilities of procuring these animals if they chose to, and given their relatively low population densities and small family group size, technologies that resulted in the procurement of large numbers of animals (e.g., mass collecting) probably would not have been necessary in order for them to capture enough animals to sustain life. As an example, if a group of eight individuals wanted to eat rabbit for a day or two, ambushing these animals along their well-worn trails or smoking them out of their burrows probably would have yielded enough animals on a daily basis to provide for the group. However, if that same group wanted to eat rabbit in the same place for a week or two, or if groups of 10-20 people wanted to eat rabbit for a week, then specialized technology such as snares or nets may have been required to make the hunt successful in meeting dietary goals. Dietary choice and mobility strategies related to the procurement of the chosen resources (e.g., Aura *et al.*, 1996; Morales *et al.*, 1998; Gamble, 1999) likely played key roles in the diversity of resources (or lack therof) consumed inside the Galeria Pesada.

It seems, therefore, that the early human occupants of the Galeria Pesada chose a relatively narrow food niche centered on the procurement of large terrestrial herbivores, rather than they ate primarily large terrestrial herbivores because they could not "catch" resources such as tortoises. In terms of the consequences of this food niche for overall health, however, it matters little whether they could or could not capture small game if they wished to do so; what really matters is that they apparently did not consistently capture the diversity of small game available to them, and this end-effect would have had health consequences that would have acted to keep population densities low, as is discussed in more detail below.

Late Neandertal sites in central Portugal tell a similar tale. As noted by Zilhão (1995) and more recently by Davis (2002) at Caldeirão Cave, as well as by Valente (2004) at Pego do Diabo Cave, faunal remains of small game from late Neandertal occupations dating to about 30,000 years ago show strong evidence for carnivore modification and scant evidence for human consumption, while the large mammal remains from these sites show greater evidence that Neandertals hunted and consumed large herbivores. Once again, 200,000 years later in time, a preference is shown for the hunting of large, terrestrial herbivores by Neandertals, and the virtual absence of small game hunting. If I find it difficult to believe that the earliest Neandertals were incapable of hunting small game such as rabbits, birds, fish and tortoises on a consistent basis, I find it even harder to believe that the latest Neandertal populations were also incapable of these tasks.

Before discussing details of the nutritional consequences of focusing a diet on large, terrestrial herbivores, it would be useful to briefly outline the subsistence data from the Upper Paleolithic of central and southern Portugal. Beginning in the early Upper Paleolithic of Portugal, or the Gravettian of approximately 26,000 years ago, a clear change is seen toward the exploitation of greater quantities of small game resources. This includes small terrestrial vertebrates such as rabbits, which are present in relatively large numbers in most of the Upper Paleolithic cave assemblages in the region, as well as marine resources such as shellfish at sites such as Val Boi in southern Portugal (Bicho *et al.*, 2003; Stiner, 2003). There is a general tendency toward increasingly diverse diets throughout the Upper Paleolithic between about 25,000 and 10,000 BP, with small game resources such as fish, terrestrial gastropods, birds, and, with the presence of milling stone technology, plants, all found in Solutrean and Magdalenian assemblages such as Picareiro Cave, Lapa dos Coelhos, and Lapa do Suão (e.g., Bicho *et al.*, 2000; Almeida *et al.*, 2004). This increase in resource diversity is associated with general increases in site densities through time (e.g., Straus and Winegardner, 2000; Straus *et al.*, 2000), although periods of subsistence stress (e.g., between roughly 14,500 and 12,500 BP) may have occurred across the region (Haws, 2003).

NUTRITIONAL ECOLOGY – A MODEL TO INTERPRET PREHISTORIC HEALTH PATTERNS

The data briefly summarized above may be utilized to develop interpretations about the nutritional health of Portugal's Paleolithic populations based on the nutritional ecology model and the current state of archaeological knowledge. Hockett and Haws (2003, 2005) recently defined nutritional ecology as "the study of the relationship between essential nutrient intake and its effect on overall human health, including growth and maintenance in individuals and general demographic trends in populations". The nutritional ecology model is based on research derived primarily from the nutrition sciences, medical researchers, human demographers, and sociocultural anthropologists. The model is based on the following facts: 1) humans require a diverse suite of essential nutrients (vitamins, minerals, protein, carbohydrate, fat, and water) for proper growth and development; 2) the diverse

suite of essential nutrients required for health cannot be found in one type of food; 3) essential nutrient intake may impact human demographic trends because less diverse essential nutrient intake leads to higher maternal and infant mortality rates and may lead to shorter life expectancies in adults; and 4) diversifying the subsistence base to include a variety of food types such as terrestrial mammals, fish, shellfish, birds, reptiles and plants leads to lower maternal and infant mortality rates, higher life expectancies, and thus overall healthier human populations. In short, the most diverse diet within a given environment sets the nutritional framework under which a given population may expand. Under competitive or stressful circumstances, those populations utilizing to a more diverse subsistence base may have an advantage over those subsisting on a narrower food niche.

The model would predict that human populations that are experiencing upward demographic curves should be associated with relatively diverse diets. Those populations subsisting on a low diversity diet will not likely experience significant population growth through time. Populations experiencing low or declining demographic trends while consuming a high diversity of resources indicates that other social or environmental factors are at play maintaining or reducing population numbers, such as disease, warfare, fertility rules, and the like (see Hockett and Haws, 2003, 2005).

As mentioned above, subsistence data from the Middle Pleistocene site Galeria Pesada and from late Middle Paleolithic sites such as Caldeirão Cave suggest that pre-Upper Paleolithic populations in central Portugal consumed a low diversity diet focused on the procurement of large, terrestrial herbivores. The nutritional ecology model suggests that these populations probably experienced very high infant mortality rates. They may have also experienced relatively high maternal mortality, especially if pregnant females consumed a low diversity diet while engaging in high mobility during the pursuit of large, gregarious herbivores. Human populations subsisting at such a high trophic level, consuming a comparatively low diversity of food types, would be expected to have relatively low population densities. These populations would be unable to grow to any significant degree through time. However, it may be pointed out that at coastal sites such as Figueira Brava along the west coast of Portugal, there are indications that some late Neandertal populations were consuming coastal resources (Antunes, 2000). If that was the case, then these populations may well have been healthier than their inland cousins to the north who may have subsisted almost entirely on large, terrestrial herbivores (reviewed in Hockett and Haws, 2005). We (2003, 2005) suggested that this may have been a contributing factor to the relatively late success of Neandertal populations in southern Iberia.

In contrast, early Upper Paleolithic populations in Portugal may have consumed a more diversified diet than the late Neandertal populations. This may have fostered larger human groups and overall larger population densities in Portugal through the lowering of maternal and infant mortality rates, particularly if mobility was also reduced for pregnant females. Whether the initial Upper Paleolithic populations competed for resources with the existing late Neandertal populations is an open question, but if these initial Upper Paleolithic groups consumed a more diversified diet, particularly incorporating a much greater diversity of micronutrient dense resources such as plant foods, then this would help account for the genetic swamping of the Neandertals in southwestern Iberia.

LIMITATIONS OF THE DATA SET

It is important to recognize the current limitations of our data, as well as to consider other plausible explanations to account for archaeological patterns. Some of these related to the Iberian Paleolithic include the following:

1) Systematic excavations have been carried out at many more inland sites than coastal sites; as a result, current data are biased toward inland habitats exploited on a seasonal basis. It may well be the case that foragers (both Neandertal and AMHS) moved from coastal to inland habitats at various times of the year.
2) Climate may have impacted the use of individual sites during specific time periods. For example, Hockett and Haws (2002) argued that this was the case for Picareiro Cave, in which this upland site may not have been utilized as frequently during colder phases such as the Solutrean or the latter Magdalenian associated with the Younger-Dryas than during warmer phases. Thus, the more sites that are incorporated into the data set from a variety of topographic settings the better the interpretations are likely to be.
3) Haws (2003) pointed out that coastal sites in Portugal will likely be biased against certain time periods such as the Solutrean when sea levels were much lower; many Solutrean sites that might have documented rather intensive coastal use are now submerged deep under water.
4) Younger sites are more visible, and may appear more numerous than earlier occupations; thus, more sites such as the Galeria Pesada need to be found and investigated, and Paleolithic archaeologists need to dig deep enough in the more visible caves to determine if pre-Upper Paleolithic occupations or sediments are preserved.
5) As Straus *et al.* (2000) and others have been pointing out for some time, during the Solutrean there may have been rather substantial movement of populations from the north southward into Iberia. As a result, de-

mographic increases during certain phases of the Upper Paleolithic may have been partially caused by migration rather than by in situ increases in population. And,

6) Social factors can dramatically influence demographic patterns (e.g., Roth, 2004). Socially accepted norms of behavior or individual decision-making related to infanticide, warfare, kinship structures, and rules governing pregnancy can have dramatic impacts on a group's fertility and mortality rates irrespective of overall nutritional health.

CONCLUDING REMARKS

Future research should determine if the broad interpretations presented here stand the test of time. We need better subsistence information from all time periods, as well as stable isotope data from human skeletons, to fully test these ideas. Research such as that spearheaded by Tony Marks at Galeria Pesada is vital to answering questions about the environments early humans adapted to and the dietary choices they made within those environments. This information can then be used to interpret early human health patterns and long-term demographic trends in Portugal.

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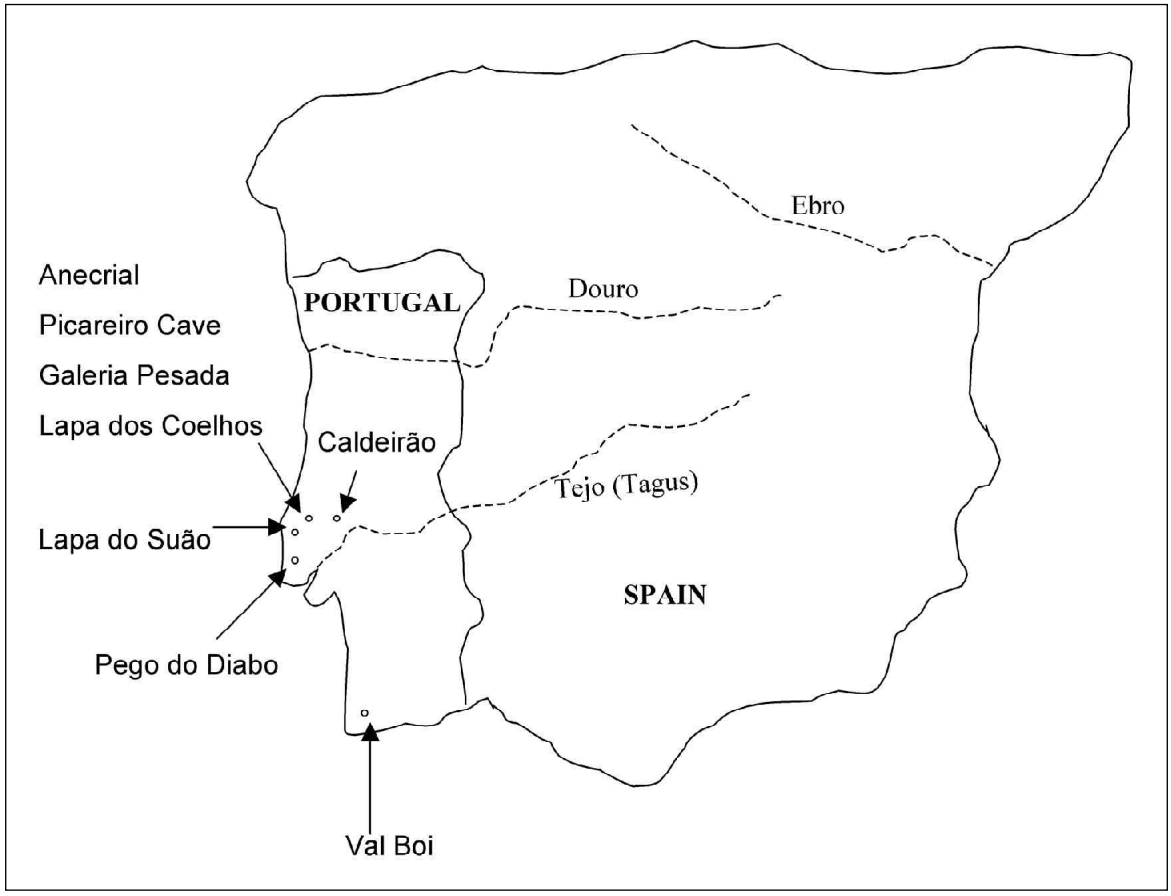

FIGURE 1. General location of the major sites mentioned in the text.