Hunter–gatherer subsistence at the end of the Pleistocene: preliminary results from Picareiro Cave, Central Portugal

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Excavation at the site of Picareiro Cave in Portugal provides an important and rare sample of animal remains. Preliminary study shows that late Pleistocene hunter–gatherers hunted rabbits, deer and a wide variety of fauna, perhaps during seasonal occupation of the cave.

Introduction

Understanding culture change and continuity at the Pleistocene–Holocene boundary requires subsistence data (see Straus *et al.* 1996). The paucity of faunal remains, however, limits what is known about subsistence strategies during the Tardiglacial and Early Postglacial of Portugal (Bicho 1998). Current models are based on old palaeontological collections, taxonomic lists in excavation reports of a few sites excavated in the late 19th and early 20th centuries, and data from a few unpublished or partially published sites. As yet, no faunal assemblage from any archaeological site dated to the Late Pleistocene has been fully analysed and published, and seasonality data are non-existent.

New faunal data from the Tardiglacial levels of Picareiro Cave (FIGURE 1) are presented in this report. Picareiro is an important site for understanding Tardiglacial subsistence because of well-preserved bone and charcoal, unique geographic location and complete sequence.

Background

Picareiro Cave is located in the Portuguese Estremadura, on the west face of the Serra d'Aire at 540 m a.s.l. The site overlooks a wide valley 10 km south of the town of Fátima. The Atlantic coast is approximately 40 km to the West. The cave measures 10x8 m with a low entrance opening to a high, irregular ceiling (FIGURE 2). The drip line is located 2–3 m out and is wider than the present entrance, suggesting the cave was larger in the past.

Picareiro was tested in the late 1950s by Marques who later reported the Iron Age deposits (Marques & Andrade 1974). In 1994, the cut of the old test was cleaned and charcoal samples collected. Immediately, a series of archaeological layers dated to the Final Upper Palaeolithic were visible. As a result, Bicho began a long-term interdisciplinary project in 1995. All the materials found during excavation are piece-plotted. All sediment has been fine-screened through 6- and 1-mm mesh, washed and sorted to recover numerous rodent, bird and fish bones, shell, charcoal and lithic artefacts.

Stratigraphy and chronology

The deposit is marked by a dip from the entrance towards the back of the cave, and a slight strike to the east wall. There is a well-developed cone formed with large limestone blocks. Testing and excavation have been carried out in two areas of the cave. The first is located immediately outside the entrance, while the second is inside near the old excavation. In 1997 a metre-deep test pit outside the cave revealed a Middle and Late Holocene human occupation (FIGURE

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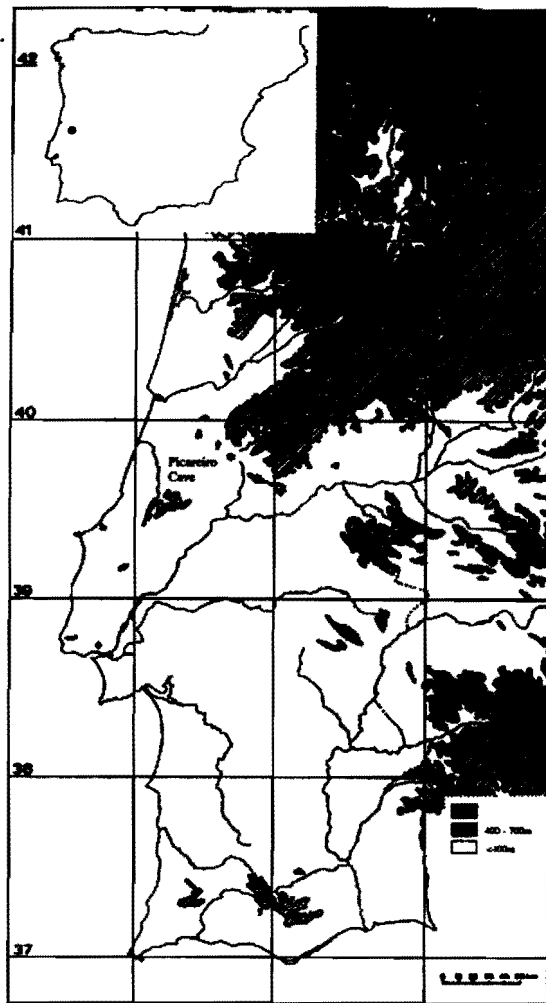
FIGURE 1. *Map of Portugal with the location of Picareiro Cave.*

FIGURE 2. *Section and plan view of Picareiro Cave.*

3). Inside the cave, 13 sq. m have been excavated, reaching a depth close to 1·7 m, with unexcavated deposits below. Levels A–C are Neolithic and Bronze Age overlaying a series of Tardiglacial deposits.

A fine light brown sandy loam characterizes stratum D dated to 8000 BP. Artefacts include lithics and a couple of perforated seashells (*Nassarius reticulatus*). Stratum E is a light grey silt loam with small-sized *éboulis*. It contains three archaeological levels dated 10,000–11,700 BP (TABLE 1). Stratum F is characterized by small-sized *éboulis*, with rare fine sediment (greyish brown clay loam). A large semi-circular hearth was excavat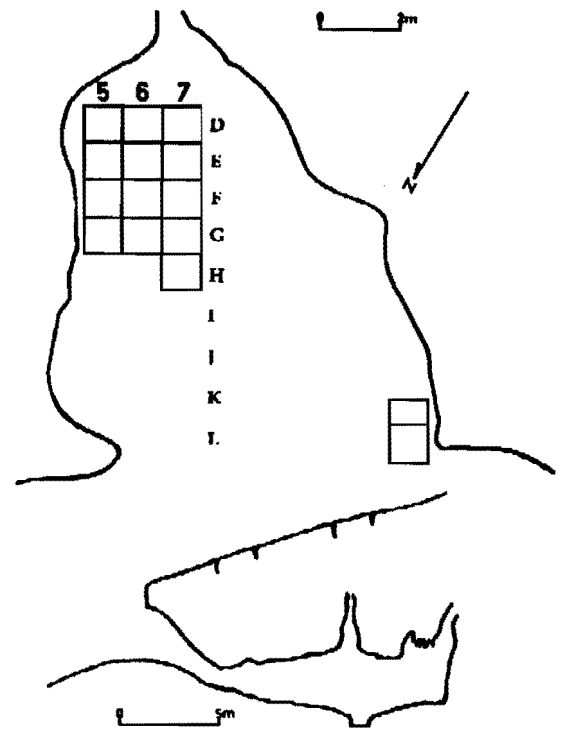ed, which contained most of the fine sediment, abundant charcoal, lithics and fauna. Stratum G, dated 12,300 BP, lies below the hearth found in F, but the sediment is finer, extremely compact and almost black. This colour is due to the very high content of charcoal and burned bone present in the stratum. Stratum H is a 3–5-cm thick stalagmitic floor. Stratum I consists of large limestone *éboulis*. There is almost no fine sediment. Stratum J is similar with smaller and less angular limestone fragments.

Subsistence at Picareiro

Macrofauna

The large mammal remains total 602 specimens of which 117 were identified to species. The majority of these are red deer (c. 70%) and wild boar (29%). Additional species include roe deer, represented by a partial maxilla, aurochs, represented by isolated foot bones, and chamois, represented by a maxilla fragment. The unidentified specimens are mostly long bone shaft fragments and other postcranial elements which fall in the red deer and smaller roe deer size range.

The bones from the Level E assemblage are covered with a carbonate crust, which can be
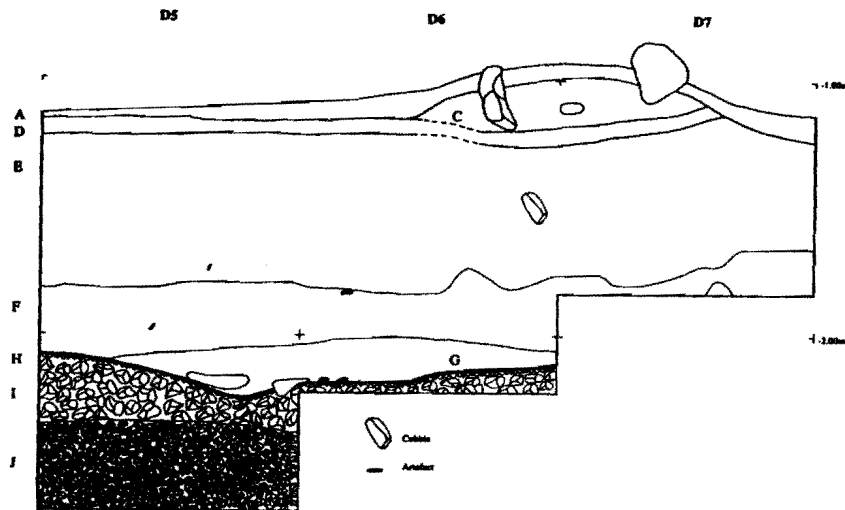
FIGURE 3. *Section of Picareiro Cave.*

lab. no.	stratum-level	elevation b.d.	sample	date b.p.*
Wk-6676	D1	−117−124 cm	charcoal	8310±130
Wk-4217	E5 (Upper)	−145−150 cm	charcoal	10,070±80
Wk-5431	E8 (Middle)	−160−165 cm	charcoal	11,700±120
Wk-4218	E10 (Lower)	−175−180 cm	charcoal	11,550±120
Wk-4219	F3	−185−190 cm	charcoal	11,780±90
Wk-6677	F10	−215−218 cm	charcoal	12,210±100
OxA-5527	G	−205−215cm	charcoal	12,320±90

* non-calibrated results

TABLE 1. *Radiocarbon dates from Picareiro Cave.*

	total	red deer		wild boar		aurochs		chamois		ibex		total
		NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	(identified)
E u.	30	3	1									3
E m.	43	6	1	4	2							10
E l.	42	5	1	1	1	1	1	1	1			8
F	309	51	4	21	2							72
G	148	12	1	6	1							19
I	16	2	1	1	1							3
J	5	1	1							1	1	2
total	602	80	10	33	7	1	1	1	1	1	1	117

TABLE 2. *Number of macrofauna bones per stratum at Lapa do Picareiro.*

removed keeping the surface intact in many cases. Many specimens have eroded surfaces consistent with chemical weathering generally in the form of small round pockmarks. Fragmentation is high, making species identification difficult. TABLE 2 shows the NISP and MNI for each species. Of the three archaeological levels, E Lower is the most diverse with red deer, wild boar, aurochs and chamois.

Level F is by far the richest level, with some of the best-preserved specimens and larger fragments. The large hearth found in this level con-

tained many burned and highly fragmentary remains. Both adult and juvenile red deer and wild boar are represented.

The Level G assemblage comes from 5 excavated units. The bones are covered with white, ashy sediment. Due to the level of burning and fragmentation, only 18 of the 148 specimens were identifiable to species. The stalagmitic crust of Level H has effectively sealed off Levels I & J providing the best preservation in the cave.

Seasonality

Preliminary seasonality determinations were made using *cementum annuli* analysis on red deer teeth (Klevezal 1996; Pike-Tay 1991). Work was carried out with Tina Dudley in the McDonald Institute for Archaeological Research at Cambridge University. Modern specimens from the Scottish Highlands were used as a control sample. Maxillary M1 teeth from two animals in Stratum F showed late autumn/early winter season of death.

Additional determinations, based on 2nd phalanx epiphyseal fusion rates (Bull & Payne 1982), suggest a late autumn/winter season of death for the wild boar in Level F. The specimen is clearly unfused, and would fall within their 7–11 month category (Bull & Payne 1982) while the specimen from E Middle, with a fusing epiphysis, would fall within the 19–23 month category, placing the season of death in autumn/winter. This is tenuous given the wide range of time estimates between those authors and the definition of unfused/fused.

Taphonomy

Most long bones show evidence of intentional cracking for marrow extraction. They are highly fragmented with percussion scars and impact fractures. In addition, the 1st and 2nd phalanges show evidence for marrow extraction. All are split longitudinally and exhibit impact fracturing, similar to ones documented by Altuna (1986) from La Riera and by Perez Ripoll (1992) in Mediterranean Spain. Binford (1978) suggested this was a sign of subsistence stress due to the effort required to obtain a small amount of marrow. The proposition should be called into question, considering that autumn and winter are not usually thought to be times of dietary stress (Speth & Spielmann 1983).

Although Late Pleistocene fauna-bearing sites in Portugal contain carnivore remains, they are almost entirely absent in the Picareiro assemblage. Only two small teeth, a premolar and molar, of a small, marten-sized carnivore have been recovered. No large carnivore elements are present, even considering the unidentified specimens, which are all from ungulates of various sizes. A few bones show tooth punctures, but none penetrated through cortical bone.

Mesofauna

Leporids

Approximately 9000 rabbit bones have been recovered from Picareiro (TABLE 3). A total of 7408 rabbit bones, representing at least 4766 elements, was recovered directly from within or just outside two hearth features. These bones represent the remains of at least 146 individual rabbits.

There is no clear evidence for the natural accumulation of rabbit bones in Picareiro except on the surface of the site. None from the subsurface deposits display evidence of puncture marks, corrosion from gastric fluids, thinning or polishing, all of which characterize leporid bone assemblages accumulated via raptor pellets and mammalian carnivore scats (Andrews & Evans 1983; Schmitt & Juell 1994; Hockett 1995; 1996). In addition, limb elements and cranial bones are abundantly represented. Rabbit-bone accumulations beneath raptor roosts generally exhibit unequal distributions of these elements (Hiraldo *et al.* 1975; Hockett 1995; Schmitt 1995; Cruz-Uribe & Klein 1998).

Small carnivores such as lynx (*Lynx pardina*) and badger (*Meles meles*) are known to hunt rabbits and accumulate bones in Iberian caves (Ripoll 1993; Mathias *et al.* 1998). These assemblages are characterized by the accumulation of entire rabbit carcasses with relatively large numbers of complete or nearly complete limb elements preserved (Ripoll 1993; Hockett 1999). At Picareiro, only 3·7% of the 1694 femur, tibia, humerus, radius and ulna specimens recovered from the hearths were complete. While small carnivores may puncture the ends of rabbit limb bones, in particular the distal end of the femur and the proximal end of the tibia, no bones from the subsurface deposits of Picareiro Cave exhibit puncture marks (Hockett 1999).

When small animal carcasses such as rabbits are roasted over or within hot coals, foot bones and the ends of limb bones are typically
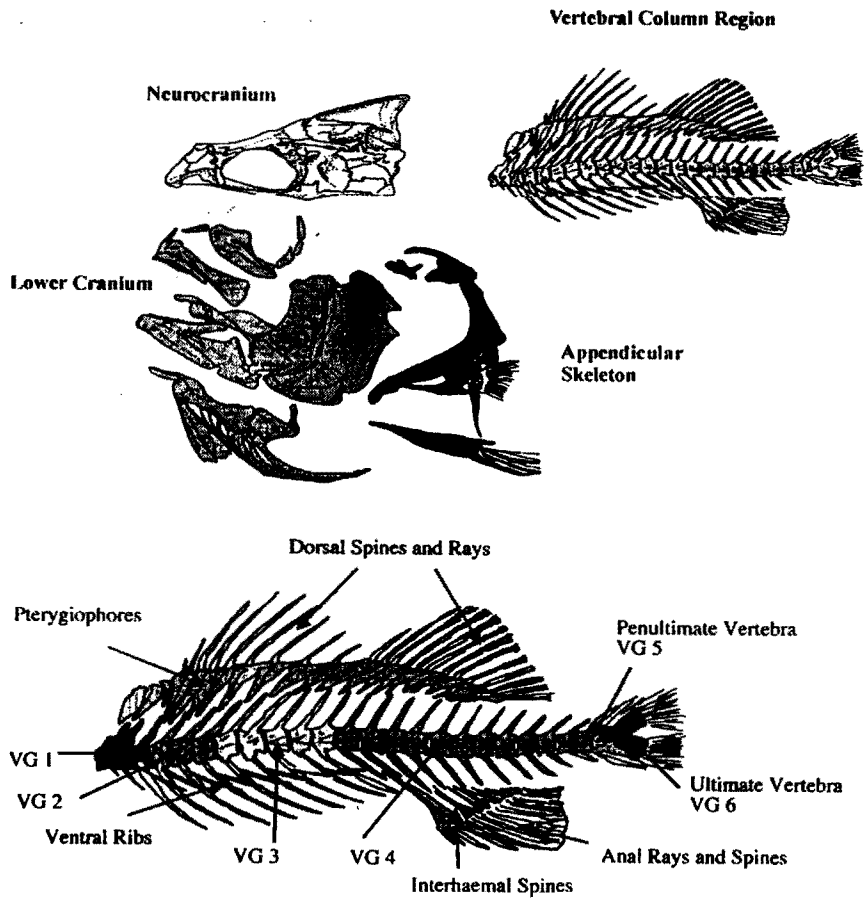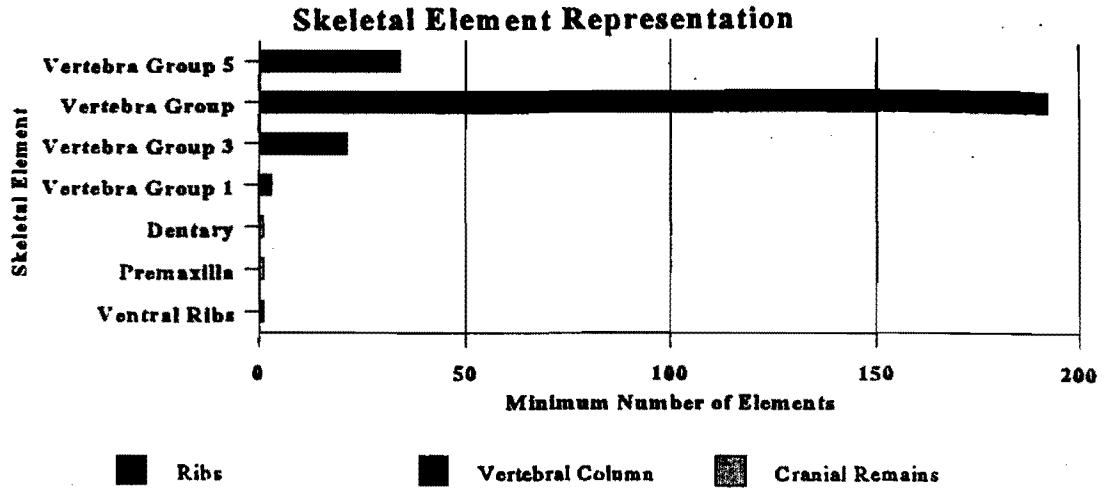
FIGURE 4. *Skeletal element and region representation of Picareiro fish bones.*

blackened or calcined white in greater frequencies than other bones or bone portions (Dansie 1991; Hockett 1992). The vast majority of charred rabbit bones at Picareiro were foot elements (69%), and many more proximal and distal limb portions than midshaft were burned. Thus, rabbit carcasses in Picareiro Cave were probably roasted whole within or over hot coals, after which the cooked carcasses were dismembered and the meat consumed.

In addition, large numbers of humeri, femora, and tibiae shaft cylinders were recovered from the hearths in Picareiro. While mammalian carnivores, raptors and rodents occasionally create rabbit long bone cylinders by chewing or breaking off the ends of limb bones, they rarely do so (Hockett 1995). In contrast, because humans may deliberately break off the ends of rabbit long bones in order to consume marrow, prehistoric hunters may discard very large numbers of rabbit bone cylinders in archaeological sites (Jones 1983). A total of 400 rabbit long bone cylinders was recovered from within the two hearths at Picareiro, while only 12 complete femora, tibiae and humeri were recovered from these features.

Seasonality

While European rabbits in the Mediterranean may breed during any season, they display sharp peaks in breeding in the spring and autumn coincident with increased precipitation and new vegetation growth (Southern 1940; Poole 1960; Soriguer & Rogers 1979; & Garson 1979). Adult rabbits are more abundant during the summer and winter months as breeding slows, and because predators take many of the young. Of the 684 proximal and distal ends of femora, humeri and tibiae recovered from Picareiro Cave, 680 (99·4%) had fully fused epiphyses indicating the cave likely was used during the summer or winter months, or both.

Fish

A few hundred fish bones have been recovered from Picareiro. Most elements are from the *Clupeidae* family, though *Cyprinidae* are also represented (FIGURE 4). The two species of *Clupeidae* known in Portugal include shad (*Alosa alosa* and *Alosa fallex*), and sardine (*Sardina pilchardus*). Almost all the samples are vertebrae while other bones, particularly cranial elements, are extremely underrepresented. This type of distribution with an extreme over-representation of vertebral remains is characteristic of small-fish-eating and disposal habits, as seen in ethnoarchaeological research in coastal Sindh and Baluchistan in Pakistan, where the heads of small fish are chewed up, while the sharp vertebrae are removed and eventually discarded into the trash (Belcher 1997). As a result of this type of food processing and use, the skeletal representation of small fishes is almost completely devoid of cranial elements (Jones 1986).

Summary and conclusions

The preliminary data from Picareiro Cave suggest a diverse subsistence base during the Tardiglacial and Early Postglacial. The faunal assemblage is dominated by rabbit and red deer supplemented by wild boar, roe deer, chamois, aurochs and fish. In addition, resource intensification is suggested by the extraordinarily high number of rabbit bones and the presence of fish, both the result of special hunting and fishing techniques that probably included traps and nets. While hunting likely took place near or around the site, fishing occurred in local streams and/or at the coast depending on whether the fish are shad or sardine. Shad are anadromous and appear in streams a few kilometres from the cave while sardines are ocean fish appearing near the shore during the summer breeding season. Despite the distance from the sea, sardines cannot be ruled out because marine shellfish were also gathered and brought inland to Casal Papagaio and Bocas as well (Arnaud & Bento 1988; Bicho 1995–7).

Initial seasonality determinations suggest people were not using the cave year-round. The large fauna were hunted in autumn/early winter while rabbit were probably taken in winter or summer. If the fish are sardine, then they were likely caught during summer but certainly could have been preserved for later use. To conclude, the seasonal occupation, patterns of rabbit carcass butchery and high fragmentation of the large mammal limb elements all indicate the cave was repeatedly used as a hunting/carcass-processing camp. Further excavation and analysis will yield additional data for more meaningful subsistence studies for the Portuguese Tardiglacial.

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