Mosaic adaptations of Early Holocene hunter-gatherers in central Portugal: lithic and faunal evidence from the open air site of Costa do Pereiro (Torres Novas)

Mosaikförmige Anpassungsstrategien frühholozäner Jäger und Sammler in Zentralportugal: Steinartefakte und Fauna von Costa do Pereiro (Torres Novas)

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Abstract - Recent syntheses of the Early Holocene of the Estremadura region of central–southern Portugal have been pointing to a mosaic of technological and subsistence options which however lacked updated, comprehensive overviews of the lithic production and faunal evidence for the so-called "inland hunters". Excavations carried out at the Costa do Pereiro campsite (Torres Novas municipality) allowed important insights on both topics.

Obtained results indicated a long-lasting continuity since the local Magdalenian in terms of lithic raw material exploitation strategies, knapping procedures and toolkit typology. Faunal remains, although scarce, show a large spectrum of hunted species (mammals and birds) that sharply contrasts with evidence from other environments (coastal, montane, and riverine) and gives support for interpreting the "inland hunters" as an individualized archaeological entity whose specific cultural traits remain to be clarified.

Zusammenfassung - *Aktuelle Untersuchungen zur Frühholozänen Besiedlung der Estremadura im zentralen Südportugal zeigen mosaikförmige Anpassungsmodelle sowohl hinsichtlich verwendetet Technologien als auch Subistenzstrategien: sogenannte „marine gatherers" (repräsentiert durch Muschelhaufen entlang der Atlantikküste und charakterisiert durch die Nutzung mariner Ressourcen) und „macrolithic makers" (verantwortlich für die Herstellung von Geröllindustrien, die sich in den Terrassen des Tagus finden). Zu letzteren fehlt ein substanzielles Wissen zur Steingeräteproduktion und Subsistenz. Grabungen die jetzt an der Freilandfundstelle von Costa do Pereiro (Gemeinde Torres Novas) durchgeführt wurden, eröffnen Einblicke in beide Themenbereiche.*

Rohmaterialversorgung (lokale Materialen wir Quarz und Quarzit dominieren, „chert" importiert), Abbaustrategien (v.a. bei Quarz und Quarzit) sowie das Gerätespektrum (rückengestumpfte und endretuschierte Spitzen an Lamellen dominieren) deuten auf eine lange Kontinuität bis zurück ins lokale Magdalenien hin. Die wenig zahlreichen Faunenreste zeigen ein breites Spektrum an gejagten Arten: Säugetiere (Rothirsch, Ibex, Wildschwein, Auerochse, Hase und Equiden), sowie Vögel (Rebhuhn). Damit unterscheidet sich dieses Inventar deutlich von denen anderer Landschaftstypen (Küste, Gebirge, Flussauen), aus denen eine vergleichbare Zusammensetzung unbekannt ist. Von weiteren Freilandfundstellen aus ähnlichen Lagen des Tagustals sind keine Fauneninventare erhalten. Sie scheinen jedoch zum selben Typ „Basislager", charakterisiert durch die gleichen Subsistenz- und Siedlungsstrategien zu gehören. Bei ihrer Trägern scheint es sich um „inland hunters" zu handeln, einer distinkten archäologischen Einheit deren genaue kulturellen Charakteritika (soziale Organisation, Mobilität, Beziehungsmuster zu anderen Gruppen usw.) noch zu erforschen sind.

Keywords - Portugal; Early Holocene; Epipalaeolithic; zooarchaeology; lithic technology
Portugal; Frühholozän; Epipaläolithkum; Zooarchäologie; Lithische Technologie

Introduction

Major changes in bioclimatic conditions and geomorphology took place in the Estremadura province of central Portugal (Fig. 1) at the end of the Pleistocene and during the earliest phases of the Holocene. Due to continuous increase in temperature the vegetal cover characterized by Scots pine (*Pinus sylvestris*) alongside Fabaceae, Ericaceae and common box (*Buxus sempervirens*) was replaced in the region by typically Mediterranean forests, of which more thermophilic pine species – maritime pine (*Pinus pinaster*) and stone pine (*Pinus pinea*) – olive tree (*Olea europaea*), mastic (*Pistacia lentiscus*), evergreen oaks and strawberry

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tree (*Arbutus unedo*) became the most commonly found in the anthracological record (Carrión et al. 2012; for a general overview see also Abrantes et al. 2012). Sea level rise led to the retreat of the coastline to its present-day configuration (Dias et al. 2000). Although presently infilled due to alluvial sedimentation in historical times, Early Holocene estuaries of brackish waters were formed at river mouths, especially in the case of the lower Tagus river basin, where a large estuary progressively penetrated deeply inland (see Vis et al. 2008: figs. 11–12).

Overall, these changes allowed the formation of elongated, contrasting ecosystems – and varied types of human occupation (see below) – in a relatively restricted geographical area sandwiched between the Atlantic and the Tagus river valley. As can be seen in Figure 1, a West–East survey crosses three main distinct geo-ecological features:

1. A highly productive coastal strip – despite decreasing upwelling activity recorded during the Early Holocene, as observed in diatom records from deep-sea cores off the Portuguese coast (e.g., Abrantes 2000) – intersected by the basins of small rivers draining to

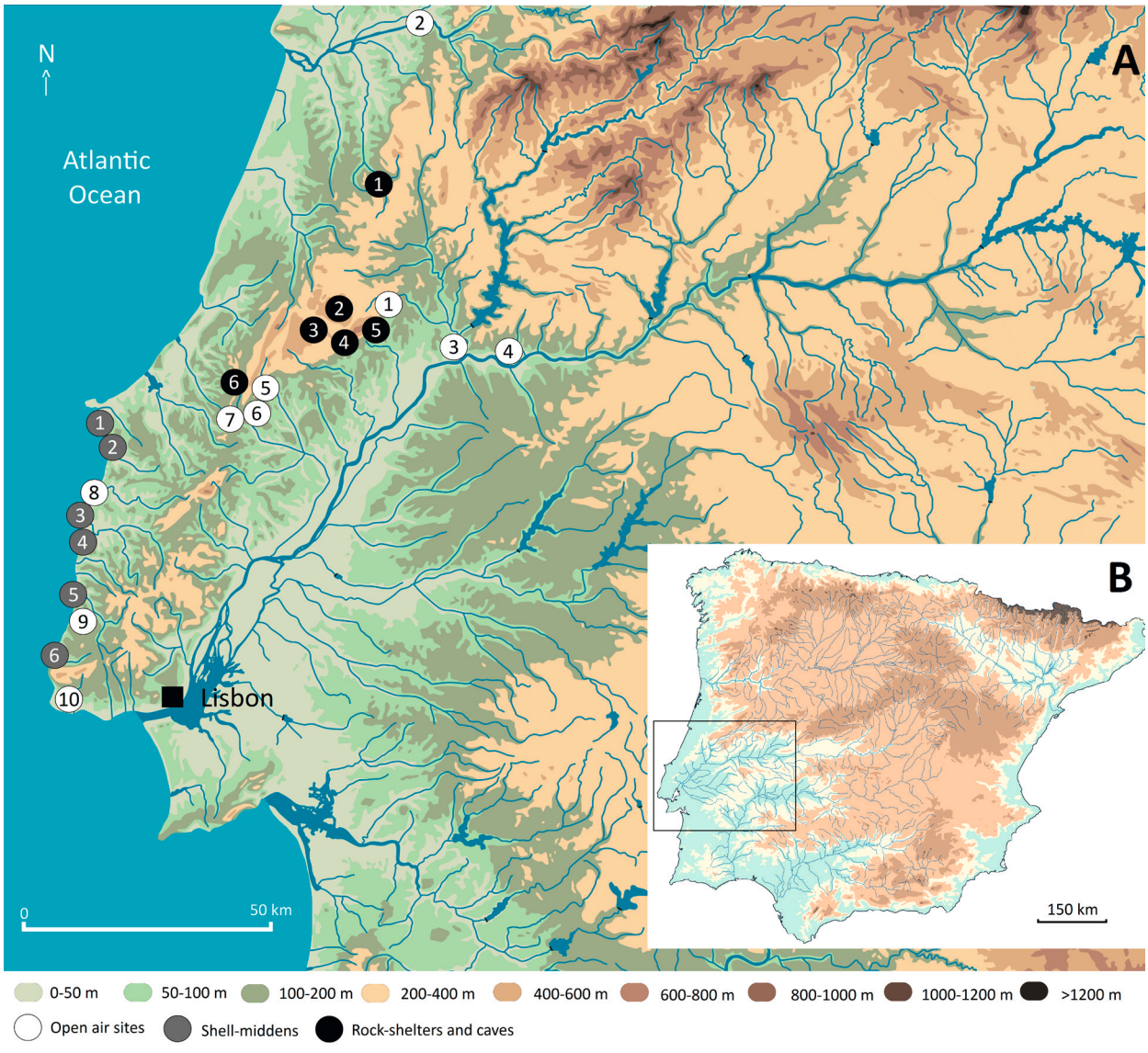

Fig. 1. A - Epipalaeolithic sites. Open-air sites: 1 - Costa do Pereiro; 2 - Vale Sá; 3 - Santa Cita; 4 - Amoreira; 5 - Areeiro III; 6 - Cabeço de Porto Marinho V; 7 - Fonte Pinheiro; 8 - Ponta da Vigia; 9 - Cova da Baleia; 10 - Quinta da Bicuda. Shell-middens: 1 - Vale Frade; 2 - Toledo; 3 - Cabeço do Curral Velho; 4 - Pinhal da Fonte; 5 - São Julião A and B; 6 - Magoito. Rock-shelters and cave sites: 1 - Buraca Grande; 2 - Casal Papagaio; 3 - Pena de Mira; 4 - Picareiro; 5 - Pena d'Água; 6 - Bocas; B - Location of the study area (rectangle) on the western, Atlantic coast of the Iberian Peninsula.

Abb. 1. *A - Epipaläolithische Fundstellen. Freilandfundstellen: 1 - Costa do Pereiro; 2 - Vale Sá; 3 - Santa Cita; 4 - Amoreira; 5 - Areeiro III; 6 - Cabeço de Porto Marinho V; 7 - Fonte Pinheiro; 8 - Ponta da Vigia; 9 - Cova da Baleia; 10 - Quinta da Bicuda. Muschelhaufen: 1 - Vale Frade; 2 - Toledo; 3 - Cabeço do Curral Velho; 4 - Pinhal da Fonte; 5 - São Julião A und B; 6 - Magoito. Höhlen und Abris: 1 - Buraca Grande; 2 - Casal Papagaio; 3 - Pena de Mira; 4 - Picareiro; 5 - Pena d'Água; 6 - Bocas; B - Lage des Arbeitsgebietes (Rechteck) an der westlichen Atlantikküste der Iberischen Halbinsel.*

the Atlantic. Together, these features explain the presence of several shell-middens near their mouths or along the coast.

2. A North–South chain of limestone massifs (that culminate at 678 metres a.s.l. in the Aire Mountain), constituting the backbone of the Estremadura region, is characterized by xerophytic plant species due to the scarcity of surface water. Numerous karstic formations with remains of human occupation are known in this inner sector of the region.
3. Plains of sandstone substrata (along the periphery of the limestone massifs) and fluvial terraces (on the right banks of the upper Tagus valley) crossed by a dense net of tributaries. In this area some open air sites have been excavated, revealing expedient macrolithic industries on top of river terraces and lithic blade assemblages in sites closer to the mountains.

In a comprehensive overview of current Early Holocene archaeological evidence in the central (Estremadura) and southern (Alentejo and Algarve) regions of Portugal, Araújo (2009: 535–539) defines "three different adaptations with both geographical and archaeological meaning" (see Fig. 2 for the Early Holocene cultural sequence in the region):

1. "Marine-gatherers", a group of shell-midden sites located along the Atlantic coast, in two main areas: the lower section of Estremadura and the south-west coast. These are characterised by accumulations of mollusc remains from local ecosystems (either from rocky or sandy/marsh environments) with other animal species (mammals, fish, birds) being scarcely represented or totally absent. Small assemblages of knapped stone tools expediently obtained from local raw materials are sometimes found in these middens. These sites result from short duration (seasonal?) occupations specialised in the harvesting of the mentioned food sources. Only Toledo is an exception to these patterns in all accounts (Araújo 2011), a fact that recently led the same author to differentiate this group of sites into three: "The material contents show: i) sites formed in the course of short, repeated passages aimed at the exploitation and immediate consumption of molluscs; ii) sites formed in the course of more prolonged stays that show the exploitation of diversified resources (of terrestrial and marine origin) and where knapping activities took on some importance; iii) observation sites (?)" (Araújo et al. 2014: 32; original text in Portuguese).
2. "Macrolithic makers", a group of sites where very expedient reduction strategies (unretouched flakes and heavy-duty tools) were applied to cobbles of locally available raw materials, usually quartzite or greywacke. In the only instance where faunal remains were preserved – at the site of Barca do Xerez de Baixo, in the Alentejo hinterland (Araújo et al. 2009) – it was possible to conclude that these industries responded to an economic system based on mobility in which the production of cutting edges to be used opportunistically in butchering activities was the main purpose. The problem with these types of sites, especially in the terraces of the Tagus Valley, has been their chronological attribution. Indeed, the abundance of high-quality quartzite pebbles made the production of chopper-like cores and flakes easy, resulting in superficial palimpsests that were traditionally dated according to the terraces' altimetry and the patina on the artefacts, as in the classic work by Breuil & Zbyszewski (1942, 1945; for a discussion regarding the current research on this topic in the Tagus Valley, see Pereira & Carvalho 2015).
3. "Inland hunters". In this category, Araújo (2009) subsumes what could in fact be considered two distinct types of sites: rock-shelter and cave sites in the core areas of the limestone mountains and open air sites located at their periphery. Not only are sites different *per se*, so are their potential catchment areas and taphonomic conditions. Sites with favourable preservation conditions allowing organic remains to be recovered have been exclusively found within the limestone massif. This is the case of the mammal assemblage from layer D at Picareiro Cave, mostly composed by red deer (Bicho et al. 2003; see discussion), or of the shell deposits at Casal Papagaio, Pena de Mira or Bocas, ca. 30–50 km away from the present-day coast line, which demonstrates the existence of diversified economic territories at the time. At the open air sites along the periphery of the limestone mountains – almost exclusively in the Rio Maior area – faunal remains are totally absent due to the sandy, acidic sediments in

Period	Date calBC	Epoch
Terminal Magdalenian	10500–8000	Pleistocene
Epipalaeolithic (or Early Mesolithic)	8000–6200	Early Holocene
Mesolithic (or Late Mesolithic)	6200–4800	Middle Holocene

Fig. 2. Cultural sequence and chronology of the Pleistocene/Holocene transition in Portuguese Estremadura.

Abb. 2. *Kulturchronologie des Übergangs vom Pleistozän zum Holozän in der Portugiesischen Estremadura.*

which they are usually found. Conversely, lithic assemblages and habitation structures are testimony of a clear functional differentiation between specialised, short term occupations in the former karstic sites (where only expedient knapping is attested) and residential occupations in the latter sites of the Rio Maior area (where hearths and abundant chert assemblages, with more complex reduction strategies, have been recorded).

Excavation in the last decade of the 20th century at Costa do Pereiro revealed an open air Epipalaeolithic occupation of residential nature (see discussion) at the foothills of the Aire Mountain (Fig. 1). The relatively abundant lithic assemblage associated with faunal remains permits the establishment of direct comparisons with other residential sites in similar geographic locations elsewhere in the region (namely in the southernmost tip of the limestone massif, in the Rio Maior area) and, more importantly, to evaluate the faunal spectrum that may have been exploited at this type of sites. The aim of this paper is therefore to provide a first comprehensive model for lithic and faunal exploitation strategies during the Early Holocene of the Estremadura region, but focusing in particular on residential-type sites.

The Costa do Pereiro open air site: lithic and faunal analyses

Results of the five seasons of excavations carried out at Costa do Pereiro (1995, 1997, 1998, 1999 and 2000), in a total contiguous area of 26 m^2 (Fig. 2B) plus a further 1 m^2 test in a disturbed area to the South–West of the site, remain unpublished. Only the Mesolithic occupation (ca. 6100 calBC) was so far studied in the framework of a broader analysis of the Neolithisation process in the region, where a short description of the site – location, stratigraphy, cultural sequence, radiocarbon chronology, etc. – is also provided (see Carvalho 2008: 51–56).

Costa do Pereiro is located on a mid-slope platform within in the 40 km long escarpment–locally known as Arrife, from the Arabic word *ar-rif* ("rock", "coast", "scarp")–separating the karstic inner territory of the Limestone Massif of Estremadura from the densely irrigated plains and fluvial terraces of the Tagus right bank (Figs. 1 and 3A). This mid-slope platform, at ca. 125 metres a.s.l., was formed due to an alignment of limestone boulders that permitted the accumulation of a colluvium which was otherwise washed downslope. During its formation, it incorporated several episodes of human occupation ranging from the Epipalaeolithic to the Iron Age (see Fig. 4 for a summary of the stratigraphic and cultural sequence). This deposit has an average thickness of around 1 m, with bioturbation affecting its upper layers. As a consequence, strata are not very thick (Fig. 3C–D) and some occupation levels are only fleeting and stratigraphically undefined (e.g., the Mesolithic and the Bell Beaker occupations). Such limitations did not prevent, however, the preservation of specific well-defined contexts such as hearths, a Neolithic child burial or pottery vessels broken *in situ*. The favourable chemical environment, on the other hand, allowed the preservation of organic remains (bone and charcoal), thus making the Epipalaeolithic open air occupation of Costa do Pereiro a remarkable discovery for the region.

As clearly evident in Cut 2 (Fig. 3D), the sedimentary deposit can be divided into two main units: an upper one, about 75 cm thick, formed by dark-brown to blackish sandy-argillaceous sediments and homogenously scattered clasts (which can be subdivided into thinner layers according to variations in sediment texture, clast density and colour nuances); and a red clayish deposit lying on top of the local limestone bedrock. The upper, darker layer – subdivided in layers 1a and 1b – is dated to the Middle/Late Holocene while the bottom reddish layer – or layer 2 – is dated to the Early Holocene and contains the remains of the above-mentioned Epipalaeolithic occupation.

With the exception of a few intrusive potsherds and lithic artefacts, the top 15 cm of layer 2 can be considered sterile; the Epipalaeolithic occupation is preserved below. However, some Epipalaeolithic items (both lithic and faunal) may be also present in the upper layers 1a and 1b mixed with later assemblages due to remobilization of sediments from the topographically superior sectors of the site (Fig. 3B) during its formation process. This is attested by one of the available radiocarbon dates. Indeed, of the two radiocarbon determinations on faunal samples pointing to the Epipalaeolithic, one was collected *in situ* in layer 2 (Wk-35997: 8680 ± 30 BP) while the other was in secondary position in layer 1b (Wk-30215: 8564 ± 37 BP), where Mesolithic–Neolithic occupations are recorded. These observations suggest caution when analysing the archaeological contents of the upper strata. Despite collected in different stratigraphic contexts, both indicate 7700–7500 calBC as the time span during which the Epipalaeolithic occupation took place (Fig. 5).

Lithic production

A total of 2022 lithic artefacts compose the assemblage (Fig. 6), which is dominated by quartzite (41.3 %), followed by chert (34.7 %), quartz (20.6 %), greywacke (2.5 %), schist (0.1 %) and other residual rocks (0.7 %). Quartzite cores resulted from the knapping of pebbles collected in the Tagus fluvial deposits; their high frequency is related to local availability near the site. Conversely, chert cores were obtained from nodules in primary position; the reduced percentage of cortex and their small sizes indicate these volumes were collected elsewhere, trimmed and only then brought

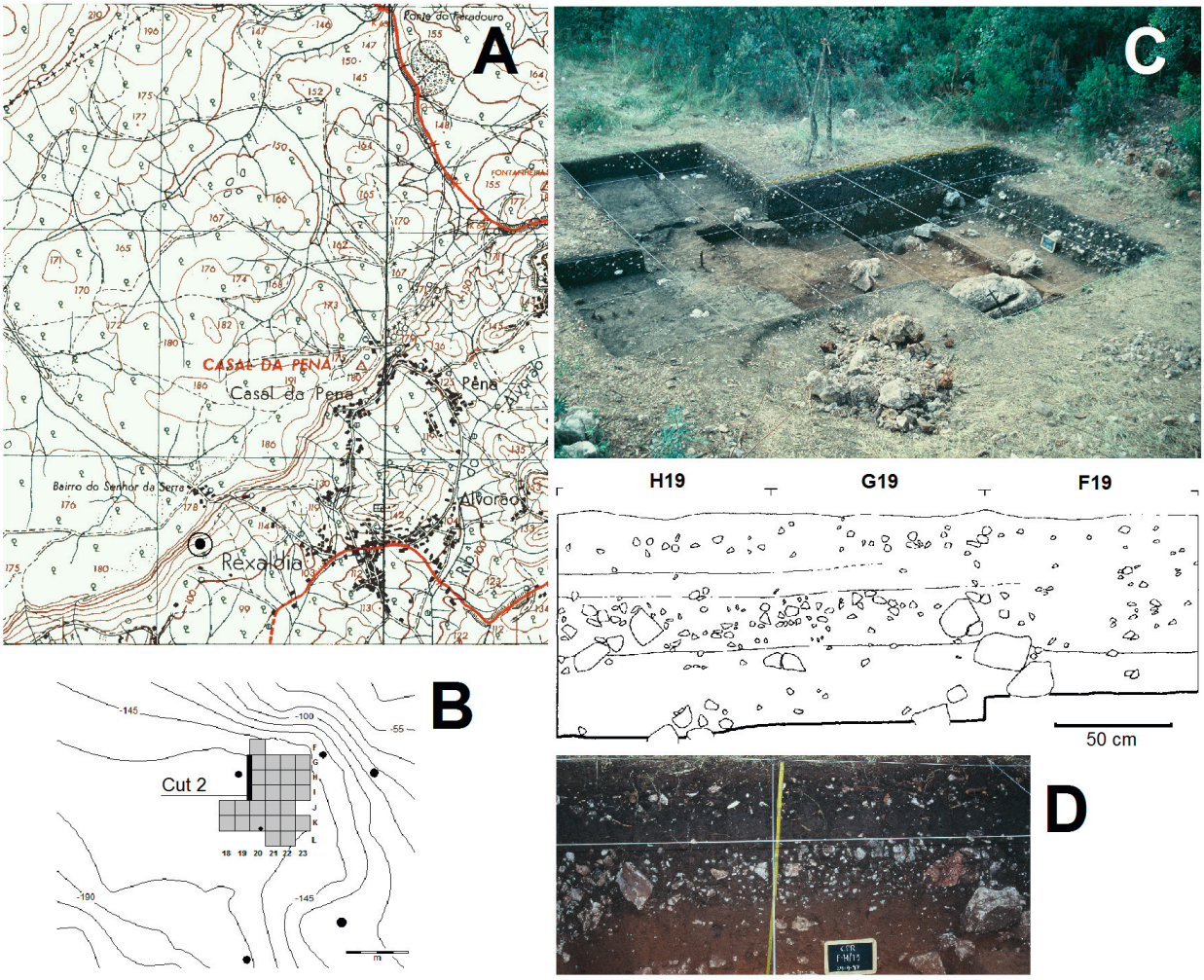

Fig. 3. A - location of Costa do Pereiro (black dot inside circle) on the escarpment separating the Aire Mountain (to the NW) from the Tagus Valley (to the SE) (map: excerpt from the Carta Militar de Portugal n.º 309). B - Topographic plan of the excavated area (ground surface measurements below local datum) with indication of "Cut 2". C - A view of the excavation works. D - Stratigraphy as observable in "Cut 2" (from top to bottom: layers 1a-top, 1a-bottom, 1b and 2, respectively), with photo (below) showing the difference in colour between layers (the upper, darker Middle/Late Holocene and the bottom, reddish Early Holocene).

Abb. 3. *A - Lage von Costa do Pereiro (schwarzer Punkt im Kreis) and der Schichtstufe, die das Aire Gebirge (NW) vom Tagustal (SO) trennt (Kartenausschnitt der Carta Militar de Portugal n.º 309). B - Topografischer Plan der Ausgrabung mit der Lage von „Cut 2". C - Grabungsarbeiten. D - Stratigrafie „Cut 2" (von oben nach unten: Schicht 1a-oben, 1a-unten, jeweils 1b und 2), einschließlich Foto, das die Farbunterschiede der Schichten erkennen lässt (das obere, dunkle Mittel- bis Spätholozän und das untere, rötliche Frühholozän).*

Layer	Strata description	Cultural horizons and absolute chronologies
Layer 1a-top	Dark clayish sediments with angular clasts, ca. 30 cm thick, affected by roots and ploughing. Severely fragmentation of artefacts and bone remains.	Mixed Modern and Iron Age materials.
Layer 1a-bottom	Same sedimentological characteristics as above, with less disturbed, more compacted sediments, ca. 15 cm thick.	Iron Age (ca. 300 calBC) and sparse Bell Beaker materials at the interface with layer 1b.
Layer 1b	Sandy-clayish sediments of dark-brown colour with abundant limestone clasts of medium sizes (15–25 cm) in its bottom half. Decreasing thickness from 30–35 cm in rows 20–21 to 20 cm in rows 22–23.	Middle Neolithic (top; ca. 3900–3100 calBC) and Mesolithic (bottom; ca. 6100 calBC).
Layer 2	Very compact clayish red sediments with small sized limestone clasts (10–15 cm) randomly scattered. Limestone blocks (> 50 cm length) accumulated on top of the bedrock prevented further excavations. Indeterminate total thickness (> 40 cm thick).	Epipalaeolithic (ca. 7600 calBC).

Fig. 4. Costa do Pereiro: stratigraphy and cultural sequence.

Abb. 4. *Costa do Pereiro: Stratigraphie and Kulturchronologie.*

Square unit, layer, artificial level	Sample description	Lab code	$\delta^{15}N$	%N	$\delta^{13}C$	%C	C:N	Date BP	CalBC
G21.1b.3	*Capra* cf. *pyrenaica*: one pelvis fragment.	Wk-30215	4.40	15.10	-20.80	*44.84*	3.50	8564 ± 37	7632–7625 (0.7 % prob.), 7611–7533 (94.7 % prob.).
H23.2.2	*Cervus elaphus*: one left distal humerus fragment and one left scaphoid.	Wk-35997	4.81	14.81	-20.68	*44.32*	3.49	8680 ± 30	7744–7599 (95.4 % prob.).

Fig. 5. Costa do Pereiro: radiocarbon determinations (calibration according to IntCal13 curve using the calibration program OxCal, version 4.2.4).
Abb. 5. *Costa do Pereiro: ^{14}C-Alter (Die Kalibrierung gemäß der IntCal13 Kurve unter Verwendung der Kalibrierungsprogramm OxCal, Version 4.2.4).*

	Chert	Burnt chert	Quartzite	Quartz	Greywacke	Schist	Others	Total
Flakes								
intact	37	11	109	12				**169**
proximal	6	2	23	3				**34**
mesial			1					**1**
distal	4		8	3				**15**
Blades								
intact			3					**3**
proximal	6	3	4	1				**14**
mesial	1			1				**2**
distal	3							**3**
Bladelets								
intact	17	3	6					**20**
proximal	13	1	3	2				**13**
mesial	5							**3**
distal	5	2	1	1				**8**
Preparation								
bladelet crests	2							**1**
Cores								
prismatic with 1 platform	2		7					**9**
prismatic with 2 platforms			1					**1**
prismatic with 2 opposite platforms	1		1					**2**
pyramidal			1					**1**
polyhedral			3					**3**
chopper			2					**2**
Retouched tools	25		18	7				**50**
Debris								
chips	440	103	396	284	27	1	7	**1258**
chunks	29	17	260	107	24	1	7	**445**
Anvils			1					
Total	**556**	**142**	**830**	**414**	**51**	**2**	**14**	**2022**

Fig. 6. Costa do Pereiro: lithic inventory.
Abb. 6. *Costa do Pereiro: Steingeräteinventar.*

to the site. However, as recently demonstrated by Pereira et al. (2016: 9), "[...] the preliminary results on the acquisition patterns of raw materials during the Epipaleolithic occupation of Pena d'Água [a nearby coeval rock-shelter] suggest an abiotic economy relying on the exploitation of sources located at short range", which suggests, until definitive confirmation by future analyses on the lithic assemblages, an opportunistic behaviour regarding the acquisition of chert too.

From the technological perspective, it was possible to observe that debitage of the three most

representative knapped rocks follows distinct strategies and choices. Such choices are likely related to distinct raw material availability and debitage purpose, i.e., the production of different blanks to configure different retouched morphotypes.

Quartzite

All debitage phases are present in the quartzite assemblage. High frequencies of cortex in cores and by-products and the presence of abandoned cores with still active platforms seem to indicate that debitage took place at the site. This assemblage is composed by 830 elements, mainly flakes (17.0 %), chips (47.7 %) and chunks (31.3 %). Blades and bladelets are residual, with only 0.9 % and 1.2 %, respectively. The low frequency of elongated products and the lack of any core-trimming element show that debitage sequences were simple, using mostly prismatic cores with one or two platforms (Fig. 6). The high frequency of dorsal and butt cortex in flakes seems to indicate a premeditated choice for the natural and regular rock surface as knapping platforms. Flake cross-sections are mainly triangular and trapezoidal, and edge morphology is convergent or circular, thus showing a high technological uniformity during debitage. Although quartzite is the best represented raw material, retouched tools are simple types, exclusively using flake blanks, represented by laterally retouched or notched edges (Fig. 7).

Quartz

Quartz is the third best represented raw material in the assemblage (Fig. 6). The frequency of debitage (93.4 %: chips 68.6 % and chunks 25.8 %) is related to the characteristically high degree of fragmentation during the knapping process of this type of rock. This is apparently the simplest reduction sequence at the site. The absence of cores might be related to an exhaustive debitage, perhaps using bipolar technique for small flakes extraction, as has been detected in

Types	Chert	Quartzite	Quartz	Total	
				n	%
Endscrapers					
Thick nosed endscraper	1			**1**	*2*
Atypical endscraper	1			**1**	*2*
Atypical carinated endscraper	3			**3**	*6*
Unguiform endscraper	1			**1**	*2*
Burins					
Déjeté dihedral burin	1			**1**	*2*
Burin on oblique truncation	1			**1**	*2*
Common tools					
Retouched flakes		1	1	**2**	*4*
Notches		15	2	**17**	*34*
Denticulates		1	2	**3**	*6*
Sidescrapers	1	1	2	**4**	*8*
"Bocas scrapers"	2			**2**	*4*
Bladelet tools					
Backed bladelet	3			**3**	*6*
Denticulated and truncated bladelet	1			**1**	*2*
Dufour bladelet	2			**2**	*4*
Truncated Dufour bladelet					
Malaurie points	1			**1**	*2*
Azilian points	2			**2**	*4*
Trapeziums	2			**2**	*4*
Notched bladelets	1			**1**	*2*
Other					
Microburins	1			**1**	*2*
Fragment of retouched tool	1			**1**	*2*
Total	**25**	**18**	**7**	**50**	***100***

Fig. 7. Costa do Pereiro: retouched tool types (according to type list proposed by Zilhão, 1997, for the Upper Palaeolithic of Portuguese Estremadura).
Abb. 7. *Costa do Pereiro: retuschierte Werkzeuge (Nach der Typenliste von Zilhão, 1997, des Jungpaläolithikums der Portugiesischen Estremadura).*

Magdalenian contexts from the region (Zilhão 1997). Technological flake analysis reveals very homogeneous attributes, such as cortical and flat platforms, trapezoidal cross-sections and parallel or divergent edge morphologies. Blanks show low frequency of retouched edges and, again similar to quartzite, quartz flakes were used to configure simple retouched tools, such as notches and denticulated pieces (Fig. 7).

Chert

Chert is the second best represented raw material, with 27.6 % of the lithic assemblage (Fig. 6). Flake (8.5 %) and bladelet (4.5 %) blanks are only outnumbered by knapping debris – chips (79.3 %) and chunks (5.2 %) constitute the overwhelming majority of the chert material – whose high number, in particular of chips, may be related to the configuration and/or resharpening of retouched tools.

Chert debitage is distinct from the other rocks, showing different technological choices operating during the successive phases of the reduction sequences. Using cortex indexes to identify different debitage phases, in which high percentages of cortex indicates early debitage stages and *vice versa*, observable technological attributes from chert by-products show a clear distinction between a first and a second phase of debitage. In the former, blanks are mainly flakes with dihedral and punctiform butts, probably knapped with organic or soft harmer (i.e., wood or antler). Cross-sections are mainly trapezoidal and edge morphologies parallel or divergent. In the latter phase, blanks – which include elongated products – show a notable diversity of butt types, among which the flat ones are the most frequent. Of notice is the presence of crests in the assemblage (Fig. 6), a product that testifies that bladelets were intentionally produced at the site. Thus, while the initial debitage is characterized by a strong homogeneity of technological choices, the second phase shows different strategies and choices, as reflected in the attributes variability.

Cores are small and present evidence of exhaustive exploitation (Fig. 8). This is likely related to two coinciding influences: the low availability of this raw material within the site catchment area – or, more likely, a preference for cherts with better knapping qualities, since a few chert sources have been recently discovered in the site's vicinity along the Arrife (Pereira et al. 2016) – and to very specific reduction strategies aiming at bladelet production from prismatic cores, thick end scrapers and burins (see below). Thus, unlike quartzite cores, chert cores were abandoned only when knapping became impossible due to small size or fracture.

Chert retouched tools represent 53 % of all retouched elements in the lithic assemblage, thus contrasting with the more abundant quartzite blanks. From the typological perspective (Fig. 7), flakes were used to configure common tools, among which end-scrapers, burins and side scrapers, including the so-called "Bocas scrapers", are the most frequent. Bladelets were retouched to produce marginally retouched points (of Dufour type), backed implements (simple backed bladelets, Malaurie points and Azilian points) and geometrics (trapezoids) using the microburin technique.

Retouched tools

Retouched tools represent 2.49 % of the entire assemblage (Fig. 6). Within this group (Fig. 7), chert is the most represented raw material whereas the low frequency of retouched tools of quartzite – and, to a lesser extent, quartz – contrasts with the high presence by-products in these materials. This pattern strongly indicates that most flakes were knapped for their cutting-edges, thus used without retouch. Retouched tools are divided into three main typological groups: the so-called domestic or common tools (e.g., side-retouched tools, denticulated pieces, notches and side-scrapers); end-scraper and burin-type cores (with dihedral and/or oblique truncation); and marginal and backed elements.

Amongst the domestic group, retouched tools such as notches, denticulated pieces and side-scrapers were configured in all raw materials, with the majority made on quartzite and quartz. As mentioned above, thick end-scrapers and burins were exclusively made on chert, and were likely used as bladelet cores. An interesting aspect in this group is the presence of "Bocas scrapers" (only on chert). This morphotype has been recognized in the Late Magdalenian of the region (Bicho 2000a; Zilhão 1997) and its presence in a context clearly dated to the Early Holocene can thus be considered a strong indicator of technological continuity at the Pleistocene–Holocene transition.

Bladelet tools represent around 20 % of all formal types and were exclusively made on chert (totalling 44 % of all chert tools). Although the assemblage is characterized by a small number of bladelet tools (n=11), different morphotypes are represented (Fig. 9: 1) "simple" backed bladelets, i.e., with abrupt retouch on one edge; 2) Dufour bladelets, i.e., characterized by Palaeolithic-like unidirectional, marginal retouch on one or two edges; 3) Azilian points; 4) trapezoids; 5) Malaurie points; and 6) denticulated and truncated bladelets. Azilian and Malaurie points are very similar to each other from a technological and typological point of view. Classical typological classifications described these two morphotypes as small bladelet points with uni- or bidirectional abrupt retouch (i.e., backed) at one edge and with a truncated butt. The main difference refers to the backed edge, which tends to be rectilinear in Malaurie points and curved or arched in Azilian points, as exemplified by the pieces in Figure 10. In sum, the observed modification of bladelets into different lithic points is likely related to their use in composite tools, probably associated with different hunting techniques and

strategies. Indeed, macroscopic use-wear analyses of some armatures showed impact fractures at the tools' tips (Fig. 10), therefore in good agreement with their supposed functional purpose.

It should be noted that Early Holocene lithic assemblages are characterized in South-Western Europe by a continuation of Upper Palaeolithic technological traditions. This is reflected in the predominance of bladelet-backed industries. Such variability has been recognized for different technological facies, including Epimagdalenian (c. 12-10.000 BP), Azilian (c. 11-8.500 BP) and Sauveterrian (c. 10-8.000 BP) around the north-western rim of the Mediterranean and the Ebro basin (Aura et al. 2011; Villaverde et al. 2012; Soto et al. 2015). This transition is marked in Portugal by the predominance of geometrics, Dufour bladelets and steep backed retouched bladelets, as those listed above (Bicho 1994, 2000a, 2000b; Zilhão 1997). However, the lack of abundant radiocarbon datasets and stratigraphic sequences prevent us from establishing a sound chronological organization, which remains unclear. Thus, the broad term Epipalaeolithic has long been applied to these industries (e.g., Marks et al. 1994).

Faunal remains

The Epipalaeolithic occupation of Costa do Pereiro has provided a small faunal collection of 1003 remains comprising a total Number of Identified Specimens (hereafter NISP) of 63 (6.3 %) and a total of non-identified specimens of 940 (93.7 %). It also displays a clear abundance of bones (ca. 95 %; n=954) when compared with teeth remains (n=49). The material is highly fragmented. Red deer (33 % NISP) and rabbit (33 %), followed by wild boar (19 %) are the most represented animals (Figs. 11 and 12); all three taxa are represented by a minimum of two individuals. Other animals identified are caprines, aurochs, an

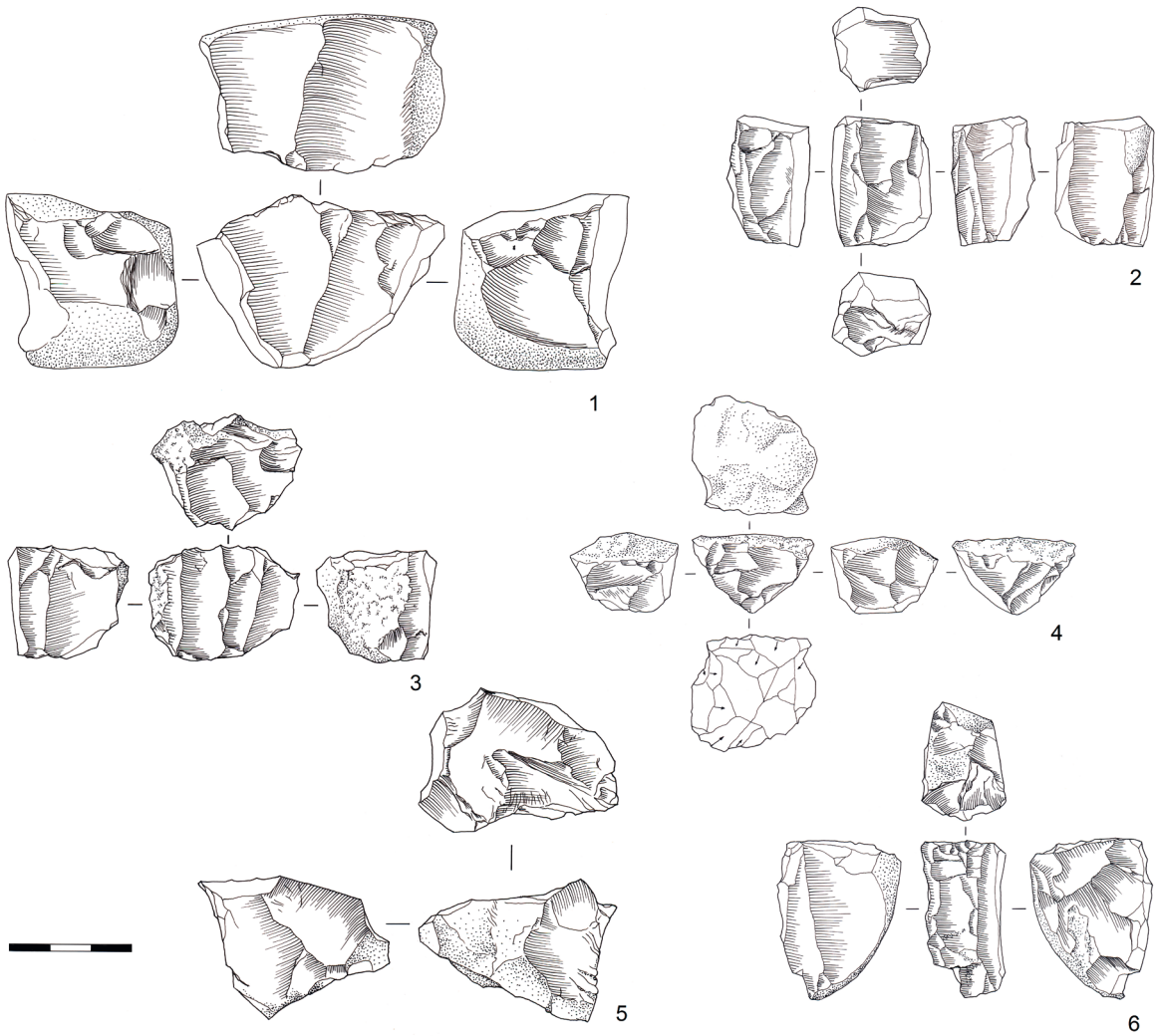

Fig. 8. 1 - quartzite core; 2 and 3 - chert prismatic core with two platforms, for bladelets; 4 and 5 - chert core, for flakes; 6 - chert prismatic core with one platform, for bladelets.

Abb. 8. *1 - Quarzit Kern; 2 und 3 - prismatischer Lamellenkern mit zwei Schlagflächen, Feuerstein; 4 und 5 - Abschlagkern, Feuerstein; 6 - prismatischer Lamellenkern mit einer Schlagfläche, Feuerstein.*

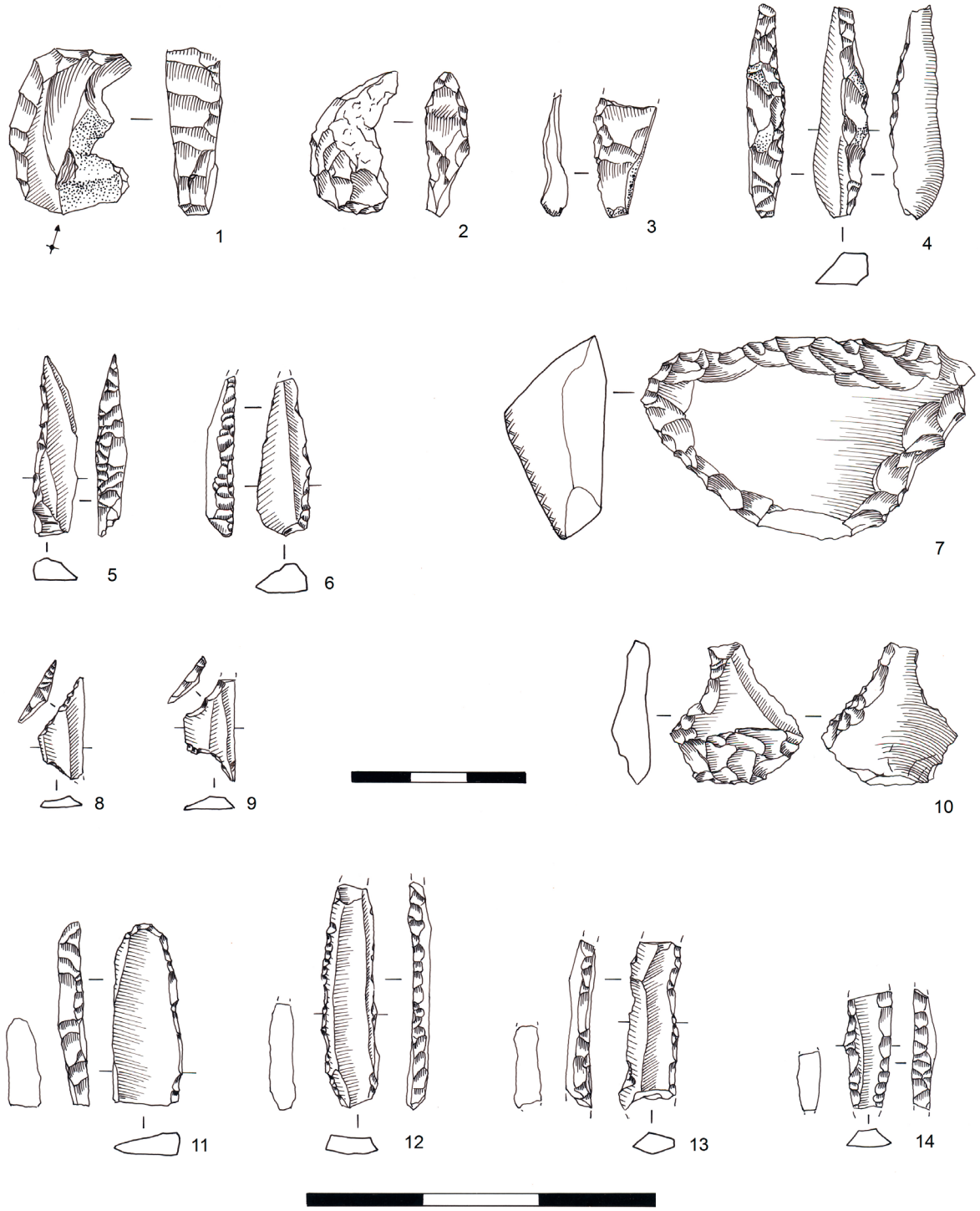

Fig. 9. 1 and 2 - core tablet; 3 - fragmented backed bladelet; 4, 5 and 6 - Malaurie points; 7 – side scraper; 8 and 9 - trapezoids; 10 - Bocas side scraper; 11 - backed bladelet; 12, 13 and 14 - Dufour bladelets.

Abb. 9. *1 und 2 - Kernscheibe; 3 – Fragment einer rückengestumpften Lamelle; 4, 5 und 6 - Malaurie Spitze; 7 - Schaber; 8 und 9 - Trapez; 10 - Bocas Schaber; 11 - rückengestumpfte Lamelle; 12, 13 und 14 - Dufour Lamellen.*

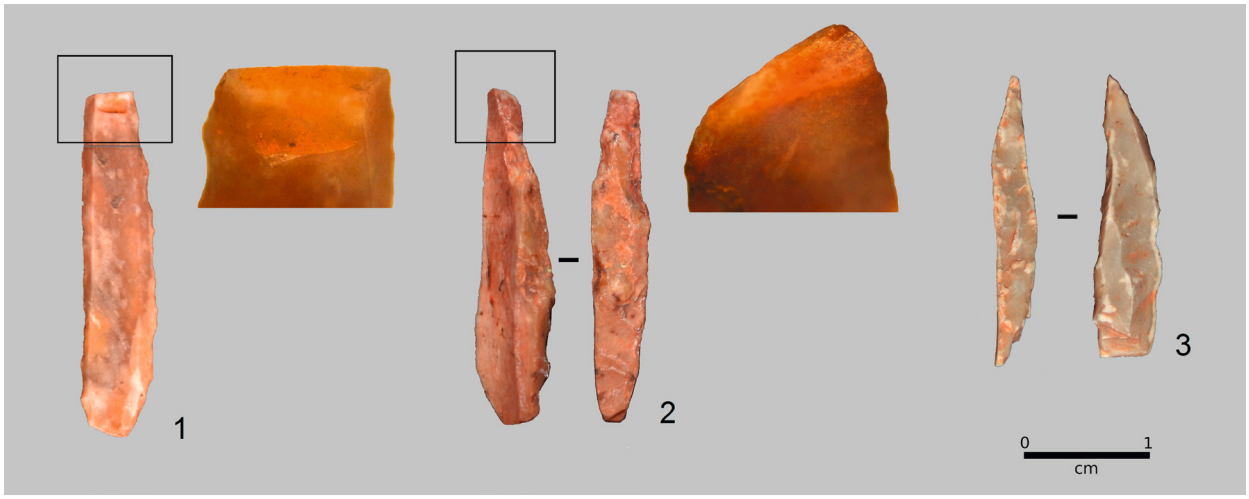

Fig. 10. Macroscopic analyses of use wear showing impact fractures in bladelet tools: 1 - Dufour bladelet with stepped fracture at the distal tip; 2 - Malaurie point with burin-like fracture at the distal tip; 3 - Malaurie point.

Abb. 10. *Gebrauchsspurenanalyse: Lamelle mit Aufprallspurens: 1 - Dufour Lamelle mit stufigem Bruch am distalen Ende; 2 - Malaurie Spitze mit stichelartigem Bruch an distalem Ende; 3 - Malaurie Spitze.*

Taxon	NISP	%	MNI	%
Oryctolagus cuniculus	21	*33.3*	2	*20*
Equus sp.	1	*1.6*	1	*10*
Sus cf. *scrofa*	12	*19*	2	*20*
Cervus elaphus	21	*33.3*	2	*20*
Caprinae	6	*9.5*	1	*10*
Bos cf. *primigenius*	1	*1.6*	1	*10*
Alectoris cf. *rufa*	1	*1.6*	1	*10*
Total	**63**	–	**10**	–

Fig. 11. Costa do Pereiro: taxonomic abundance.

Abb. 11. *Costa do Pereiro: Artenverteilung.*

	Cervus	Capri-nae	*Bos*	*Sus*	*Equus*	*Oryc-tolagus*
Mandible						1
Isolated teeth	12	4	1	3	1	2
Vertebrae						1
Innominate		1				1
Scapula						1
Humerus	3					1
Radius	1					2
Ulna						1
Carpal	1					
Metacarpal	1			1		1
Femur						1
Astragalus	2	1				1
Calcaneum						1
Metatarsal	1					5
Metapo-dial				1		1
First phalanx				4		1
Second phalanx				2		
Third phalanx				1		
Total	**21**	**6**	**1**	**12**	**1**	**21**

Fig. 12. Costa do Pereiro: skeletal representation (mammals only).

Abb. 12. *Costa do Pereiro: Skelettmaterial (nur Säugetiere).*

equid and partridge. As for the non-identified remains, most of them are extremely small (>750 are smaller than 2 cm) not even allowing animal body size attribution. When animal size categorization was possible, specimens of small (e.g. leporid, small carnivores) or middle sized (e.g. caprines, swine) animals are the most abundant (Fig. 13).

Taxonomic identification

Cervid remains are classified as red deer (*Cervus elaphus*). While the obtained measurements are within the lowest range of the biometry for this taxon during the Early Holocene in Portugal (Davis & Detry 2013; Valente 2013; Fig. 14) we have no knowledge for the same timeframe of any fallow deer (*Dama dama*) specimens, the only species that shares similar morphology and close biometry. We should also point out that the available data for Roman and Medieval specimens of fallow deer (Davis & MacKinnon 2009) indicate smaller sized animals than the cervid found at Costa do Pereiro.

The identified caprine elements (four teeth, one astragalus and one innominate; see Fig. 12) are small in size (Fig. 14). Based on metric and morphological data, there are two possibilities for their taxonomic classification:

1. We are in the presence of displaced domesticated caprine remains, originating from the overlying layer 1b (with Mesolithic–Neolithic occupations). In this case, the remains could belong to *Ovis aries* (sheep) and/or *Capra hircus* (domestic goat). Probably the former, since one of the specimens (a burned astragalus; Fig. 15A) exhibits sheep morphology following Zeder & Lapham (2010) standards. Though burned, its measurements are within the data range presented by Davis (2008) for Leceia and Zambujal's Chalcolithic levels for that species.
2. At Costa do Pereiro we have a smaller body size population of Iberian ibex (*Capra pyrenaica*). This could follow a Holocene trend already attested by red deer or aurochs in other Portuguese archaeological contexts in which many animals demonstrate size reduction during that period (Davis & Detry 2013).

Supporting the presence of at least some *Capra pyrenaica* remains is a caprine pelvis fragment directly dated to 8564 ± 37 BP (Fig. 5) which was found in square G21 in the lower level of layer 1b and therefore above layer 2. Most certainly it belongs to a caprine wild species since, at the time indicated by the radiocarbon result (ca. 7600 calBC), no domesticated animals are known from the Iberian Peninsula. In this case, we would have a remobilization of material through slope-wash processes from the higher, unexcavated sector of the site (Fig. 1) to layers 1a and 1b of the excavation area.

The identification of ibex in the limestone mountains of Estremadura is a rare event if the zooarchaeological evidence for this time period in the region is taken into consideration: the evidence from Picareiro (Bicho et al. 2003) and Caldeirão (Davis 2002) caves has been taken as suggesting that ibex became rare in these low-altitude mountains after the Solutrean. And indeed both Magdalenian and Holocene strata from these cave sites, located at 540 and 120 metres a.s.l. respectively, lack or provide a meagre record of uncertain wild caprine remains. This was understood as result of forest growth, leading to the local extinction of Alpine species and horse.

	N	%
Herbivore (teeth)	22	*2.3*
Microfauna	1	*0.1*
Small size	33	*3.5*
Medium size	26	*2.8*
Medium/Large size	10	*1.1*
Indeterminate	848	*90.2*
Total	**940**	*100*

Fig. 13. Costa do Pereiro: Non-Identified remains quantification.
Abb. 13. *Costa do Pereiro: Anzahlen nicht identifizierter Fragmente.*

Taxon	Square unit, layer, artificial level/s	Anatomy	Greatest Length	Breadth proximal	Depth proximal	Breadth distal	Notes
Sus* cf. *scrofa	G23.2.2	phalanx 1	34.0	15.1	13.4	–	–
Sus* cf. *scrofa	G23.2.2	phalanx 2	13.0	9.4	9.4	–	–
Sus* cf. *scrofa	G20.2.top	phalanx 3	–	14.9	–	–	–
Cervus elaphus	H20.2.1-3	metacarpal	–	31.6	–	–	–
Cervus elaphus	G22.2.1	astragalus	44.5	–	–	28.3	–
Caprinae	H20.2.1-3	astragalus	27.3	–	–	18.2	burned

Fig. 14. Costa do Pereiro: Bone measurements (in mm).
Abb. 14. *Costa do Pereiro: Messwerte Knochen (in mm).*

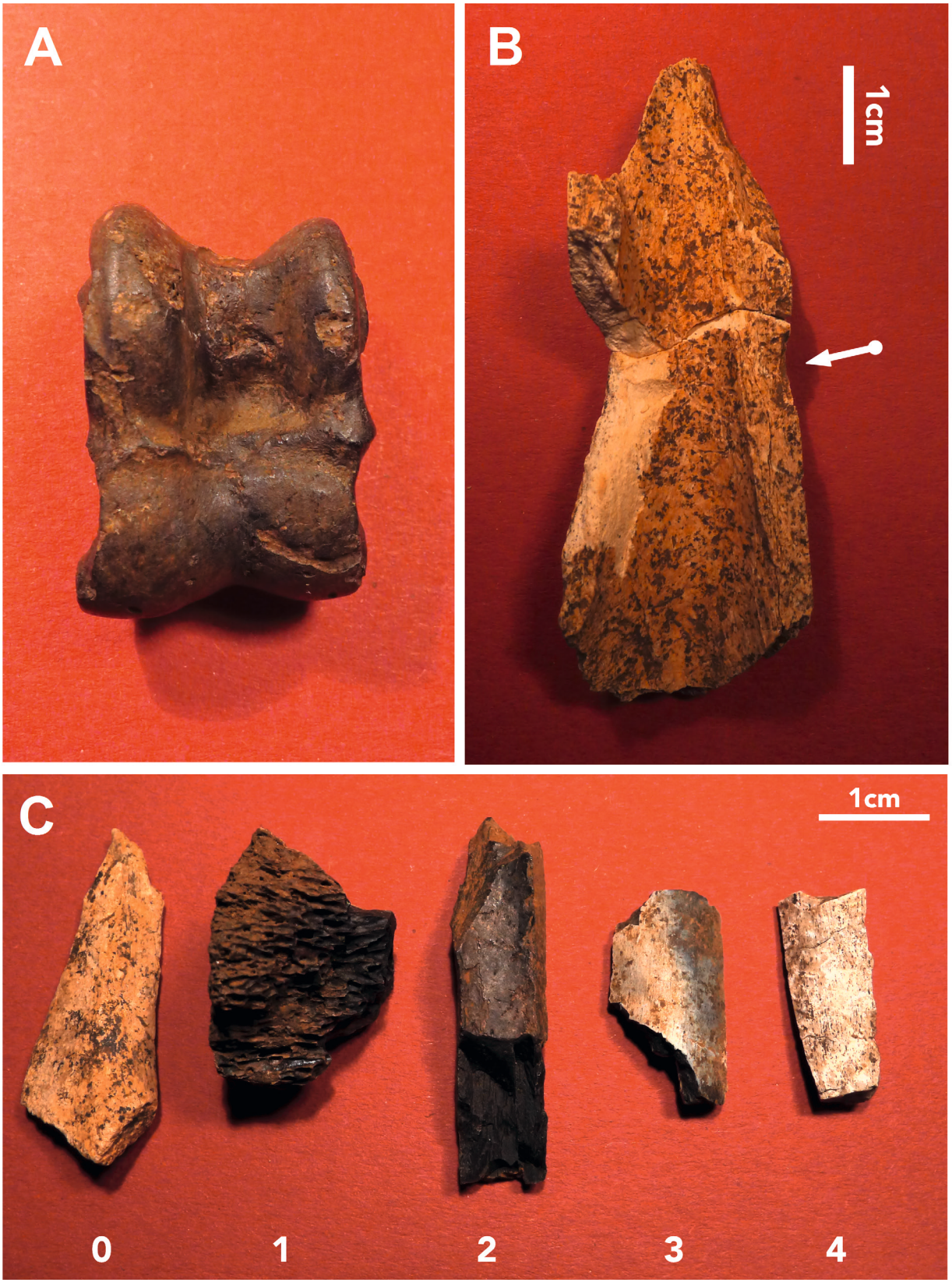

Fig. 15. A - Caprine astragalus (burned; see text). Measurements (von den Driesch, 1976): greatest length (of the lateral half) = 27.3 mm; breadth of the distal end = 18.2 mm. B - Middle-sized mammal long bone with impact point. C - Bone remains with different stages of burning (following Shipman et al., 1984 and Stiner et al., 1995): 0 - unburned; 1 - brown / black (Shipman's Stage II/III; half carbonized); 2 - black (Shipman's Stage III; fully carbonized); 3 - grey / white (Shipman's Stage IV; half calcinated); 4 - white (Shipman's Stage V; fully calcined).

Abb. 15. *A - Astragal Ziegenartige (verbrannt; vgl. Text). Messwerte (von den Driesch, 1976): Größte Länge (laterale Hälfte) = 27.3 mm; Breite am distal Ende = 18.2 mm. B - Mittelgroßer Säugetierlangknochen mit Aufprallspur. C - Knochenfragment mit Brandspuren verschiedener Stadien (nach Shipman et al., 1984 und Stiner et al., 1995): 0 - nicht verbrannt; 1 - braun / schwarz (Shipman's Stage II/III; halb verkohlt); 2 - schwarz (Shipman's Stage III; vollständig verkohlt); 3 - grau / weiß (Shipman's Stage IV; halb kalziniert); 4 - weiß (Shipman's Stage V; vollständig kalziniert).*

Their scarce representation (as at Costa do Pereiro) or total absence in the faunal records might mean this species was still present in the Aire Mountain – that reaches 678 metres a.s.l. – but in very low numbers.

Two teeth fragments are attributable to bovines or equines, but do not allow a specific taxonomical classification. None of the remains was recovered from the top of the layer, which is in direct contact with the Neolithic occupation; therefore we do not consider them intrusive. The bovid tooth was considered to be aurochs (*Bos* cf. *primigenius*) given the occupation period (the first domestic specimens in Portugal date from the Early Neolithic). The equid remain can either belong to *Equus caballus* or to the smaller species, *Equus hydruntinus*. However, this species – European ass, or "*zebro*" in Portuguese – is not known to exist in the area during the Terminal Upper Pleistocene / Early Holocene, i.e., the Magdalenian and Epipalaeolithic (Brugal & Valente 2007).

It is not easy to distinguish wild boar (*Sus scrofa*) from its domestic counterpart (*Sus domesticus*), much less in Iberia, where their size often overlaps (Albarella et al. 2005). Given the stratigraphic position, and the age of associated materials, all the pig remains are considered as belonging to the wild species.

All leporid remains seem to comply, either morphologically or in size, with rabbit (*Oryctolagus cuniculus*). The identification was made following parameters given by Callou (1997) and Llorante (2010) and comparison with reference collections at the University of Algarve, in Faro, and at the Archaeosciences Laboratory of the Directorate of Cultural Heritage, in Lisbon.

The only avifaunal remain of the collection is a coracoid of red-legged partridge (*Alectoris rufa*). This species is very common in the Mediterranean biome, and is a regular find in Portuguese Estremadura archaeological sites from the Middle Palaeolithic onwards (Hockett & Haws 2009). Its presence suggests the existence of low vegetation areas nearby.

Human modifications

Evidence for cut or percussion marks is modest in the collection (n=1+2) and exclusively found on bones of middle-sized mammals. Impact points (percussion marks) like the ones identified at Costa do Pereiro (on the thick-walled limb bones) are normally evidence of marrow extraction (Fig. 15B; Fisher 1995). The majority of fractures are not anthropically produced, instead showing intense post-depositional fragmentation. There is a high number of fire altered remains (n=359, meaning 36 % of all remains; 93 % of these less than 2 cm). The majority of them are charred bones (60.5 %) – i.e. black in colour, representing carbonized skeletal material in direct contact with heat and flames (Herrmann 1970 in Symes et al. 2008: 37) – with a few calcined ones (9.7 %)–i.e. grey or white–displaying even higher temperature alteration that resulted in organic material and moisture loss (Fig. 15C). As such, evidence supports the idea of faunal remains being subjected to high temperatures (>500 °C, according to Shipman et al. 1984), which was not unexpected given the presence of several fire cracked cobbles at the site. Since cooking activities do not demand such temperatures (most food can be cooked with a maximum temperature of 250 °C; Théry-Parissot 2001), highly burned or calcined bones are rarely created during this process. In our opinion, the data imply that, following general consumption, some food leftovers were thrown into fireplaces that have not been fully preserved. Several taxa exhibit burned bones with similar patterns: black in colour, most of them with full burning, a few only partially (none of the classified remains is calcinated): rabbit (n=6), red deer (n=3) caprine (n=1) and swine (n=1). The similarity in fragmentation and burning between leporids and other taxa lead us to consider the latter as non-intrusive and therefore also most likely the result of human activities.

Figure 16 displays the spatial dispersion of burned materials, both faunal and lithic, in the excavation area, showing that there is no obvious correlation between them but a rough juxtaposition between the frequencies of burnt items and their total number. Together with poor preservation, the lack of pattern in the burned remains' spatial distribution indicates some post-depositional disturbance of the layer, probably due to a continuous human occupation of the site into later periods.

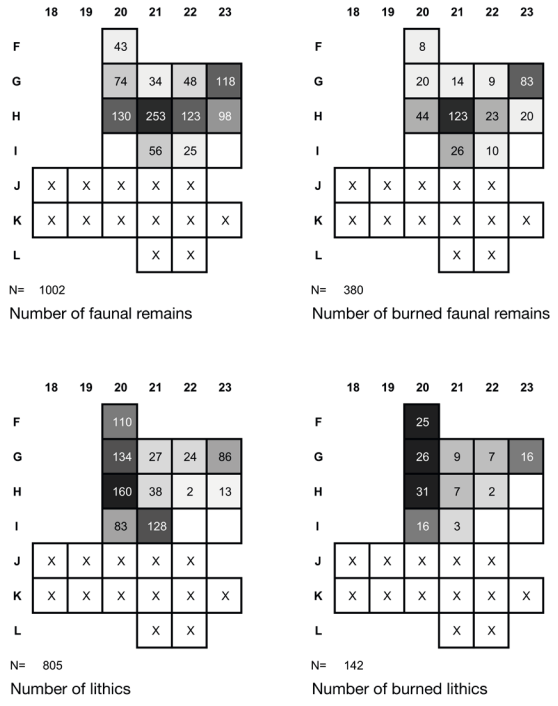

Fig. 16. Spatial distribution of burned materials.
Abb. 16. *Räumliche Verteilung verbrannten Materials.*

Age estimation

A few bones and teeth enabled age estimation (n=28), with most having been classified as belonging to adult animals (fused limb bones, absence of deciduous teeth, and intermediate wear for permanent teeth). Two exceptions were noted, both from wild boar (*Sus* cf. *scrofa*): one first and one second phalanges, both unfused, indicating younger animals less than two years and one year old, respectively (Bull & Payne 1982; Bridault et al. 2000).

Discussion and conclusions

Several aspects of the archaeological record observed in layer 2 of the Costa do Pereiro strongly suggest we are facing a residential occupation:

- Despite the fact that no intact human made structures have been identified during excavation, the high frequency of burned chert (20.3 % of total chert), the presence of fire-cracked quartzite and quartz cobbles (from dismantled hearths), and the high density of burned faunal remains (36 % of total fauna) are a good testimony that such kind of domestic structures did exist.
- The lithic assemblage is characterized by the presence of three main raw materials (quartzite, chert and quartz), all with more or less complete reduction sequences indicating continued human occupation at the site. Only the chert debitage shows a slightly different scenario, with nodules being collected in primary position probably in more outlying sectors of the landscape and brought in after a preliminary cortex removal. Flake and bladelet blanks were used to configure, respectively, common tools (e.g., side-retouched tools, notches, denticulated pieces, side scrapers, etc.) and a panoply of lithic points (backed or marginally retouched). The two groups of tools indicate that both "domestic" and hunting activities took place at (or from) the site. The presence of fractured points shows that hunting weapons were repaired here, therefore indicating that hunters would return to the main camp after their journeys away. In sum, the knapped stone evidence also points to a residential site.
- The presence of such a diversity of animal species at an open air site should also suggest an occupation of residential nature with its inhabitants hunting a large spectrum of locally available fauna. At more specialised sites (e.g., hunting camps, shell-middens) we would likely find a less varied collection with clear predominance of a particular species, which is not the case at Costa do Pereiro.

The first two points make this site comparable in all mentioned aspects of its archaeological record with other sites located along the western rim of the Tagus Valley (Fig. 1), such as, from North to South, Santa Cita (Bicho & Ferring 2001), Cabeço de Porto Marinho V (hereafter, CPM V) and Areeiro III (Bicho 2000a), and may be also Quinta da Bicuda (Carvalho 1996, 2016), near Lisbon. This is particularly evident in their knapping sequences, where most, if not all, reduction stages are represented, as well as the recycling of lithic implements or the repairing of hunting weaponry (the latter indicated by the presence of broken lithic points). Moreover, if tool inventories are compared according to main morphotype categories (Fig. 17) we can see that, in spite of the low total number of retouched pieces, at Costa do Pereiro common tools represent the majority (56.0 %) and increase dramatically to 72.0 % if end-scrapers and burins are added. This repeats a trend recognized elsewhere at Santa Cita, CPM V and Areeiro III, where similar activities may have taken place.

Conversely, Costa do Pereiro sharply contrasts with Picareiro and their respective lithic and faunal records (Fig. 1). At the latter cave, which is considered a logistical site given its location near the summit of the Aire Mountain (Bicho et al. 2003), bladelet tools comprise 55.6 % of the Epipalaeolithic assemblage, whereas at Costa do Pereiro they represent 28.0 %, thus in line with residential sites where these tools are kept below 30 % in all cases. The small number of tools recovered at Picareiro (n=36) in a total excavated area of around 30 m^2 can be considered by itself a good testimony of its logistical character.

Tool type category	Costa do Pereiro (this paper)		Santa Cita (Bicho & Ferring 2001)		CMP V (Bicho 2000)		Areeiro III (Bicho 2000)		Picareiro (Bicho et al. 2003)	
	n	%	n	%	n	%	n	%	n	%
Endscrapers	6	*12.0*	68	*58.6*	37	*24.6*	230	*26.8*	1	*2.8*
Burins	2	*4.0*	17	*14.7*	14	*9.3*	76	*8.8*	3	*8.3*
Common tools	28	*56.0*	17	*14.7*	56	*37.0*	460	*53.4*	12	*33.3*
Bladelet tools	14	*28.0*	14	*12.0*	44	*29.1*	95	*11.0*	20	*55.6*
Total	**50**	***100***	**116**	***100***	**151**	***100***	**861**	***100***	**36**	***100***

Fig. 17. Inter-site comparison of tool types according to main categories.

Abb. 17. *Vergleich von Werkzeugtypen mehrerer Fundstellen nach Hauptkategorien.*

Unfortunately, the other two karst sites with Epipalaeolithic occupations known in the Aire Mountain – Pena de Mira and Casal Papagaio (Fig. 1) – were already largely destroyed at the time of discovery, preventing recovery of rich faunal or artefact assemblages. But, as Araújo (2011: 179; original in Portuguese) claims, "[...] the most interesting aspect to register, which is common to the three contexts that have been referred to, is the fact that they document, within the respective sequences, shell deposits formed by molluscs from marine and estuarine environments. The presence of items of coastal origin in places this far away from the coastline, of around 30 to 50 km – considering the distance from the shoreline at the time when these sites were occupied – and at altitudes above 400 metres has obviously consequences at various levels, namely in the mobility patterns of the human communities and in the extent of their economic territories, now encompassing coastal and interior lands". It is in this particular sphere of interpretation – relating to economic territories – that the Costa do Pereiro evidence may provide further inferences, in two specific aspects.

A first observation is the complete absence of marine / estuarine food resources at Costa do Pereiro (Figs. 11 & 12). If its faunal variability is accepted as corresponding to the past reality – and not a distorted depiction of past hunting behaviours due to small sample size – one can arguably conclude that the discussed economic territories encompassing both the coastal plains and the limestone mountains do not seem to have extended to the Tagus river basin.

The second aspect to take into account regarding these sites is the relative abundance of rabbit/hare, red deer and wild boar remains among the mammal remains when we consider NISP and MNI values (Fig. 18). By comparison, aurochs and equid presence by NISP/MNI is vestigial. Neither NISP nor MNI are reliable *per se* for evaluation of the amount of meat consumption, but they do show us that the triad leporid/deer/boar was the most hunted one. At Picareiro, the amount of rabbit is more pronounced – the taphonomic analyses of the rabbit bones and the absence of carnivores are understood as an accumulation by human groups that repeatedly occupied the cave, probably on a seasonal basis (during the summer and/or winter months), and opportunistically exploited local hunting resources (Hockett & Bicho 2000).

Red deer and wild boar remains are also abundant at the coastal shell-midden sites (Fig. 18); their varying amounts probably reflect local topographic relief and vegetational cover rather than deliberate hunting strategies. However, if at Costa do Pereiro and Picareiro all rabbit remains seem to have been accumulated due to human hunting, the same can not be concluded at the coastal sites. Indeed, part of the leporids found in Toledo and Vale Frade may result from natural accumulation events. Regarding the latter, Araújo et al. (2014: 12; original in Portuguese) write that "[...] more than 10 % of rabbit bones belong to juvenile individuals, new-borns or foetuses, thus a

Species	Costa do Pereiro (this paper)			Picareiro Cave, layer D (Bicho et al. 2003)			Toledo Shell-midden (Moreno-García 2011)			Vale Frade Shell-midden (Araújo et al. 2014)		
	NISP		MNI	NISP		MNI	NISP		MNI	NISP		MNI
	n	%		n	%		n	%		n	%	
Hare (*Lepus* sp.)							51	*5.3*	5			
Rabbit (*Oryctolagus cuniculus*)	21	*33.9*	2	32	*71.1*	4	619	*64.4*	17	106	*88.4*	4
Hare / Rabbit							90	*9.4*		2	*1.7*	1
Wild cat (*Felis sylvestris*)							2	*0.2*	1	1	*0.8*	1
Fox (*Vulpes vulpes*)							10	*1.0*	1	3	*2.5*	1
European otter (*L. lutra*)										1	*0.8*	1
Equid (Equus sp.)	1	*1.6*	1									
Wild boar (*Sus scrofa*)	12	*19.3*	2	2	*4.5*	1	135	*14.0*	4	4	*3.3*	1
Roe deer (*C. capreolus*)							28	*2.9*	2	1	*0.8*	1
Red deer (*Cervus elaphus*)	21	*33.9*	2	9	*20.0*	1	22	*2.3*	3	2	*1.7*	1
Auroch (*Bos primigenius*)	1	*1.6*	1	2	*4.5*	1	5	*0.5*	2			
Ibex (*Capra* cf. *pyrenaica*)	6	*9.7*	1									
Total	**62**	***100***	**9**	**45**	***100***	**7**	**962**	***100***	**35**	**120**	***100***	

Fig. 18. Inter-site comparison of faunal remains (mammals only) according to NISP.
Abb. 18. *Vergleich der Fauna mehrerer Fundstellen (nur Säugetiere) nach to NISP.*

hypothesis of a natural, not human, origin to the presence of this species in the site should not be excluded". At Toledo, taphonomic observations and declining amounts of leporid remains from top to bottom of the sedimentary deposit, suggested to the author of the study a "[...] marginal role of this species in the food diet of the human community established in the Toledo site in relation to the ungulate species (aurochs, red deer, roe deer, and wild boar), whose contribution would have been more significant" (Moreno-García 2011: 113; original in Portuguese). In both studies it is proposed that environmental conditions (thick, temperate forest) may have limited rabbit populations in the sites' surrounding area during the human occupation. A full understanding of the ecosystem dynamics and leporid populations will require new data and further analyses.

In summary, Costa do Pereiro shows very similar lithic raw material acquisition strategies, technological procedures and tool type variability to those recognized elsewhere in residential sites of the Tagus Valley western rim. Hunting strategies and options were completely unknown for this type of sites until the discovery of the Costa do Pereiro campsite but, by comparison with faunal records from other sites, as essayed in the paragraphs above, it was observe to conclude the following distinctions:

- marine and estuarine species (fish, molluscs) are restricted to the coastal plains and the inner areas of the limestone massifs;
- carnivores are absent from Picareiro and Costa do Pereiro, although they recurrently occur in faunal inventories from the coastal shell-middens;
- probably related to the latter conclusion, most rabbits in the coastal shell-middens have been classed as intrusive and/or due to natural accumulation but as a small-prey hunting strategy by the hunters established in the Aire and Tagus sites.

The latter topics suggest a contrast in subsistence strategies between the littoral and inner areas of the Estremadura region, which surprisingly is not restricted to variable weights of marine and estuarine foods, as could be expected *a priori*: at Costa do Pereiro carnivores are absent and, unlike its coastal counterparts, leporids were hunted, with no evidence of naturally accumulated remains. At first sight, this could be understood as strong evidence for economic differentiation between human groups, in which the ones settled in Tagus Valley would include in their subsistence strategies a particular focus on leporid hunting. However, we prefer first to envisage a critical evaluation of the processes underlying the formation of the sedimentary deposit at Costa do Pereiro rather than moving towards what could soon become a poorly sustainable interpretative model. Indeed, stratigraphic discontinuity is observed at both the shell middens where carnivores and naturally-accumulated rabbit bones were found. No relevant sedimentation seems to post-date the human occupation at the shell midden sites, thus allowing burrowing animals – either carnivores or herbivores – to "reoccupy" these midden surfaces and leave direct testimony of their presence (see Araújo [2011] and Araújo et al. [2014] for sites and strata descriptions). The same did not occur at Costa do Pereiro. Here, the deposition of layer 2, from which the Epipalaeolithic remains were excavated, was immediately covered by layer 1b due to continuous sedimentation. This may have contributed decisively to the rapid sealing of this archaeological occupation with no major post-depositional disturbances by animals, thus resulting in the preservation of the original record.

In any case, it is beyond any reasonable doubt that Costa do Pereiro, along with Santa Cita, CPM V and Areeiro III, form a group of campsites of residential nature, of which only the former provides a glimpse of their original hunting strategies. More ephemeral occupations recorded either in the limestone massifs (cave or rock-shelter sites) and on the Tagus terraces (the so-called "macrolithic sites") or even in the nearby Pena d'Água Rock-shelter (see Pereira and Carvalho [2015] for an updated review of the latter sites), have likely been part of the same settlement and mobility system, with their tool kits and faunal remains reflecting functional variability and specific ecosystems, thus a mosaic of human adaptations to the new bioclimatic conditions of the Early Holocene in central Portugal.

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