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PRELIMINARY RESULTS OF THE FAUNA OF CABEÇO DE AMOREIRA AND CABEÇO DE ARRUDA (Muge, Portugal)

BY

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1. INTRODUCTION

During Mesolithic times very important changes occurred in the social behaviour of man. The prehistoric hunter and gatherer appears to have switched to a broad spectrum economy which included the collecting of shells, the catching of fish, birds and other small vertebrates. Prehistoric people went to live near the sea or streams leaving the waste of their mollusc consumption in so-called shell-middens. These vaste mounds of empty shells were also used as refuse-dumps for other waste. Evidence for this behaviour is found on the whole of the European Atlantic coast in the *kjøkkenmøddings* of Denmark, the *escargotières* of France and the *concheiros* of Portugal.

The Portuguese Mesolithic is famous through the *concheiros* of the Sado and Tagus valley, but little is known about the fauna and economy of these sites. Recently, Peter Rowley-Conwy (pers. comm.) has made a faunal analysis of some sites in the Sado valley which were excavated by J. E. Morais Arnaud. We have been given the opportunity to investigate in detail the Muge shell-middens in the Tagus bassin.

This paper discusses the faunal remains of two sites: Cabeço de Amoreira and Cabeço de Arruda. These shell-middens were discovered by C. Ribeiro during a prospection in 1863. Prof. A. Mendes Corrêa coordinated the excavations at Cabeço de Amoreira in 1930-31-33, and at Cabeço de Arruda in 1937. The excavations were continued by J. Roche at Cabeço de Amoreira in 1960-1967 and at Cabeço de Arruda in 1964-1965. The collections were stored in the university of Porto but never completely

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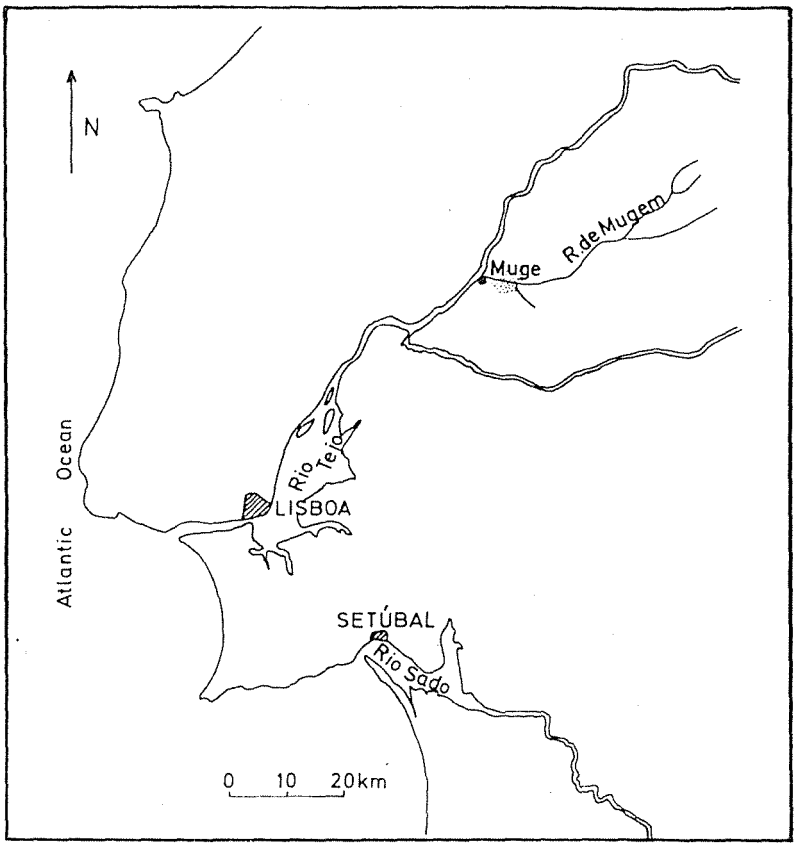
analysed. We could make the faunal study by the permission of Prof. Dr. J. Machado Cruz and through the kind help of Dr. A. Huet Bacelar. The fauna of a third Mesolithic concheiro in the Muge bassin, Moita de Sebastião will be reported on elsewhere.



Map. 1 — View of the Tagus bassin (Rio Tejo).
·::: Area where Muge sites are situated.

The three sites are situated near the Muge river at proximately 80 km northeast of Lisbon (see map 1 and 2). Recently completed C_{14} datings give the following results (Lubell, pers. comm.).

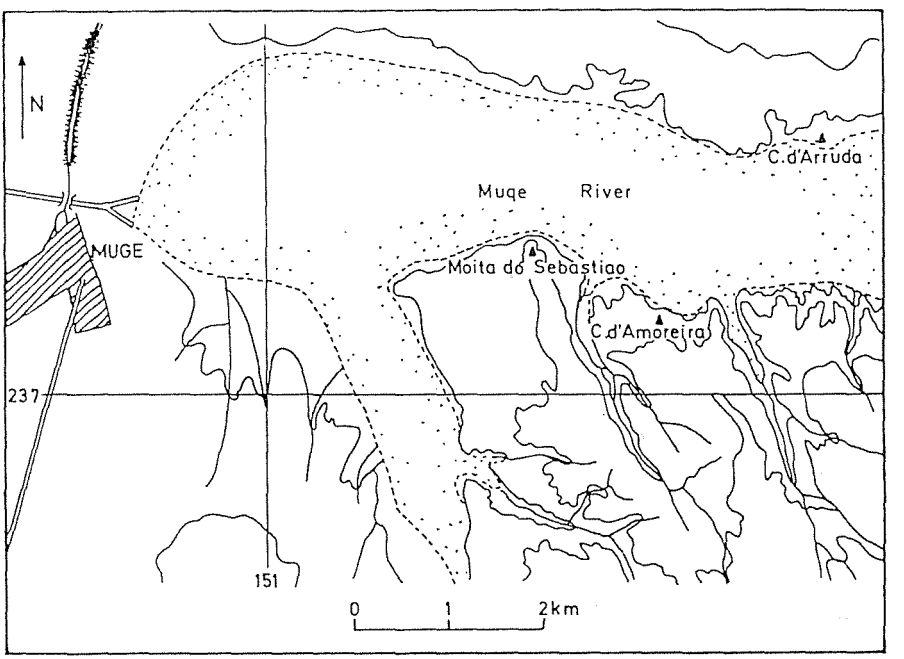
Moita de Sebastião	:	7350 to 7080 ± 350 BP
Cabeço de Amoreira	:	7030 to 6050 ± 300 BP
Cabeço de Arruda	:	6430 to 5210 ± 300 BP

2. ANALYSIS OF THE FAUNAL MATERIAL

Tables 1 to 4 give the identified animal groups of Cabeço de Amoreira, tables 5 and 6 those of Cabeço de Arruda. In the list the assemblages are labeled A, B, C and X, representing

A : lowest layer
B : middle layer
C : upper layer
X : no exact provenance

We analysed the material in the Instituto de Antropologia «Prof. Mendes Corrêa» of the Science Faculty of the University of Porto from 17-28 February 1986 and 26 May to 20 June 1986. Problematic species were compared with the osteological material from the Laboratorium of Palaeontology (Ghent). Two of the amphibian remains could not be identified.



Map. 2 — View of the Muge area with indication of the Mesolithic shell-middens.

Osteologically, they belong to the Bufonidae family. Within the group of the European toads, the females of *Bufo bufo* are the biggest. The two bones found in the collection of Cabeço de Amoreira are however twice as big as is usual in that family! According to Dr. Rage (Paris), whom we thank for his professional opinion, they correspond in size with African species. Among the fishes only 12 to 16 % of the fragments counted could be determined. None of the vertebrae, which are the most abundant remains, could be labeled precisely (with the exception of *Lamna nasus*).

TABLE 1 — *Molluscan fauna of Cabeço de Amoreira*

Species \ Assemblage	A	B	C	X	Total
Marine bivalves					
Pecten maximus	3	5	10	—	18
Ostrea angulata	4	6	3	4	17
Ostrea sp.	12	11	4	8	35
Laevicardium norvegicum	10	7	6	4	27
Cardium glaucum + *C. edule*	7.502	3.479	3.587	10.704	25.272
Venerupis decussata	2	1	3	5	10
Scrobicularia plana	871	716	229	765	2.581
Solen or *Ensis* sp.	89	19	25	22	155
Not identified marine bivalves	1	4	1	1	7
Marine gastropods					
Neritina fluviatilis	74	92	93	21	280
Cypraea sp.	75	23	14	5	57
Charonia nodifera	—	1	—	—	1
Charonia nodifera/Thais haemastoma	—	1	1	1	3
Nassa reticulata	9	4	6	8	27
Not identified marine gastropods	—	—	—	2	2
Landsnails and Freshwater molluscs					
Hydrobia sp.	3	3	42	30	78
Helicella sp.	46	21	33	106	206
Theba pisana	389	122	156	612	1.279
Helix spp.	52	6	26	92	176
Not identified landsnails	—	—	3	—	3
Cephalopoda (Cuttlefishes, Squids and Octopuses)					
Sepia officinalis (Common Cutlefish)	4	3	2	2	11

As to the canid remains, none of the measurements which could be taken, did exceed the range of the measurements of the dogs found at Manching (Boessneck *et al.*, 1971) and Eketorp (Boessneck and von den Driech, 1979).

TABLE 2 — *Crustaceans, fishes, amphibians and reptiles of Cabeço de Amoreira*

Species \ Assemblage	A	B	C	X	Total
Cirripedia (Barnacles)					
Banalus balanoides? (Acorn Barnacle)	17	2	—	—	19
Decapoda					
Brachyura (True Crabs)	4.141	2.870	1.507	1.901	10.419
Pisces (Fishes)					
Selachii (Sharks)	—	—	1	—	1
Lamna nasus (Porbeagle)	6 (1)	(1)	—	1 (2)	7 (4)
Myliobatis aquila (Eagle Ray)	107	146	166	83	502
Acipenser sturio (Sturgeon)	1	—	—	—	1
Sparidae (Sea-breams)	2	2	2	—	6
Sparus aurata (Gilthead)	—	—	1	1	2
Argyrosomus regius (Meagre)	12	7	9	1	29
Cyprinidae (Minnows)	3	1	—	—	3
Percidae (Perches)	—	—	2	1	3
Not identified fishes	1.171	931	482	368	2.952
Amphibia (Amphibians)					
Salamandra salamandra (Fire Salamander)	1	—	—	—	1
Discoglossus pictus (Discoglossid)	11	—	—	2	13
Pelobates cultripes	2	—	—	1	3
Bufo bufo (Common Toad)	39	—	1	10	50
Ranidae (True Frogs)	72	4	—	5	81
Anura (Frogs and Toads)	124	1	—	18	143
Not identified amphibians	236	33	14	20	303
Reptilia (Reptiles)					
Emys orbicularis (Swamp Turtle)/ /*Mauremys caspica*	—	2	—	1	3
Lacerta lepida (Eyed Lizard)/ /*L. schreiberi* (Schreiber's Lizard)	12 (1)	7	8	6	33 (1)
Anguis fragilis (Slow-worm)	1	—	—	—	1
Serpentes (Snakes)	69	28	9	11	117

Some of the bones, however, were, too fragmented to be measured and among these we could not exclude the presence of wolf; therefore this carnivore is listed in tables 4 and 6. Dogs may have been hunting partners, but they also could live at the site as commensals: eating the abandoned

TABLE 3 — *Avian fauna of Cabeço de Amoreira*

Species \ Assemblage	A	B	C	X	Total
Podiceps ruficollis (Little Grebe)/*P. nigricollis* (Black-necked Grebe)	—	—	2	—	2
Botaurus stellaris (Bittern)	—	1	—	—	1
Anseriformes (Waterfowl and Screamers)	3	1	1	1	6
Anser anser (Greylag Goose)	2	1	—	—	3
Tadorna tadorna (Shelduck)?	—	(1)	1	1	2 (1)
Anas platyrhynchos (Mallard)	7	5	2	4	18
Anas platyrhynchos/A. strepera (Gadwall)	1	—	—	—	1
Anas crecca (Teal)	—	1	—	—	1
Anas crecca/A. querquedula (Garganey)	1	—	—	—	1
Anas penelope (Wigeon)/*Aythya fuligula* (Tufted Duck)	—	—	—	1	1
Falconiformes (Diurnal Birds of Prey)	1	—	—	—	1
Buteo buteo (Buzzard)	2	—	2	—	4
Falco columbarius (Merlin)/*F. naumanni* (Lesser Kestrel)	—	1	—	—	1
Falco naumanni (Lesser Kestrel)	1	—	—	—	1
Alectoris rufa (Red-legged Partridge)	7	—	—	—	7
Otis tarda (Great Bustard)	1	—	—	—	1
Charadriiformes	2	—	2	1	5
Vanellus vanellus (Lapwing)	—	—	1	—	1
Numenius arquata (Curlew)	4	—	—	—	4
Scolopax rustricola (Woodcock)	2	2	—	—	4
Scolopax rusticola/Gallinago gallinago (Snipe)	1	—	—	—	1
Larus argentatus (Herring Gull)	1	1	1	—	3
Columba palumbus (Woodpigeon)	4	2	1	1	8
Tyto alba (Barn Owl)	—	—	1	—	1
Asio otus (Long-eared Owl)/*Strix aluco* (Tawny Owl)	1	—	—	—	1
Strix aluco (Tawy Owl)	—	1	—	—	1
Passeriformes (Sparrows)	—	—	—	1	1
Turdus philomelos (Song Trush)	1	—	(1)	2	3 (1)
Corvus corone (Carrion Crow)	4	2	6	1	13
Not identified birds	60	26	23	12	121

TABLE 4 — *Mammalian fauna of Cabeço de Amoreira*

Species \ Assemblage	A	B	C	X	Total
Erinaceus europaeus (Hedgehog)	7	7	7	5	26
Talpa caeca (Blind Mole)	20	6	—	4	30
Oryctolagus cunniculus (Rabbit)	3.717	2.538	2.157	1.273	9.685
Lepus capensis (Brown Hare)	39	43	40	28	150
Rodentia (Rodents)	73	—	2	—	75
Sciurus vulgaris (Red Squirrel)	30	19	20	11	80
Eliomys quercinus (Garden Dormouse)	1	—	—	—	1
Microtidae (Voles)	36	13	3	6	58
Arvicola amphibius (Water Vole)	247	123	46	74	490
Pitymys savii (Savi's Pine Vole)/*P. duodecimcostatus* (Mediterranean Pine Vole)	5	1	—	—	6
Microtus agrestis (Short-tailed Vole)	1	—	—	—	1
Pitymys sp./*Microtus agrestis*	2	—	—	—	2
Muridae (Old World Rats and Mice)	—	—	1	—	1
Sylvaemus sylvaticus (Wood Mouse)	1	—	—	—	1
Carnivora (Carnivores)	—	2	—	5	7
Canidae (Canids)	4	4	—	2	10
Canis lupus (Wolf)/*C. lupus* f. familiaris (dog)	11	7 (1)	12	16 (1)	46 (2)
Vulpes vulpes (Red Fox)	15 (2)	9 (1)	20 (2)	13 (1)	57 (6)
Meles meles (Badger)	11 (6)	12 (3)	1 (2)	56	80 (11)
Putorius putorius (Polecat)	1	—	—	1	2
Lutra lutra (Otter)	1	3	4	1	9
Martes foina (Beech Marten)	1	—	—	1	2
Martes foina/*M. martes* (Pine Marten)	1	—	—	—	1
Felis silvestris (Wild Cat)	11	9	8 (1)	4 (1)	32 (2)
Lynx pardina (Pardel Lynx)	11	1 (1)	—	1	13 (1)
Equus przewalskii (Wild Horse)	8	17 (1)	8	1 (1)	34 (2)
Sus scrofa (Wild Boar)	244 (8)	385 (3)	308	174	1.111 (11)
Cervus elaphus (Red Deer)	317	407	458	305	1.487
Capreolus capreolus (Roe Deer)	39	81 (1)	73 (1)	47	240 (2)
Bos primigenius (Aurochs)	24 (3)	28 (1)	7	30	89 (4)
Not identified mammals	9.956	6.818	7.132	4.909	28.815

TABLE 5—*Molluscs, crustaceans, fishes, amphibians and reptiles of Cabeço de Arruda*

Species \ Assemblage	A	B	C	X	Total
Marine bivalves					
Mytilus edulis	1	—	—	—	1
Pecten maximus	2	2	1	—	5
Ostrea sp.	1	1	—	—	2
Laevicardium norvegicum	4	2	2	1	9
Cardium glaucum + *C. edule*	1.102	31	122	4	1.259
Venerupis decussata	3	2	—	—	5
Scrobicularia plana	103	15	18	6	132
Solen or *Ensis* sp.	6	3	3	2	14
Marine gastropods					
Neritina fluviatilis	55	27	45	209	336
Bittium sp.	1	2	1	—	4
Cypraea sp.	7	6	2	5	20
Landsnails and Freshwater molluscs					
Hydrobia sp.	1	1	—	15	17
Helicella sp.	9	1	5	2	17
Theba pisana	77	41	26	44	188
Helix spp.	1	1	1	2	5
Unio tumidus	4	—	—	1	5
Cephalopoda (Cuttlefishes, Squids and Octopuses)					
Sepia officinalis (Common Cuttlefish)	2	—	—	—	2
Decapoda					
Brachyra (True Crabs)	660	178	134	69	1.041
Pisces (Fishes)	6	17	7	11	41
Myliobatis aquila (Eagle Ray)	—	1	1	—	2
Acipenser sturio (Sturgeon)	3	—	—	—	3
Sparidae (Sea-breams)	1	—	1	—	2
Sparus aurata (Gilthead)	3	2	1	—	6
Argyrosomus regius (Meagre)	265	94	24	21	404
Not identified fishes	1	1	2	—	4
Amphibia (Amphibians)					
Not identified amphibians					
Reptilia (Reptiles)					
Emys orbicularis (Swamp Turtle)/ /*Mauremys caspica*	—	1	—	—	1
Lacerta lepida (Eyed Lizard)/*L. schreiberi* (Schreiber's Lizard)	12	—	4	3	19
Serpentes (Snakes)	2	2	1	—	5

TABLE 6 — *Avian and mammalian fauna of Cabeço de Arruda*

Species \ Assemblage	A	B	C	X	Total
Aves (Birds)					
Anseriformes (Waterfowl and Screamers)	2	—	2	—	4
Anser anser (Greylag Goose)	2	2	2	—	6
Anser fabalis (Bear Goose)	—	—	1	—	1
Anas platyrhynchos (Mallard)	2	1	1	—	4
Anas crecca (Teal)/*A. querquedula* (Garganey)	2	—	—	—	2
Spatula clypeata (Schoveler)/*Aythya ferina* (Pochard)	—	1	—	—	1
Falconiformes (Diurnal Birds of Prey)	—	—	1	—	1
Accipiter nisus (Sparrow Hawk)	1	1	—	—	2
Buteo buteo (Buzzard)	—	1	—	—	1
Alectoris rufa (Red-legged Partridge)	1	—	—	—	1
Grus grus (Crane)	1	—	—	—	1
Scolopax rusticola (Woodcock)	1	—	—	—	1
Columba palumbus (Woodpigeon)	4	2	3	—	9
Columba livia (Rock Dove)	—	1	—	—	1
Passeriformes (Sparrows)	2	—	1	—	3
Corvus corone (Carrion Crow)	1	—	1	—	2
Not identified birds	11	12	5	1	29
Mammalia (Mammals)					
Erinaceus europaeus (Hedgehog)	2	4	2	5	13
Oryctolagus cunniculus (Rabbit)	1.497	1.158	1.092	213	3.960
Lepus capensis (Brown Hare)	35	24	11	—	70
Rodentia (Rodents)	1	—	—	—	1
Sciurus vulgaris (Red Squirrel)	19	14	7	4	44
Arvicola amphibius (Water Vole)	32	12	17	6	67
Sylvaemus sylvaticus (Wood Mouse)	1	—	—	—	1
Canis lupus (Wolf)/*C. lupus* f. familiaris (dog)	1	1	1	1	4
Vulpes vulpes (Red Fox)	7	4	7	—	18
Meles meles (Badger)	—	2	1	—	3
Mustela nivalis? (Weasel)	—	1	—	—	1
Lutra lutra (Otter)	—	3	—	—	3
Felis silvestris (Wild Cat)	2	5	5	—	12
Lynx pardina (Pardel Lynx)	—	—	1	—	1
Equus przewalskii (Wild Horse)	—	—	1	—	1
Sus scrofa (Wild Boar)	56	48	44	12	160
Cervus elaphus (Red Deer)	61	89	64	17	231
Capreolus capreolus (Roe Deer)	4	20	6	2	32
Bos primigenius (Aurochs)	23	15	27	6	71
Not identified mammals	2.872	736	961	167	4.736

meat and thus cleaning the campsite (Rozoy, 1978). According to Mendes Corrêa (1933) all canids at Muge were still wild, because no gnawed bones were found. Indeed we recognised only a few carnivore gnawed fragments in the collections, but one should consider that if food supply is ample, domestic dogs do not necessary gnaw bones intensively.

2.1. Taphonomy

As known, taphonomy is a subdiscipline of palaeontology, which tries to analyse what happens with the animal remains between death and the eventual recovery of these remains as fossils. We can divide our faunal material in three taphonomical groups (cf. Gautier in press): (1) remains of animals collected for human consumption; (2) debris of artisanal activity; (3) intrusives. There is little doubt that the shells, together with most of the other fauna, were primarily collected for consumption by man and thus form the first taphonomic group. Especially at Cabeço de Amoreira the abundant shell remains suggest that marine molluscs are an important food resource. However many recent authors (see for example Bailey, 1975) have pointed out that molluscan remains from even a large and imposing looking shell-midden may represent a minor rather than a major component in the diet.

Among the molluscan food remains, cockles (*Cardium glaucum* and *C. edule*) are the most frequently represented animals. They predominate by tenfold the second most abundant bivalve group which is the peppery furrow shell (*Scrobicularia plana*). We also classify the cephalopods, the fishes, the lizard, the birds and the larger mammals in the food remains group. Crustaceans are abundantly represented by the extremities of the main claws of crabs. With Arnaud (pers. comm.), we believe that these crabs were mainly used as bait. Their meat amount is too small to be of any economic value. If, however, these crab claws are the remains of part of the diet, they could indicate a scarcity of other, more valuable or more palatable food.

Our second taphonomical group consists of the remains of artisanal activity. Up to 95 % of the recovered shells pertaining to little marine gastropods like *Neritina fluviatilis* and *Cypraea* have been perforated by people. Veiga Ferreira (1954) already proposed that they were used essentially to make necklaces. A few of the worked canines of red deer (*Cervus elaphus*) were probably also used to make articles of adornment, e.g. earrings

(Rozoy, 1978). Many carnivores like fox, wild cat, pardel lynx etc. may have been hunted for their fur or skin. The few antlers of red deer recovered show working traces and were no doubt used for tool-making as prehistoric man was used to do.

The third taphonomical division, the intrusives are animals which are not consumed nor used in any other way by the site occupants. Some of these animals invaded the site contemporaneously or almost contemporaneously with the occupation, others are more recent intrusives. The barnacles, for example, probably arrived at the site attached to other marine animals or to marine plants gathered by people. The landsnails found their natural habitat in or around the site and died there accidently. The same could apply for the amphibians, some of the reptiles and the micromammals. It should also be noted that, as rabbits and badgers make burrows, some of them may also be intrusives. We could date some bones of these creatures as being recent intrusives in older archaeological layers by their state of preservation. In the lower layer of Amoreira 127 fragments of rabbit bones are considered as recent. In the unlabeled layer X of Amoreira we found 27 bones of one young badger which could also be intrusive. These finds are included in the counts of table 1 to 4.

2.2. **Palaeoecology**

Many site reports tend to restrict themselves to the palaeontological and chronological study of the recovered remains (Freeman, 1973). However, an ecological interpretation of the identified wild species may enable us to sketch a picture of the site catchment area: the natural habitat around the occupation area.

In this evaluation only the most abundant marine molluscs and vertebrates are considered. Cockles (*Cardium glaucum* and *C. edule*) can live in a variety of substrates ranging from mud, clay, coarse sand to gravel and pebbles. The lagoon cockle (*Cardium glaucum*), which is the most abundant shell, is an euryhaline species of which the upper and lower limits of salinity tolerance are 3 to 60 per mil (Gaillard and Testud, 1980). The peppery furrow shell (*Scrobicularia plana*) burrows in mud and sand in shallow brackish water (e.g. estuaries) and has a salinity tolerance of 6 to 30 per mil. The razor shells (*Ensis* sp.; *Solen* sp.) burrow in sand on the lower shore and in shallow water.

The eagle ray (*Myliobatis aquila*) lives in surface water and on soft substrates down to about 250 m. Fishes of the Sparidae family can tolerate brackish conditions. They are normally found among rocks overgrown with seaweed in the shallow water near the coast, but migrate to deeper water when it becomes cold. Only during the spawning season, from June to September are these fishes found in the estuary. Occasionally, they also migrate into brackish lagoons, where they find large food resources. The meagre (*Argyrosomus regius*) is an erratic species that follows banks of Mugilidae or other fishes especially near sandy beaches. During the spawning season (April to August), these fishes are found in estuaries and the young sometimes migrate into freshwater.

Most of the amphibians, with the exception of *Bufo bufo* live in humid localities including marshes. The turtles (*Emys orbicularis* and *Mauremys caspica*) can tolerate a relatively high salinity. They also occur in marshes, or in streams with a dense vegetation on the banks. The lizards (*Lacerta lepida* and *L. schreiberi*) require a high air humidity. They sometimes live in rabbit burrows.

For much of the bird species, marshes can constitute the natural habitat: e.g. the bittern (*Botaurus stellaris*), almost all waterfowl, the curlew (*Numenius arquata*) etc. Many of these birds require a dense vegetation or reedland near the banks of these marshes. The mallard (*Anas platyrhynchos*) and the tawny owl (*Strix aluco*) may breed in rabbit burrows. Only a few birdspecies are restricted to woods, such as the sparrow hawk (*Accipiter nisus*), that breeds in pine trees or mixed woods. The woodpigeon (*Columba palumbus*) and the buzzard (*Buteo buteo*) live in wooded areas. The carrion crow (*Corvus corone*) prefers open or wooded grounds.

Among the mammals, some species can live in marshes: brown hare, short-tailed vole, otter, wild cat, pardel lynx and wild boar. The wild rabbit (*Oryctolagus cunniculus*) prefers the open fields for the location of its burrows, but may be found in deciduous or coniferous forest with widely spaced trees. The brown hare (*Lepus capensis*) lives in all sorts of open country, but sometimes inhabits deciduous forests. Coniferous forests or mixed woodlands form the habitat of the red squirrel (*Sciurus vulgaris*). Antunes (1985) states that in Portugal this animal became extinct in the first decades of the 16th century. This extinction probably occurred as a result of degradation of the forests, especially those with pines. Hunting pressure probably played a minor role in the extinction process. The water vole (*Arvicola amphibius*) lives near streams with dense vegetation on the banks. Wolves (*Canis lupus*) frequent wooded plains or mountains as much as open country with sufficient cover. These animals are now extinct over

most of Western Europe but are still present in parts of Portugal. The red fox (*Vulpes vulpes*) is well represented in a diversity of landscapes. Badgers (*Meles meles*) are primarily animals of open woodland, but occur commonly in open country, if there are banks to burrow in or rocks to provide a den (Mallinson, 1978). They may also use the burrows of wild rabbits. The wild cat (*Felis silvestris*) inhabits extensive and varied forests with dense undergrowth and is often found near streams and ponds (Walker, 1964). In southern Europe, it is often encountered in the scrubby type of bush known as *macchia.* The pardel lynx (*Lynx pardina*) lives in mixed forests with dense undergrowth but can colonise a variety of other habitats. In Portugal, it still inhabits some areas in the south and east of the country.

The most important mammals in the prehistoric diet are wild boar (*Sus scrofa*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and the aurochs (*Bos primigenius*). The wild boar likes to live in closed forests, often near small lakes or marshes where food is abundant. On the whole red deer prefers deciduous woodland with dense undergrowth. Aurochs are often considered forest-specific (Walker, ibid), but recent evidence suggests that forest margins or wooded parkland rather than closed forest were their favorite haunt.

The foregoing data suggest a picture of the site-catchment area. Fishes and molluscs point to a sandy estuary with at some distance a rocky coastal configuration. Landwards there were marshes with reed-fields or dense vegetation near the banks, as indicated by the birds. The actual situation is much comparable, since the sites are located near the still existing *do Duque* marshes. The abundance of the lagomorphs suggests that the landscape was relatively open. The habitat preference of the larger mammals indicates that a rather open mixed woodland was also present. This environment however is being destroyed by recent man.

2.3. **Palaeoeconomy and seasonality**

The most common molluscs, the cockles (*Cardium glaucum* and *C. edule*), the peppery furrow shell (*Scrobicularia plana*) and the razor shells (*Ensis* sp.; *Solen* sp.) all burrow in sandy bottoms, the peppery furrow shell up to 25 cm. Hence, these creatures are not easily gathered and collecting them in quantities requires a special effort.

The ease or dificulty with which the various fish species can be collected gives us information about the techniques and the form of group cooperation used by prehistoric people. The presence of porbeagle (*Lamna*

nasus) does not necessarily indicate an active catch of these fishes, since they are known to become stranded easily (Chaix and Desse, 1978). Probably catching sparid fishes was easiest, when they were feeding on mussels in shallow water or when they penetrated into the estuary during the spawning season. During this migration (June-September), they were no doubt coming by in great numbers. Meagre (*Argyrosomus regius*) are predatory fishes probably caught through chasing smaller individuals into shallows, but during their spawning season they also migrate into the estuary. Fishes are normally difficult to catch in winter because the inactivity of certain species, their migration into deeper water and the fact that bad weather upsets fishing activities (Wilkinson, 1981). Spring and summer are and were therefore the most succesfull seasons for fishing.

As for the birds, most of the species occur in Portugal only as winter guests or during the migration to their breeding places. This information indicates at least winter-occupation of the site.

The identified mammals lived in the area all year round, although some are hunted more efficiently in certain periods of the year: red deer from January to March; wild boar from November to March (Price, 1978). The study of the age distribution of the game bag of wild rabbit, red deer and wild boar has not been finished, but at first sight it would seem that these species are represented by all age-categories. This fact could indicate an overyear occupation.

Table 7 shows the diversification of the diet calculated on the counted fragments. At Cabeço de Amoreira, marine bivalves and crabs represent a high percentage although we know that this does not implicate a great importance in the diet of the prehistoric people.

Table 8 gives, within the group of mammals, the percentage of the most important species. Calculated on the amount of counted fragments, wild rabbit was the most important food resource (74,2-86,8). If we take into account that the amount of usuable meat from one rabbit is much smaller than from one red deer, other percentages can be estimated. We calculated the relative importance in weight for our most important animals, by multiplying each counted fragments with the average amount of usuable meat of the species to which it was assigned; the values obtained are given in table 8. It becomes clear that the importance of wild rabbit was in fact much smaller (3,3 to 5,1 %) than that of larger game, but no doubt it was easier to come by, with the use of snares or digging the animals out of their holes.

TABLE 7 — *Diversification of the diet calculated on the counted fragments*

	Amoreira		Arruda	
	Total number	%	Total number	%
Marine bivalves	28.123	31,6	1.437	11
Marine gastropods	703	0,8	360	2,8
Landsnails and Freshwater molluscs	2.644	3	232	1,8
Cuttlefishes, Squids and Octopuses	11	0,01	2	0,02
Barnacles	19	0,02	—	—
True crabs	10.419	11,7	1.041	8
Fishes	3.511	3,9	458	3,5
Amphibians	593	0,7	4	0,03
Reptiles	155	0,2	25	0,2
Bidrs	220	0,2	69	0,5
Mammals				
Identified mammals	13.867	15,6	4.693	35,9
Not identified mammals	28.815	32,3	4.736	36,2
Total	42.682	47,9	9.429	72,2

TABLE 8 — *Percentages of the most important mammals calculated on the total number and on the total weight*

Species	Usuable meat (kg)	Amoreira				Arruda			
		Total number	%	Total weight	%	Total number	%	Total weight	%
Oryctolagus cunniculus	1	9.685	74,2	9.685	3,3	3.960	86,8	3.960	5,1
Lepus capensis	2,7	150	1,1	405	0,1	70	1,5	189	0,2
Canis lupus (1)	27	47	0,4	1.269	0,4	4	0,09	108	0,1
Vulpes vulpes	4	63	0,5	252	0,08	18	0,4	72	0,1
Meles meles	8	91	0,7	728	0,3	3	0,07	24	0,03
Felis silvestris	6	34	0,3	204	0,07	12	0,3	72	0,1
Equus przewalskii	210	36	0,3	7.560	2,6	1	0,02	210	0,3
Sus scrofa	60	1.122	8,6	67.320	22,7	160	3,5	9.600	12,4
Cervus elaphus	105	1.487	11,4	156.135	52,6	231	5,1	24.255	31,4
Capreolus capreolus	13	242	1,9	3.146	1,1	32	0,7	417	0,5
Bos primigenius	540	93	0,7	50.220	16,9	71	1,6	38.340	49,6

(1) These counts may include dog remains as is explained in the text.

In table 9 we consider the largest mammals. At Cabeço de Amoreira, the red deer (*Cervus elaphus*) is the most important food resource (in total number and total weight), followed by wild boar (*Sus scrofa*) and aurochs (*Bos primigenius*). At Cabeço de Arruda, however, aurochs becomes more important and even the most important when we consider the weight percentages. At first sight we can not give a logical explanation for these differences. The sites are situated at 2 km distance only from each other, but are located on different banks of the *do Duque* marshes. This location could implicate a different environment or a different accessibility to where aurochs could be found.

TABLE 9 — *Percentages of the largest mammals calculated on the total number and on the total weight*

Species	Usuable meat (kg)	Amoreira				Arruda			
		Total number	%	Total weight	%	Total number	%	Total weight	%
Equus przewalskii	210	36	1,2	7.560	2,7	1	0,2	210	0,3
Sus scrofa	60	1.122	37,7	67.320	23,7	160	32,3	9,600	13,2
Cervus elaphus	105	1.487	49,9	156.135	54,9	231	46,7	24.255	33,3
Capreolus capreolus	13	242	8,1	3.146	1,1	32	6,7	416	0,6
Bos primigenius	540	93	3,1	50.220	17,7	71	14,3	38.340	52,6

Further investigations on the fauna of these collections together with the comparison of these sites with other Mesolithic shell-middens will hopefully shed more light on the exact status of the sites.

ABSTRACT

This preliminary archaeozoological study, analysed the faunal material of two Mesolithic shell-middens: Cabeço de Amoreira and Cabeço de Arruda. A taphonomical division is made. We recognize consumption remains (mainly red deer, wild boar and aurochs); debris of artisanal activity (little gastropods, antler and teeth of red deer etc.); penecontemporaneous intrusives (herpetofauna, little mammals etc.) and late intrusives (rabbit, badger). The palaeoecological and palaeoeconomical analysis provides some information on the importance of each animal group in the diet of the Mesolithic Muge people and on the season of occupation of the two sites.

RESUMO

A fauna analisada, preliminarmente, neste trabalho arqueozoológico, provém das escavações sistemáticas dos dois concheiros mesolíticos de Muge: Cabeço de Amoreira e Cabeço de Arruda. O estudo tafonómico mostra-nos que a fauna destes dois sítios é constituída por restos alimentares (essencialmente, veado, javali e auroque), alguns restos artesanais (pequenos gasterópodes, pontas e dentes de veado, etc.), intrusões contemporâneas da ocupação dos concheiros (répteis, pequenos mamíferos, etc.) e intrusões mais tardias (coelhos e texugos). O estudo paleoecológico e paleoeconómico fornece-nos informações sobre o carácter sazonal da ocupação de Muge, revelando ao mesmo tempo a importância dos diferentes animais na alimentação dos seus habitantes.

RÉSUMÉ

La faune de cette analyse archéozoologique préliminaire provient des fouilles systématiques de deux escargotières mésolithiques de Muge: Cabeço de Amoreira et Cabeço de Arruda. L'étude taphonomique indique que la faune des deux sites consiste de déchets de consommation (essentiellement cerf élaphe, sanglier et auroch), quelques déchets artisanaux (petites gastropodes, bois et dents de cerf élaphe etc.), d'intrusions pénécontemporaines (herpétofaune, micromammifères etc.) et d'intrusions plus tardives (lapins, blaireaux). L'étude de la paléoécologie et de la paléoéconomie donne des informations sur le caractère saisonnier de l'occupation et sur l'importance des differents animaux dans l'alimentation des occupants du site.

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