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MESOLITHIC-NEOLITHIC CONTINUITY: EVIDENCE FROM CHRONOLOGY AND HUMAN BIOLOGY

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Résumé: Nous avons fouillés deux gisements préhistoriques littorals au sud de Sines. L'un, le coquillière de Medo Tojeiro, a livré quelques outils et tessons, semblables à d'autres assemblages attribués au "Néolithique ancien", dans les dépôts typiques de coquilles brisées ou entières et pierres chauffées. L'autre gisement, Samouqueira, n'a produit aucun vestige, ni de l'outillage, ni de la faune ou de la flore, qu'on peut attribuer au Néolithique; ce gisement a tous les caractéristiques du Mésolithique. Néanmoins, les datations de ^{14}C pour Samouqueira et Medo Tojeiro, se tombent dans la même période - entre 5100 et 5600 avant notre ère.

A Samouqueira nous avons trouvés deux squelettes humains partiels dans le niveau daté par ^{14}C. Nous avons analysés ces restes en comparaison des deux séries de squelettes de Moita do Sebastião que, d'après nos resultats, sont homogenes. Ces analyses ne donnent aucun indication des différences biologiques entre les deux populations malgre les distinctions d'écologie, d'environnement et de l'âge. Ces distinctions sont, néanmoins, indiquées dans la forte incidence des conditions pathologiques resultant des accidents et de petite traumatisme à Samouqueira, et les indications a Moita do Sebastião de traumatisme resultant de la violence. Les restes humains de Samouqueira indiquent une société qui peut soutenir mais ne guerir pas les blessés. Les modes d'inhumation sont différentes dans les petits détails, mais nous avons plusieurs indications des correspondances et aucune évidence de la discontinuité génétique entre ces populations. Nous conciuons, malgre que nos résultats soient preliminaires, que des bornes bien définies n'existent pas entre des industries, des économies ou des populations dites Mésolithiques et Néolithiques.

INTRODUCTION

The characteristics which have been used to define the change from the Mesolithic to the Neolithic have, in the past, varied according to the nature of the evidence as well as the theoretical orientation of the researcher (cf. Czarnik 1976). The strictly technological definition (flaked stone vs. ground stone and ceramics) used by 19th century scientists is no longer acceptable. Following upon the work of Childe, Braidwood, Flannery, MacNeish and many others (see Reed 1977 and Wright 1971, both with extensive bibliographies), most archaeologists now agree that the distinction between pre-agricultural and agricultural societies must be based upon a combination of technological, economic, ecological and demographic criteria. Here, we expand upon our earlier paper (Lubell, Jackes and Meiklejohn, in press) in which we argued that the transition from the "Mesolithic" to the "Neolithic"in southern Portugal was less clear than has been suggested by other authors (compare Serrão 1979; Soares and Silva 1981, 1982 with Arnaud 1982, in press; Clark 1983; Gilman in press). We also use, as a point of departure, the idea of continuity in the prehistoric record advanced for the Maghreb in two recent papers (Lubell, Sheppard and Jackes 1984; Lubell, Sheppard and Gilman in press).

Our views here are based upon several lines of evidence, all incoirporated into a research project on the Mesolithic-Neolithic tranistion in southern Portugal which has two major foci.[1] These are:

> 1. Interdisciplinary palaeoenvironmental and chronological study of late Pleistocene to mid-Holocene archaeological and non-archaeological deposits, using geoarchaeological and radiocarbon analyses, so as to understand the nature of economies within the context of changing environmental conditions (and thus gain a better idea of why cultural change occurred). This method has yet to be applied extensively in Portugal (but see Arnaud 1982, in press) although it has been used in Spain (Clark 1983; Guilaine *et al.* 1982).

2. Full osteological analysis of early and mid-Holocene human skeletal series (Moita do Sebastião, Cabeço da Arruda and Cabeço da Amoreira among others) to determine if there were changes in physical characteristics, health and life span with time, and thus to test some of the hypotheses which have been proposed (e.g. Binford 1968; Cohen 1977; Hassan 1975; Cohen and Armelagos 1984) regarding the presence or absence of demographic change over the Mesolithic-Neolithic transition.

PALAEOENVIRONMENT AND PALAEOECONOMY

Our investigations have so far been confined to the excavation and analysis of the shell midden at Medo Tojeiro discovered by Carlos Penalva (Zbyszweski and Penalva 1979)[2], and to test excavation and preliminary study of Samouqueira (Silva and Soares 1981, 1982). The Medo Tojeiro midden is said to be Early Neolithic (Tavares da Silva, personal communication) on the basis of one polished celt found on the surface of the midden deposits, and several potsherds and microblades found throughout the deposits. The deposits investigated at Samouqueira have so far produced neither ceramics nor ground stone artifacts, and are assigned to the Mesolithic (ibid.). A more complete discussion of the archaeology of these two sites can be found in Lubell, Jackes and Meiklejohn (in press).

Site location, stratigraphy and chronology

Medo Tojeiro

The Medo Tojeiro midden appears to be a small remnant (about 6 x 12m and 75cm thick) of a much larger site now destroyed. It is sandwiched between two deposits of dune sand, about 30m above modern sea level, and the midden itself has been deflated in the past so that its upper surface immediately beneath the sand overburden is now a lag deposit.

Our investigations recovered no bone, almost no artifacts and a few arrangements of fire-cracked rock which we interpret as hearths. We identified six strata (C.1 to C.6 from top to bottom) of which C.2 to C.4 appear to be the main occupation deposits. They were distinguished in the field on the basis of colour, texture and species of shellfish observed.

Two radiocarbon dates are available for the midden. A sample of marine shell, probably from C.4, collected during our preliminary inspection of the site in 1983, has been dated at 6150 ± 120 BP (BM 2275). A sample of charcoal, excavated in 1984 from C.4 in an apparently undisturbed part of the midden, has been dated at of 5450 ± 160 BP (corrected for ^{13}C: Beta-11723).

The shell sample was collected from the exposed western face of the midden, in an area affected by weathering which has obscured stratigraphic relationships and may have led to sample contamination. In view of this, and the greater uncertainty usually attached to shell dates, we have more confidence in the charcoal date even though the sample was small and required extended counting time. Our best estimate is that the midden dates somewhere between about 6300 and 5300 BP, probably towards the upper end of that range.

Samouqueira

Surface finds suggest that Samouqueira covers an area of ca. 120 x 140m in what is now a ploughed field that slopes down to the rocky shore (a 10m cliff) from an old beach about 200m inland. The cultural deposits are exposed along the top of the cliff and are buried beneath coarse sand further inland. The depth of this overburden may be considerable. We excavated a $1m^2$ test pit in Sector XX Square A1, 40m in from the cliff edge, to a depth of almost 2m without reaching in situ cultural deposits. There were lithic artifacts scattered throughout this depth. We suspect that the land surface has risen continually (due to slopewash) during the last one or two centuries, so that

continued cultivation has dispersed artifacts throughout the deposit and left only the uncultivated edge of the site in situ.

We placed a 7 x 2m test excavation Sector XII Squares A19-G19 and A20-G20, just at the edge of the cliff where the site has been least affected by ploughing. The deposits containing artifacts reached a maximum depth of 76cm and were underlain by the same coarse beach sand (here sterile and in places consolidated) seen in the test pits. Three main levels were distinguished: C.1, C.2 and C.3 from top to bottom, sub-divided into 5cm spits designated by letters. One of these, C.3a, may be the only portion still in situ, and is the only level which contains appreciable quantities of shell (5.1% to 11.3% in the <2mm fraction of three samples).

An AMS radiocarbon date on bone collagen from a partial tibia shaft of a large bovid or cervid found in C.2a, gives an age, corrected for ^{13}C, of 5190 ± 130 BP and a $^{13}C/^{12}C$ value of -17 ‰ (Beta-11722). This implies that the "mesolithic" occupation of Samouqueira, and the "neolithic" occupation of Medo Tojeiro, were contemporaneous.

Geoarchaeology

Medo Tojeiro

Table 1 and Figure 1 give summary information on the sedimentology and geochemistry of the Medo Tojeiro midden deposits. Fire-cracked rock was very common, forming up to 97% by weight of the >2mm fraction. C.2 and C.4 were especially rich in shell as can be seen from the high values for shell in the <2mm fraction and the low values for rock in the >2mm fraction. Lower values for calcium, nitrogen and carbon indicate that C.1 (10-20cm thick) has been leached, a conclusion reinforced by the high frequency of iron which would have been derived from the overlying dune sand. Phosphorus (an indicator of decayed organic matter) has not been so strongly leached from these upper levels, suggesting that the site was covered quite rapidly after it was abandonned.

C.2, C.3 and C.4 are the main cultural levels, comprising in all about 60cm of deposit. The geochemical data suggest that C.2 represents more intensive occupation than C.4, thus reinforcing our impression in the field that C.3 indicates a period during which the site was not so intensively utilized, or perhaps utilized differently.

Samouqueira

A limited number of samples was taken for geochemical and sedimentological analysis from the test pit in SXX/A1 and the main test excavations in SXII/A19-G19, A20-G20. The results are summarized in Table 2 and Figure 2. While preliminary, they do tend to confirm our interpretation of the stratigraphy.

High levels of carbon and nitrogen in the upper levels of SXX/A1 are no doubt due to modern cultivation and fertilization. Calcium is low throughout, except at the very bottom where a high concentration of calcium is associated with a very low concentration of carbon. This may indicate an older but much disturbed C horizon. Nitrogen and phosphorus, high near the top as expected in a deposit under continual cultivation for a long period of time, both decrease with depth.

In SXII/E19 the shell content of C.3 is clearly shown by the increase in calcium. The high value for carbon in C.2b indicates the presence of buried cultural materials but these may not be in situ. Nitrogen and phosphorus also indicate decayed organic matter, consistent with the presence of both human and animal bone in this level. The high level of iron may be due to downslope movement of soil and water.

Table 1

Medo Tojeiro, Area 1, 1984

Mean percentage frequencies of major constituents of the midden deposits

Values for >2mm fraction calculated by weight from 1 litre bulk samples.
Values for <2mm fraction calculated by weight (shell) and by analysis (elements).

	>2mm fraction						<2mm fraction					
Couche	rock	shell	*Patella*	*Monodonta*	*Thais*	*Mytilus*	shell	Ca	Fe	C	N	P
C.1	57.8	42.2	14.0	1.9	11.1	73.2	19.1	6.06	0.44	1.43	0.058	0.015
C.2	11.0	89.0	17.5	0.8	2.5	79.2	23.3	14.70	0.39	2.00	0.079	0.014
C.3	21.7	78.3	23.8	0.8	5.4	70.0	10.6	3.57	0.29	0.72	0.020	0.007
C.4	22.4	77.6	16.2	1.0	5.3	77.4	20.6	0.58	0.37	0.75	0.029	0.007
C.5	19.6	80.4	14.7	1.2	5.4	78.7	8.1	1.19	0.28	0.18	0.011	0.005
C.6	44.9	55.1	17.7	0.7	3.6	78.0	4.2	0.81	0.39	0.17	0.012	0.004
mean	29.6	70.4	17.3	1.1	5.5	76.1	14.3	4.48	0.36	0.87	0.035	0.009
sd	17.8	17.8	3.5	0.45	3.0	3.7	7.7	5.43	0.06	0.72	0.03	0.005

Table 2

Samouqueira, 1984

Geochemical composition of the deposits (as percentages)

Provenance	Carbon	Nitrogen	Phosphorus	Calcium	Iron
SXII E19 C.1	.204	.020	.021	.04	1.85
SXII E19 C.2	.419	.021	.028	.46	1.90
SXII E19 C.3	.295	.016	.022	.55	.73
SXX A1 604cm	.519	.021	.020	.04	.81
SXX A1 608cm	.282	.013	.028	.09	1.96
SXX A1 634cm	.362	.017	.016	.08	.67
SXX A1 639cm	.244	.012	.013	.12	1.87
SXX A1 643cm	.228	.013	.012	.06	.62
SXX A1 650cm	.409	.015	.016	.11	.76
SXX A1 657cm	.202	.010	.009	.03	.36
SXX A1 664cm	.325	.011	.011	.03	.51
SXX A1 669cm	.077	.009	.011	.78	.47
Mean	.297	.015	.017	.20	1.04
s	.118	.004	.006	.25	.64

NB: Measurements for SXX A1 are for bottom of unit in centimetres below datum. The ground surface at SXX A1was 512cm BD, and the test was excavated to 689 cm BD.

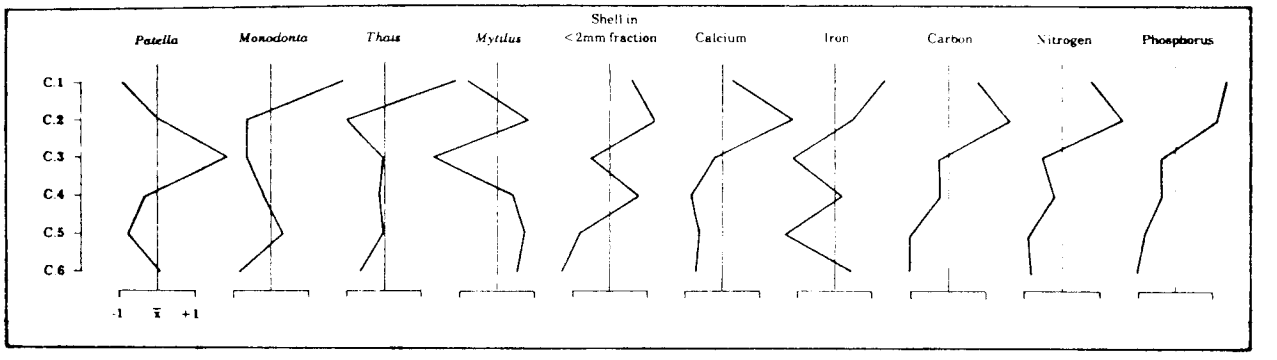

Fig. 1. Major constituents of the Medo Tojeiro midden deposits. Curves represent ± 1 standard deviation based on data in Table 1.

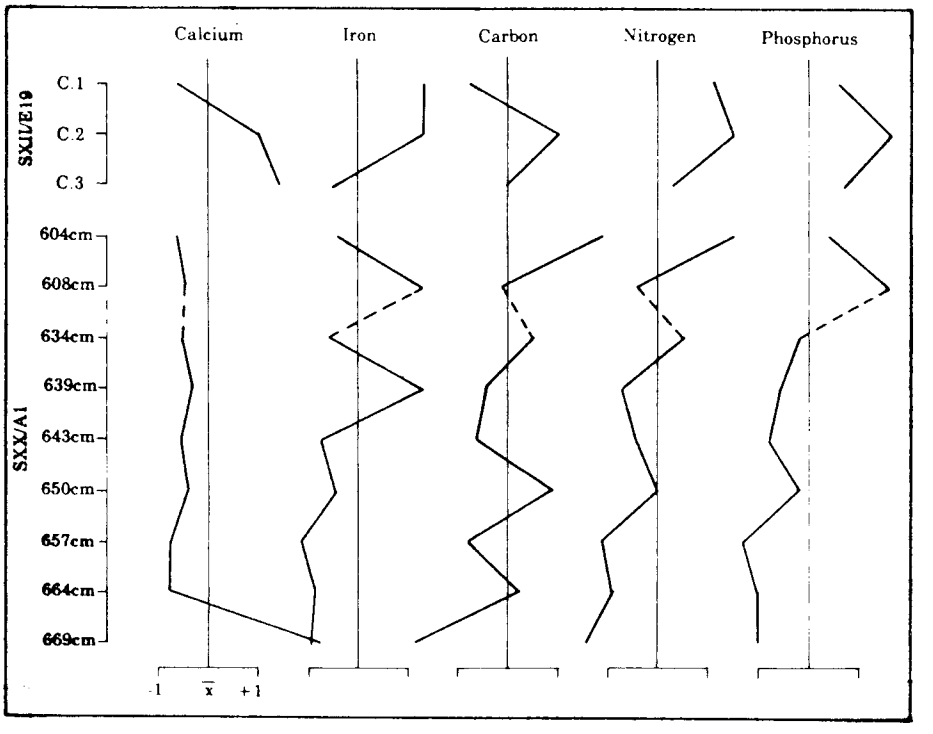

Fig. 2. Geochemical composition of Samouqueira deposits. Curves represent ±1 standard deviation based on data in Table 2. Dashed line indicates samples not yet analyzed. The break between the curves for SXII/E19 and SXX/A1 is used to emphasize that these are different areas (see text).

Diet and economy

Medo Tojeiro

At least 20 species of marine invertebrates were found at Medo Tojeiro, but only four (*Mytilus*, *Patella*, *Monodonta* and *Thais* [or possibly *Purpura*]) were major sources of food (Table 1). Other species (*Cardium*, *Glycimeris*, *Ostryea*) were present but not common. Barnacles and sea urchins appear to have been collected frequently, and crustaceans rarely. Much of the variation in representation of the four major species (Table 1 and Figure 1) may be due to taphonomic factors. *Monodonta* and *Thais*, both of which have quite robust shells, are more frequent in C.1, the part of the midden deposit which appears to have been most affected by deflation. *Patella* (a strong shell) is more common in C.3 where *Mytilus* (a fragile shell) is least abundant. Almost all the major species could have been collected from the rocky shore now some 30m below the site. The presence of *Cardium* and *Ostryea* suggests, however, that collecting activities ranged some distance away. If *Thais* and/or *Purpura* were not picked up along the shore following storms (one possibility) then their presence suggests use of nets and offshore "fishing" in boats.

We recovered no bone at all, and interpret the Medo Tojeiro midden as a single-purpose site, perhaps one used seasonally for very short periods. Oxygen isotope analyses of shell are now in process to try and narrow down the range of possibilities.

We also note that the frequencies of species can differ remarkably within the same level of two adjacent squares. This suggests rapid accumulation of the deposits, possibly resulting in a record of the collection and discard of individual "catches" of shellfish.

Samouqueira

Analysis of the Samouqueira fauna is still in progress. Preliminary results show that shellfish (Table 3), fish (*Sparus auratus*), mammals (*Cervus elaphus*, *Sus scrofa*, *Lepus capensis*, *Vulpes vulpes*) and birds are all present along with probable dog (?*Canis lupus* f. *familiaris*). The frequencies for *Cardium* reflect closer proximity of habitats suited to this species than at Medo Tojeiro. The difference in frequencies for other shellfish from those at Medo Tojeiro may be due to season of occupation, local ecology, technology, taphonomic processes or a combination of all four. However, the diet of the occupants of Samouqueira was more varied than at Medo Tojeiro. Whether the two sites represent fragments of a larger, common, subsistence-settlement pattern remains to be determined.

Palaeobotany

Samples were collected at Medo Tojeiro and Samouqueira for both palynological and palaeobotanical analysis. Preliminary results are available only for palaeobotany (Table 4) and should be interpreted with caution until all samples have been analyzed. They suggest a slightly more varied terrestrial ecology in the region around Samouqueira than near Medo Tojeiro, and this is consistent with the faunal assemblages. The presence of *Pinus* cf. *pinea* and *Pistacia* sp. show that the vegetal component of the diet could have included nuts, and further analyses may help to narrow down the range of possible times during the year when these sites were utilized.

Comparisons

The faunal assemblages from the Muge shell middens are not completely published (cf. Roche 1972), while those from previously excavated sites in the Sado basin are only now being studied (Arnaud 1982, in press; Rowley-Conwy, personal communication 1985). Detailed reports available for later sites (Zambujal: von den Dreisch and Boessneck 1976; Rotura: Gautier and Lentacker 1985) suggest that even after the introduction of domestic animals a mixed economy incorporating hunting, fishing, herding and cultivation was maintained. It is not, therefore, surprising to find that both Medo Tojeiro

Table 3

Samouqueira 1984, SXII/A19-G19, A20-G20

Summary of shellfish frequencies.

Genus	Mean %	s	Samples n
Patella	44.9	17.3	9
Mytilus	17.6	3.5	8
Cardium	11.2	10.0	4
Thais	38.0	12.4	9

Table 4

Charcoal from Samouqueira and Medo Tojeiro[a]

Taxa	Samouqueira (6 samples) n	%	Medo Tojeiro (5 samples) n	%
Conifers				
undifferentiated	13[b]	26.5	8	6.7
Pinus sp.	19[c]	38.8	9[d]	7.6
P. cf. *pinea*	10	20.4	81	68.1
Juniperus sp.			2	1.7
Hardwood				
undifferentiated	3	6.1	12	10.1
Pistacia sp.			3[e]	2.5
Unidentifiable	4	8.2	4	3.4
	49		119	

[a]Identifications by Janus Zwiazek; n = number of pieces, unidentifiable = too small or too poorly preserved to identify
[b]Includes 3 uncharred conifer fragments and 2 uncharredcf. conifer fragments
[c]includes 2 cf. *Pinus* sp.
[d]includes 1 cf. *Pinus* sp.
[e]includes 2 cf. *Pistacia*

and Samouqueira represent slightly different economic practices. Flexibility and variation (probably seasonal) appear to have been common here as elsewhere (e.g. the Maghreb, cf. Lubell 1984).

This pattern also appears to be reflected in the artifact assemblage from Samouqueira. We recovered no ceramics or ground stone artifacts, but did find a rich assemblage of predominantly microlithic artifacts made on flint which is not locally available today. Instrumental Neutron Activation Analysis conducted by Dr. P. Sheppard and L. Pavlish, suggests that a wide range of raw materials, apparently coming from some distance, were employed in the manufacture of the microlithic component. If the sources from which these raw materials were collected can be identified, we may be able eventually to delimit exploitation territories and thus regions likely to have sites of the same, or related, populations. It is to this point, but using the evidence of physical anthropology, that we now turn.

SKELETAL BIOLOGY

Discussion of Mesolithic-Neolithic continuities in Portugal must include consideration of the abundant skeletal remains. The Mesolithic material has never been published in full, although Ferembach (1972), Fléchier *et al.* (1976) and Lefèvre (1973) have written on some of the Moita do Sebastião material. Neolithic skeletal material has been studied in even less detail and we therefore have only very slight evidence upon which to base a discussion of Mesolithic-Neolithic continuity. Nonetheless, the evidence available suggests that there is no clear break to be seen between earlier and later populations.

Two partial human skeletons were recovered in 1984 from C.2 at Samouqueira in SXII/G20 and E19. The radiocarbon age of between 5060 and 5320 years BP (5190 ± 130 BP: Beta-11722), makes them probably at least 1700 years younger than the Mesolithic human remains at Moita do Sebastião (7080 ± 130 BP: H2119/1546) and Cabeço da Amoreira (7135 ± 65 BP: Hv-1349 [Kalb 1981 71]). Samouqueira is younger than the Neolithic levels at Cabeço da Amoreira (6050 ± 300 BP: Sa 194) by 1000 years, and contemporaneous with the Neolithic at both Cabeço da Arruda (5150 ± 300 BP: Sa 196), and Medo Tojeiro (5420 ± 160 BP: Beta-11723). We will thus use the Samouqueira material as representative of the time period generally accepted as "neolithic", and the Moita collection at the Geological Survey (Lisbon) will be compared with it.

Comparison of Lisbon and Porto skeletal collections

There is some uncertainty about the date of the Moita material in Lisbon, which could be much younger than the skeletons now housed in Porto that were excavated from dated context in the base of the midden (Newell *et al.* 1979:150).

However, we have now made detailed examinations of the Moita skeletons at the Geological Survey and preliminary surveys of the Arruda material there as well as all Muge skeletons housed at the Mendes Correa Insitute of Anthropology in Porto. On the basis of these studies, we can say that all supposedly Mesolithic Muge material is comparable in terms of general characteristics (size, shape, condition) and that specific aspects, which could be regarded as diagnostic, are equivalent. These results suggest that there are no significant differences between the two Moita collections, and therefore no reason to argue that the sample in Lisbon (excavated up to 100 years ago, and presumably from upper levels in the site) differs from materials in Porto which were excavated much later, from lower strata. We hope to obtain an AMS radiocarbon date for one or two of the Moita skeletons from the earlier excavations which may help to resolve this question.

Dental attrition and dental pathology

We have seriated the Moita adult mandibles using a very detailed system for coding dental attrition (cf. Lubell, Jackes and Meiklejohn in press). This system was developed by Jackes and Weih and is derived from the one published by Smith (1984). The Smith system was not applicable to the Moita mandibles in Lisbon, and it was modified until it was suitable for the particular characteristics of the Moita dentition. The system we developed was found to be completely applicable to all mandibles housed in Porto.

The level of dental pathology amongst the Lisbon Moita specimens is equivalent to that found in the Moita mandibles at Porto. A very preliminary assessment of the numbers of carious molars or those lost pre-mortem has been completed for Moita mandibles in Lisbon and Porto. The Porto mandibles represent attrition stages 1 to 5 and can thus be compared with the Lisbon Moita mandibles at the same levels of attrition. Differences between the Lisbon and Porto samples can be seen, partly perhaps because of the different sample sizes, but overall the differences are slight: 22.6% (12/53 mandibular molar sockets) Porto molars are carious or lost premortem compared to 22.0% (29/132 mandibular molar sockets) of those examined in Lisbon. In both samples, abscessing is rare.

Sex ratios

Females are underrepresented in both samples. We have assessed the Moita Lisbon adult innominates many times by observation of morphology and by measurement of the form of the sciatic notch as seen from standardized photographs. We are continuing the attempt to perfect the sex assignment of damaged and incomplete innominates: at the moment it seems that 44.4% of right innominates are female and 36.8% of left innominates. The Moita innominates at Porto have been assessed only once. The figures will no doubt alter after further work: on preliminary assessment only 25% of the adult sample is female. The difference between the Lisbon and Porto Moita innominates for sex distribution by side is not significant ($X^2 = 3.6$, df = 3, P = .31).

Burial patterns

Some information can be gathered regarding the disposition of the bodies at burial. For specimens in Lisbon this can be derived only from the few fragments left in articulation in matrix. One hand seems to lie in the abdomen and the other often on the shoulder; knees may be flexed, with legs crossed at the ankles. The Porto sample provides clearer information, since so many individuals are still *en bloc* and Roche (1972) published details. The arrangement just described for the Lisbon material is in fact seen often amongst the specimens at Porto (e.g. Moita 3, 12, 19). The Arruda specimens in Lisbon and Porto were also apparently buried in the same posture.

Chemical analyses and stratigraphic provenance

We observed several different types of matrix adhering to the Moita specimens in Lisbon, varying from concreted (e.g. Moita 21, 22, 23, 24), to very hard (Moita 41, 42), to general rather crumbling calcium carbonate (most Moita specimens), to sandy loam and crushed shell (Moita 25a), to dark sandy clay with pebbles and few shells (*sans numéro* of Ferembach 1972: 25, here called Moita CT). We collected samples of ribs with matrix still adhering for chemical analysis, in the hope that the results would help us to distinguish different provenances and, perhaps, time periods within the site. Two sets of analyses were done.

(i) Bone stable isotope analyses by Dr. H. Schwarcz for Moita 22, 24, 29, 41 and CT, show no difference among the samples. The ^{13}C values average 16.4 (s = .669) and the ^{15}N values average 11.8 (s = 1.123), suggesting a "mesolithic" diet about equally divided between foods of marine and terrestrial origin.

(ii) Moita 22, 24, 29, 41, CT, Arruda 28 and an unnumbered specimen from Arruda we have called PJ (all from Lisbon), and an unnumbered fragment of a stray humerus from Porto, were examined by energy dispersive X-ray analysis in a Scanning Electron Microscope. The matrix adhering to the Porto sample was in no way different from that on the Lisbon specimens with concreted matrix. In all cases the bone mineral content is the same, with high calcium and lower phosphorus. The matrix differed very slightly among specimens, but even Moita 41 showed aluminium, silicate and potassium in the matrix (indicating a clay component) just as did CT. The matrix consists of a little more silicate, potassium and iron when it is clay rather than shell, but the lack of difference among the specimens is surprising. More sensitive techniques (e.g. staining with Prussian Blue), pick up slight iron staining on the periosteal surface, as shown for the Porto humeral fragment, even when the matrix appears to consist entirely of concreted calcium carbonate.

Therefore, while there were variations in the matrix of the Moita midden (greater or lesser concentrations of shell or clay - a normal circumstance in shell middens and just as described by Roche [1972]), we cannot use these variations to distinguish different time periods. They occur across groups of Moita bones in Lisbon. The matrix adhering to Porto bones appears similar to the "general" matrix found with the Lisbon specimens, with the expected variations in hardness. We conclude that Moita specimens from the excavations of Ribeiro and of de Paula e Oliveira in the 19th century, and those from the excavations conducted by Roche and Veiga Ferreira in the 1950s, can be grouped together as Mesolithic.

Post-cranial analyses: Samouqueira vs. Moita do Sebastião

We proceed then on the assumption that the Moita material in Lisbon is a homogeneous grouping of individuals dating to a "mesolithic" time period which can be compared with the two individuals from Samouqueira, dating rather later, to a period which many would assume to be "neolithic"

Post-cranial metrical data

Table 5 provides data for comparison. Distinctions between males and females are made on the basis of a number of careful reassessments of sex using (1) innominate morphology, (2) measurement of the sciatic notch from standardized photographs, and (3) univariate and multivariate tests on long bone measurements. This is necessary because the bones labelled as belonging to a single individual are very often a mixture of several. For example, Moita 5 has three right and two left clavicles. Moita 7 consists of a minimum of 4-5 individuals on the basis of femora and innominates; possibly two males, one of whom is 18 years old, an infant, a young child, and another adult. It is, therefore, essential to be extremely careful in deriving male and female means.

From Table 5 we can see that Samouqueira 2 is likely to be a male, and that Samouqueira 1, although less robust, is nonetheless male based on tibial measurements.

We see no evidence that the bones of either Samouqueira 1 or 2 diverge in size or shape from those of Moita males. Moita stature has been estimated from Trotter's (1970) formulae, using maximum length measurements. Examination of Table 6 will show that certain bones consistently give higher or lower stature estimates. On the assumption that the femur gives the best estimate of true stature (see Trotter and Gleser 1958: 102, who advise against using arm bones), we calculate deviations from stature based on femora. We find that the Moita humerus gives a stature estimate equivalent to that of the femur, the ulna estimate is 5.6% too great, and the radius estimate is 4.7% too great. Our data for the tibia are inadequate for reliable estimation, and our measurement of the bone was the maximum, rather than the measurement recommended by Trotter and Gleser which excludes the

Table 5

Measurements (mm) of Moita Skeletons in the Geological Survey, Lisbon.
(all measurements marked * have significant male-female differences: t with alpha at .05)

Clavicle

		mid-shaft diameter*			
		mean	s	n	CV
male	r	12.3	.675	10	5.5
	l	12.2	.718	12	5.9
female	r	10.6	.976	7	9.2
	l	9.7	.577	3	5.9
San. 2	l	12.0			

Humerus

		maximum shaft diameter*				minimum shaft diameter*			
		mean	s	n	CV	mean	s	n	CV
male	r	21.0	1.961	14	9.3	16.7	2.054	14	12.3
	l	20.6	1.454	15	7.0	16.5	1.767	15	10.7
female	r	18.2	1.079	11	5.9	14.1	0.944	11	6.7
	l	17.4	1.272	7	7.3	13.4	1.272	7	9.5
San. 2	l	22.0				16.0			

Radius

		maximum length				physiological length				radial head diameter*				distal breadth*			
		mean	s	n	CV	mean	s	n	CV	mean	s	n	CV	mean	s	n	CV
male	r	236.7	14.896	7	6.3	224.9	14.207	8	6.3	22.8	1.789	5	7.8	29.8	1.932	10	6.5
	l	232.4	10.830	7	4.6	218.8	9.771	7	4.5	21.6	1.817	5	8.4	30.0	1.528	7	5.1
female	r	211.5	10.607	2	5.0	204.7	9.074	3	4.4	19.0	1.414	2	7.4	27.2	1.708	4	6.3
	l	-				-				-				-			
San. 2	r	-				226.0				22.0				29.0			
	l	249.0				225.0				-				29.0			

Ulna

		maximum length				physiological length*				olecranon height*				olecranon breadth*			
		mean	s	n	CV	mean	s	n	CV	mean	s	n	CV	mean	s	n	CV
male	r	260.5	15.834	6	6.1	231.0	14.379	9	6.2	30.5	3.375	10	11.1	25.0	1.871	5	7.5
	l	266.5	11.962	6	4.5	232.6	10.555	8	4.5	32.1	1.287	10	4.0	25.6	1.813	7	7.1
female	r	241.8	11.649	5	4.8	211.5	7.994	6	3.8	27.7	1.506	6	5.4	22.3	1.890	7	8.5
	l	232.5	14.849	2	6.4	221.3	26.407	3	11.9	26.0	3.225	6	12.4	22.0	-	1	-
San. 2	r	264.0				232.0				31.0				24.0			
	l	260.0				229.0				-				23.0			

Table 5 (continued)

Patella

		maximum thickness			
		mean	s	n	CV
all		20.4	1.74	9	8.5
San. 1		18.0			

Tibia

		transverse cnemic diameter*				sagittal cnemic diameter*				midshaft transverse diameter*				midshaft sagittal diameter*			
		mean	s	n	CV	mean	s	n	CV	mean	s	n	CV	mean	s	n	CV
male	r	22.7	1.653	13	7.3	34.8	2.455	13	7.1	19.8	2.145	15	10.8	30.7	1.952	15	6.4
	l	23.2	2.624	15	11.3	35.3	2.576	15	7.3	19.9	2.031	15	10.2	31.2	2.704	15	8.7
female	r	19.3	0.756	7	3.9	30.3	2.059	7	6.8	16.1	0.900	7	5.6	25.3	3.498	7	13.8
	l	19.6	0.548	5	2.8	30.6	1.673	5	5.5	16.4	0.548	5	3.3	24.2	3.271	5	13.5
San. 1	r	21.0				35.0				20.0				31.0			

Talus

		maximum length				maximum breadth				height			
		mean	s	n	CV	mean	s	n	CV	mean	s	n	CV
male	r	52.4	2.252	11	4.3	41.2	2.049	5	5.0	32.1	1.727	8	5.4
	l	53.9	2.667	9	4.9	42.8	1.643	5	3.8	31.0	2.000	4	6.4
female	r	45.0	4.243	2	9.4	40.0	-	1	-	25.0	-	1	-
	l	47.0	4.243	2	9.0	-				28.5	3.536	2	12.4
San. 1	l	47.0								30.0			

Table 6

Maximum length of long bones and stature estimates (Trotter 1970) for Moita do Sebastião (M) and Samouqueira (S). Underlined measurements are estimated.

			Maximum length in millimetres						Estimated stature in centimetres						Overall stature**
ID#	Side	Sex	Femur	Radius	Tibia	Ulna	Humerus	Fibula	Fibula	Femur	Radius	Tibia*	Ulna	Humerus	(cm)
M0024	R	M					281							157.00	157
M1007	R	M		248							172.75				164
M0006	R	M				263	290						171.36	159.77	160
M0006	L	M				266							172.47		163
M0053	L	M				278							176.91		167
M0016	R	M		227			276				164.82			155.46	155
M0016	L	M		227			275				164.82			155.15	155
M0026	L	M			328		272					161.28		154.23	154
M0003	R	M			382	277		365	169.60			174.88	176.54		166
M0003	L	M		253	383		310				174.64	175.14		165.93	166
M0018	R	M		256		278					175.78		176.91		167
M000A	L	M		241							170.11				162
M0032	L	M		224							163.68				156
M0013	R	M	426							163.27					163
M0013	L	M	426							162.80					163
M0017	R	M	452				322			168.99				169.63	169
M0017	L	M	452			279	320			168.99			177.28	169.01	169
M00CT	R	M		252							174.27				166
M00CT	L	M				270							173.95		164
M0025	R	M				250							166.55		157
M0031	R	M						339	162.63						155
M0014	R	M	418	227	361	258	286	354	166.65	160.89	164.82	169.59	169.51	158.54	161
M0014	L	M		230		258					165.95		169.51		158
M000C	R	M		218		237	278				161.41		161.74	156.07	156
M0020	R	M		238		258					168.97		169.51		161
M0008	R	M	406	229	334		286			158.04	165.57	162.79		158.54	158
M0008	L	M	410	229		248				158.99	165.57		165.81		159
M1030	L	M		223							163.30				156
S0002	R	M		249		264					173.13		171.73		162
S0002	L	M				260							170.25		162
M1018	R	M?					271							153.92	154
M0058	L	F			303							149.40			-
M0001	R	F	375							146.73					147
M1029	R	F				241							160.67		152
M0030	R	F				247							165.44		156
M0042	R	F		219							158.74				151
M0022	R	F				236							158.53		150
M0023	L	F		215			273				156.84			149.70	150
M0005	R	F		202							150.68				144
M0005	L	F					265							147.01	147
M9005	R	F				202							144.01		136
M9005	L	F				202							144.01		136
M2011	R	F					282							152.72	153
M0054	R	F		204		227					151.63		154.69		145
M0054	L	F				222							152.55		144
M0010	L	F				243							161.52		152

*This estimate is incorrect (see text).

**This estimate is based, in order of preference, on femur, humerus, radius (-4.7%), fibula (-4.9%), ulna (-5.6%) (see text). The figures in this column provided the mean stature estimates for the population used in the text. When two estimates existed for one individual, the mid-point was used.

intercondyloid eminence. Reducing the ulna estimate by 5.6% provides estimates equivalent to those based on the femur and humerus, and we thus derive an estimate for

Samouqueira 2 which is within 1 standard deviation above the mean for Moita males. Using the data contained in Table 6 the Moita mean male stature is 160.5cm (s = 4.7, n = 20) and the Moita female mean stature is 149cm (s = 5.4, n = 11). Samouqueira 2 stature is 162cm calculated from the ulna stature reduced by 5.6%. The stature derived from the radius (reduced by 4.7%) is 165cm, a discrepancy attributable to the pathology of the right radius.

Post-cranial morphology

Human skeletal elements can vary ~~in size as well as~~ in details of surface morphology. as well as in size

> (1) The shape of articular facets may vary within a certain range, and details of the form of foramina which allow passage of blood vessels and nerves may also vary. Such variations are perfectly normal and the morphology most common within one population may serve to distinguish that group from others. These variations are often genetically determined and may serve to mark genetic relationships between skeletal samples.
>
> (2) Variations which have a large environmental component in their expression, while excluded from population distance studies, may point to the possibility of similar activity patterns. Variations in the size and shape of muscle attachment areas are of considerable interest here, and will be a focus for the future study of Arruda material.

With such fragmentary material, few non-metrical traits can be examined and it is not possible to test the statistical significance of a sample of two individuals against a larger sample. Nevertheless, a general impression can be gained.

The trait commonly observed on the humerus is the presence of the septal aperture just above the distal articular surface. The aperture is found in 13 of 57 right and left humeri from Moita. It is found in the left humerus which perhaps belongs to Samouqueira 1 but not in the Samouqueira 2 left humerus.

The articular surface of the ulnar trochlear notch can take on several forms. At Moita 14 are single, 6 are double and 23 take on a slightly hourglass shape because of the partial division of the vertical and horizontal portions of the notch. Both the Samouqueira 2 ulnae have a slightly hourglass form, indistinguishable from that of Moita ulnae.

The patella may exhibit one of a number of normal variations along its lateral superior margin at the vastus lateralis insertion. The Samouqueira 1 right patella has the classic smooth margin. This form is shown by 4 of the 13 Moita patellae, too small a sample for satisfactory analysis.

The anterior aspect of the distal portion of the tibia occasionally displays an extension of the articular surface, known as the "squatting facet". This extension occurs on 27 of 30 Moita tibiae and on the right tibia of Samouqueira 1.

The talus may show variations in the form of the superior articular facet. In all Moita tali (42/42) the facet extends medially and the right talus of Samouqueira 1 also bears a medial extension of the superior facet. The same facet has a lateral extension in 19 Moita tali, but lacks such an extension in 21 bones. The Samouqeira talus similarly lacks the lateral extension of the superior facet.

A fragmentary right calcaneus from Samouqueira 1 shows an hourglass form of the anterior-middle facet. This form is shown by 12 of 37 Moita calcanei, slightly fewer than the 19 calcanei displaying a double facet form.

A number of other observations are frequently made, but the majority of them relate to spurs of bone forming at sites of muscle attachments. The aetiology of such spurs is complex and they are not necessarily valuable in population distance studies. All such spurs are either entirely absent or extremely rare in Moita and all are absent in the Samouqueira post-cranials.

Further studies are required on characteristics of bone morphology resulting from particular muscle activities. Both Samouqueira individuals had skeletal pathologies, making it inappropriate to discuss muscle markings in detail. The left clavicle of Samouqueira 2, however, had features (a quite marked deltoideus insertion, a strongly developed conoid tubercle and a well-marked pectoralis major insertion) which can be duplicated amongst the Moita clavicles.

This evidence does not suggest genetic discontinuity or divergent activity patterns between the Moita population and that at Samouqueira. We expect this similarity between Moita and Samouqueira to be expressed also by the stable isotope analysis of the Samouqueira 1 fibula now being undertaken at McMaster University, thus indicating a diet combining marine and terrestrial components.

Contrasts between Samouqueira and Moita do Sebastião

Posture at burial

The test excavations at Samouqueira in 1984 were not fully controlled. Many of the human elements were recovered from the faunal bags or the screens. The position of all material was not fully defined by coordinates and so complete details of provenance are unavailable and it is not possible to explain the dispersal of human bone throughout the trench.Altogether 49 human fragments were recognized in deposits between 630 and 640cm below datum, partly in articulation (although perhaps not in situ) in SXII/G20 and F19, scattered over square F20, and with fragments also in E19 and D19.

It appears from several broken bones of Samouqueira 2 that could be reconstructed and for which provenance was established, that the human material was washing downslope to the west. Downslope wash does not, however, provide an explanation for the unusual preservation of Samouqueira 2 as shown in Figure 3. The individual was given an in-flesh burial and yet he is represented now only by two arms. Furthermore, while the arms and hands remain in articulation, no carpal bones are present. Disturbance by plough or rodent burrowing might explain this unusual pattern.

No evidence of burrowing was observed, but the dispersal of Samouqueira 2 cranial fragments indicates that the skull was probably broken by ploughing and widely scattered. Furthermore, fragments of Samouqueira 1 were found upslope to the north, and this is best explained by the dragging action of ploughs. Unless Samouqueira 1 was disarticulated before burial, disturbance must, in fact, explain the disposition of the body which probably was buried in a supine extended postion: but the right arm lay palm upward inside the right leg, with the elbow at knee level and the radius placed on the wrong side of the ulna.

Samouqueira 2 evidently lay on his left side, head to the west and face to the north. The arms were slightly flexed, presumably lying in front of the head. Their unnatural positioning reflects burial after rigor mortis had relaxed. There is no evidence at all for a similar disposition of the body amongst the material from the Muge sites now in the Geological Survey, Lisbon or the Mendes Correa Institute, Porto. That material indicates a careful disposition of the dead in a fairly standardized

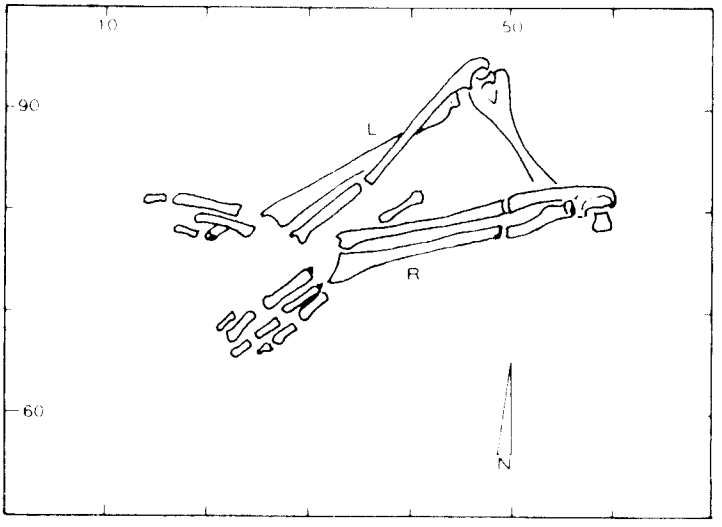

Fig. 3. Plan of Samouqueira 2 at 638cm BD in SXII/G20.

Note that right MCI, II, III are in correct position with dorsal surface up, but with MCV displaced. Left MCI, II, and III are present with MCI lying beneath MCIII.

posture. One basic similarity exists between the Moita and Samouqueira peoples: both buried their dead in the midst of their food debris.

Skeletal pathology

Mild osteoarthritis is fairly common on the Moita adult post-cranials, but there is no example of arthritis sufficiently severe to destroy the cartilage protecting the joint surfaces. In contrast, the right distal radius of Samouqueira 2 has a reactive build-up of bone on the radio-carpal joint surface itself, around central areas of eburnation (smooth, ivory-like bone caused by friction). Slight arthritic changes can be seen elsewhere on the bones: the distal surfaces of the right first and third metacarpals and the left third metacarpal, the left distal radius, on all joint surfaces of both ulnae, and lipping at the joint capsule on a right distal humerus which probably belonged to Samouqueira 2. However, the more complete left humerus, found in situ, shows no joint changes. The total pattern suggests traumatic arthritis to the wrists, with marked emphasis on the right wrist. This individual was not simply predisposed to arthritis; had that been so the changes would have been more general and less variable in expression. He was most likely right-handed and constantly stressing his right wrist, with repeated minor trauma resulting perhaps from the use of heavy hammerstones.

The Moita skeletal remains present several instances of major trauma which can be attributed to violence rather than accident (Lubell, Jackes and Meiklejohn in press). Samouqueira, on the other hand, suggests a high level of accidental trauma resulting from activity and environment. Besides the probable traumatic arthritis of Samouqueira 2, there is evidence for double trauma in Samouqueira 1. Firstly, he had suffered a major fracture of the right distal humerus. Infection of the wound led to osteomyelitis. The break was not reset, resulting in medial deflection and anterior rotation of the trochlea. This led to abnormal functioning of the arm. The right radius has a highly unusual interosseus ridge, because the area of origin of the superior flexor pollicis longus is abnormal. The trochlea of the humerus shows some arthritic changes.

A right third metatarsal which is presumed to have been excavated from below Samouqueira 1 is markedly pathological with bone reaction and destruction, limited (on radiographical evidence) to the volar half of the proximal portion. The best interpretation is injury with infection in the sole of the foot. Moita metacarpals present evidence of infection of the hands (Moita 6, 7, 25a) but infection of the feet was not observed.

It is interesting to speculate upon the level of society which could support an individual such as Samouqueira 1, for whom walking would have been extremely painful. Furthermore, he had suffered from an infected open fracture which had occurred so long before death that only indirect evidence of the position of the fracture is radiologically visible.

In sum, while accidental trauma, resulting perhaps from the life of seashore gathering and fishing, distinguishes Samouqueira pathology from that of Moita, we see no evidence at all for genetic separation of the Moita population and the individuals buried at Samouqueira, despite a time gap of at least 800 to 1,000 years. We do see differences in patterns of pathology and trauma, which may be due to different environments (rocky shore as against estuarine). At Samouqueira, these indicate the support of people with marked physical handicaps. We infer differences in burial practices, but these indicate variations upon a theme, rather than qualitative differences. We find no evidence of biological differences: the similarities of post-cranial metrical and morphological characteristics are striking.

NOTES

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Dr. D. Lubell (University of Alberta), Director, Archaeology
Dr. M. Jackes (University of Alberta), Co-director, Osteology
Dr. C. Meiklejohn (University of Winnipeg), Co-Director, Osteology
Dr. P. Sheppard (University of Waterloo), Archaeology
Dr. A. Gautier (Rijksuniversiteit-Gent), Archaeozoology
Dr. C. Devereux (London), Geomorphology
Mr. R. de Ceunynck (Rijksuniversiteit-Gent), Palynology
Dr. C.T. Shay (University of Manitoba), Palaeobotany
Dr. H.P. Schwarcz (McMaster University), Stable isotopes
Dr. G.P. Weih (Victoria), Osteology.

[2]Penalva collected about 300 artifacts from a deflated surface to the east of the midden which is discussed in Lubell, Jackes and Meiklejohn (in press). Penalva and Zbyszweski (1979) identify these artifacts as belonging to the Languedocian and/or Mirensian industry. They show many similarities to the Portuguese Asturian (Maury 1977) and perhaps to the Asturian of Cantabria as well (but see discussion in Clark 1983). The assemblage has been re-studied by Dr. Sheppard, and a report is in preparation.

BIBLIOGRAPHY

ARNAUD, J.M. (1982) Le néolithique ancien et le processus de néolithisation au Portugal. In, J. Bousquet, ed., Le Néolithique Ancien Méditerranéen. Actes du Colloque International de Préhistoire, Montpellier, 1981, pp. 29-48.

ARNAUD, J.M. (in press) The mesolithic communities of the Sado Valley (Portugal) in their ecological setting. In, C. Bonsall ed., Proceedings of the III International Mesolithic Symposium, University of Edinburgh Press.

BINFORD, L.R. (1968) Post-Pleistocene adaptations. In, L.R. Binford and S.R. Binford, eds., New Perspectives in Archaeology, Chicago: Aldine, pp. 313-341.

CLARK, G.A. (1983) The Asturian of Cantabria: Early Holocene Hunter-Gatherers in Northern Spain. Anthropological Papers of the University of Arizona, No. 41.

COHEN, M.N. (1977) The Food Crisis in Prehistory. New Haven: Yale University Press.

COHEN, M.N. and G.J. ARMELAGOS, eds. (1984) Paleopathology at the Origins of Agriculture. New York: Academic Press.

CZARNIK, S.A. (1976) The theory of the Mesolithic in European archaeology. Proc. Amer. Philos. Soc. 120: 59-66.

FLECHIER, J.-P., J. LEFEVRE and J. VERDENE (1976) Mensurations dentaires des hommes de Muge. Bull. et Mém. de la Soc. d'Anthrop. de Paris., t. 3, série XII: 147-164.

FEREMBACH, D. (1972) Le Gisement Mésolithique de Moita do Sebastião, Muge, Portugal, II. Anthropologie. Lisboa: Instituto de Alta Cultura.

GAUTIER, A. and A. LENTACKER (1985) Etude préliminaire de la faune du site Chalcolithique de Rotura (Setúbal). Manuscript on file.

GILMAN, A. (in press) The Iberian peninsula: 6000 to 1500 B.C. In, R.W. Ehrich ed., Chronologies in Old World Archaeology, 3rd ed. University of Chicago Press.

GUILAINE, J., M. BARBAZA, D. GEDDES, J.-L. VERNET, M. LLONGUERAS and M. HOPF (1982) Prehistoric human adaptations in Catalonia (Spain). Journal of Field Archaeology 9: 407-416.

HASSAN, F.A. (1975) Determination of size, density, and growth rate of hunting-gathering populations. In, S. Polgar, ed., Population, Ecology and Social Evolution. The Hague: Mouton, pp. 27-52.

KALB, Ph. (1981) Zur relativen chronologie Portugiesischer megalithgräber. Madrider Mitteilungen 22: 55-77.

LEFEVRE, J. (1973) Etude ondontologique des hommes du muge. Bull. Mém. Soc. Anthrop. Paris. 10, serie XII, pp. 301-333.

LUBELL, D. (1984) Paleoenvironments and Epi-Palaeolithic economies in the Maghreb (ca. 20,000 to 5000 B.P.). In, J.D. Clark and S.A. Brandt, eds., From Hunters to Farmers: The Causes and Consequences of Food Production in Africa. Berkeley: University of California Press, pp. 41-56.

LUBELL, D., M. JACKES and C. MEIKLEJOHN (in press) Archaeology and human biology of the Mesolithic-Neolithic transition in southern Portugal. In, C. Bonsall ed., Proceedings of the III International Mesolithic Symposium. University of Edinburgh Press.

LUBELL, D., P. SHEPPARD and M. JACKES (1984) Continuity in the Epipalaeolithic of Northern Africa with emphasis on the Maghreb. In, F. Wendorf and A. Close, eds., Advances in World Archaeology, Vol. 3, pp. 143-191.

LUBELL, D., P. SHEPPARD and A. GILMAN (in press) The Maghreb. In, R.W. Ehrich, ed., Chronologies in Old World Archaeology, 3rd edition. University of Chicago Press.

MAURY, J. (1977) Typologie et Préhistoire de l'Asturien du Portugal. B.A.R. International Series S21. Oxford: British Archaeological Reports.

NEWELL, R.R., T.S. CONSTANDSE-WESTERMANN, and C. MEIKLEJOHN (1979) The skeletal remains of Mesolithic man in western Europe: an evaluative catalogue. Jr. Hum. Evol. 8(1):1-233.

REED, C.A., ed. (1977) Origins of Agriculture. The Hague: Mouton.

ROCHE, Abbé, J. (1972) Le Gisement Mésolithique de Moita do Sebastião, Muge, Portugal. I. Archéologie. Lisboa: Instituto de Alta Cultura.

SERRAO, E. da Cunha (1979) Sobre a periodização do Neolítico e Calcolítico do território português. Trabalhos do Grupo de Estudos Arqueológicos do Porto, No. 3, pp. 148-182.

SILVA, C. Tavares de, and J. SOARES (1981) Pré-História da Area de Sines. Lisboa: Gabinete da Area de Sines.

SILVA, C. Tavares de, and J. SOARES (1982) Des structures d'habitat du Néolithique ancien au Portugal. In, J. Bousquet, ed., Le Néolithique Ancien Méditerranéen. Actes du Colloque International de Préhistoire, Montpellier, 1981, pp. 17-28.

SMITH, H. (1984) Patterns of molar wear in hunter-gatherers and agriculturalists. Amer. Jr. Phys. Anthrop. 63:39-56.

TROTTER, M. (1970) Estimation of stature from intact long limb bones. In, T.D. Stewart ed., Personal Identification in Mass Disasters, Washington, D.C.: National Museum of Natural History, pp. 71-83.

TROTTER, M. and G.C. GLESER (1958) A re-evaluation of stature based on measurements taken during life and of long bones after death. Amer. Jr. Phys. Anthro. 16: 79-123.

VON DEN DREISCH, A. and J. BOESSNECK (1976) Die fauna vom Castro do Zambujal. Studien über frühe Tierknochenfunde von der Iberischen Halbinsel, 5, pp. 4-129. Inst. für Paläeoanat., Domestikationsforsch. u. Geschichte d. Tiermedizin, Univ. München.

WRIGHT, G.A. (1971) Origins of food production in southwestern Asia: a survey of ideas. Curr. Anthro. 12: 447-477.

ZBYSZWESKI, G. and C. PENALVA (1979) A estação paleolítica do Medo Tojeiro (Baixo Alentejo). Contribução para o estudo do 'Languedocense' costiero. Comm. Serv. Geol. Port. 8: 1-6.

Samouqueira:

cliffs below the site;
photograph of individual *2 in situ;*
right humerus of individual 1
(photograph and radiograph)