E.
The Early Neolithic human remains from Gruta do Caldeirão

Mary JACKES
David LUBELL
University of Alberta
Edmonton, Alberta, Canada

1. Introduction

A complete analysis of the human remains from Caldeirão would require full comparative data on Mesolithic, Neolithic and Chalcolithic Portuguese skeletal populations. Unfortunately, such data are lacking. In 1984, we began to analyze the Mesolithic skeletal collections from Moita do Sebastião and Cabeço da Arruda (Ferembach 1974; Roche 1972), and have since begun study of the Neolithic samples from Melides (Nogueira 1930), Casa da Moura (Delgado 1867), Furninha (Delgado 1884) and Feteira (Zilhão 1984). Our studies are continuing and are not yet complete. Thus the present analysis must be regarded as preliminary and exploratory.

2. Representation of skeletal elements

The Neolithic deposits at Caldeirão contain 627 pieces of human bone, mostly very fragmentary. Six of these, all found in disturbed areas at the top of layer Eb in the corridor area (two from square L15 and four from square M15) are considered to be possibly intrusive from the overlying post–neolithic layers (see Zilhão, chapters 3 and 9), and are therefore excluded from Table 1 and from any further discussion here.

The Neolithic remains are divided into two assemblages, NA1 and NA2, constituted as discussed in this volume (Zilhão, chapters 3 and 4). NA2 contains the human bone recovered in association with the cardial archaeological horizon excavated at the base of layer Ea and inside layer Eb. NA1 contains the human bone recovered in association with the later early neolithic archaeological horizon excavated inside layer Ea, in the back chamber. Given the partial overlapping of the spatial distributions of the NA1 and NM (Middle Neolithic) horizons, it was not possible to discriminate the bone component of the latter. The human remains here discussed as NA1 therefore probably contain a small component of Middle Neolithic age which had to be subsumed in it for practical analytical purposes (Zilhão, chapter 4). Table 1 records all anatomical elements catalogued during the excavation, including (in the Total column) nine bone fragments not assigned to either of the layers during excavation (a deciduous right lower first molar, a sacral fragment, a lumbar fragment, two foot bones and four bones of the hand).

When whole skeletons are not present and the bones are highly fragmented, it must be determined whether certain bones are either differentially represented or fragmented. Differential representation can be due to many factors: breakage dependent on the structure of the bone; preservation dependent upon conditions in the surrounding deposits; recovery rate dependent upon excavation techniques; the extent to which broken fragments can be identified as specific bones; human and animal interference during and after placement of bodies in the cave. It is possible to estimate differential representation by weighting the frequencies of anatomical elements in proportion to the number of bones in the skeleton.

In Table 1, this weighted representation is expressed as n/ss, the number of catalogued fragments of certain bones (n) divided by the number of those bones in a single human skeleton (ss). Although this figure gives only a rough picture of differential representation, it does show that hand and foot bones are not over-represented, and that in general, all bones are equally represented. The exceptions are the scapula, radius, femur, tibia and fibula. The tibia and fibula may be over-represented because their size and structure allows them to break easily. Three tibial portions were reconstructed, but there was only one reconstructed fibula. One radius was reconstructed (from four fragments). The scapula, of course, is fragile and numerous fragments are to be expected. Only one femur was reconstructed, but it is clear that three adults and two juveniles were represented among the NA1 femora and one adult only by the NA2 femoral fragments.

In Table 1, n/ss is not calculated for teeth and jaws because the number of teeth per individual varies with age. A rough estimate can be derived by dividing total number of teeth present (n = 70, including loose teeth, those still in the socket, and unerupted teeth) by 20 (the number of teeth in a young child) and by 32 (the number of teeth in an adult). This gives a range for n/ss of 2.2 to 3.5, figures that are in accord with the majority of those in Table 1.

The representation of body parts suggests that entire human bodies were laid in the cave. Subsequent breakage of the bone was not due to intentional post-mortem interference. Recovery during excavation was excellent and we therefore regard the sample available for analysis as unbiased.

3. Distribution by horizons

In broad terms, the data for n/ss in Table 1 provides no evidence for great differences between the two horizons. Based on the sacrae and femora, NA1 seems to have a higher MNI and/or more fragmentation. Since tarsals, metatarsals and metacarpals also show higher n/ss values, and these bones do not readily fragment, a higher MNI seems the best explanation. The higher n/ss values in NA2 for pelves, clavicles, scapulae, ulnae and fibulae, probably result from the fact that these bones are among the first to fragment and be dispersed. Their lower n/ss values in the upper level may indicate greater bioturbation; also the probable explanation for the higher number of unidentifiable fragments in the upper level.

Once again, it is clear that complete individuals were laid in the cave and that we are dealing with fragmentation and dispersal due to natural taphonomic processes rather than to unusual interment practices.

Tables 2 and 3 show the distribution of bones over the 1m² excavation units in the two horizons, grouped according to anatomical region to improve sample sizes (the 11 unidentified long bone fragments shown in Table 1 are excluded). The frequency (n) comprises individual fragments before reconstruction, since about 45% of the more than 30 joins made used material from different squares. Density (D) is calculated across the table as the number of fragments/m³ in that excavation unit. The weighted percentage (w%) is calculated by totalling the densities in each column and recalculating the density for each excavation unit as a percent of that total: (density within column/total densities in column)*100. In this way the percentage frequencies of pooled skeletal elements are calculated from the distribution of bones weighted according to the volume of deposit in each square.

A comparison of the distribution of pooled body parts between the two horizons gives a X^2 of 26.8 (df = 7) which indicates a significant difference in body part representation frequencies at P = .0000. The difference lies mainly in the higher frequency of teeth and of jaw fragments and leg bones in NA1. A greater number of individuals contained in NA1, combined with reduced preservation and more disturbance, could account for the differences between the two horizons.

The overall density of human bone in NA2 is 59.1/m³, more than twice that for NA1 of 26.9/m³ (excluding material from square M18 for which a volume estimate was not available). The minimum number of individuals contained in each level must be determined in order to interpret these densities.

4. Minimum number of individuals (MNI)

The MNI is determined by the most frequently represented skeletal element. Since teeth are often the best preserved element, we will consider teeth first and in detail, followed by the most common post-cranial elements in order to check the accuracy of the estimate based on dental data alone.

4.1. Dental data

There are 64 Neolithic teeth, only 15 of them still in sockets (Table 4).

4.1.1. Horizon NA1

The incisors indicate an MNI of 9 in this horizon: an infant of 9–10 months (Hillson 1986:189), a child of 3–4 years (based on the unerupted central incisors in M18sc24), three children between five and seven years (Anderson *et al.* 1976), an early adolescent and at least three adults, one of whom is very old.

The canines provide evidence for a child of 10 years, two adolescents, and four adults, one of whom is very old. This increases the MNI to 12 by adding two adolescents and one adult.

On the basis of the premolars and deciduous molars we have an infant of 10–11 months, a child of 10 years, an adolescent and three older adults. Thus the MNI remains at 12.

Neither the upper nor the lower molars contribute further information. The MNI remains at 12.

Therefore, on the basis of dentition, the upper horizon contains an infant under 1 year, a child of less than 5 years, three children between 5 and 7 years, a pre–adolescent, two adolescents, and four adults.

4.1.2. Horizon NA2

In this horizon the 13 teeth present indicate an MNI of four: an infant of 7 months (a single deciduous incisor), an adolescent (one canine and one premolar), and at least two adults (two incisors, one canine, three premolars, 6 molars). Some of these teeth indicate the presence of a very old individual, perhaps male. Since the heavily worn teeth were found against opposite walls, the presence of two elderly individuals cannot be discounted.

4.1.3. Horizons NA1 and NA2 combined

If we combine the data, the MNI based on the upper horizon is increased to 14 because the canines add a fifth adult and a third adolescent, probably male. However, for the determination of the MNI, the lower horizon should probably be considered separately. There was only one cross–horizon join: a tibia (O11–74) in the lower horizon which fitted with P11sc174 whose upper horizon provenance was regarded as uncertain.

If the two horizons are considered separately, the teeth indicate a maximum MNI of 16.

4.2. Post–cranial data

The left tali indicate that there are four adults in NA1 and two in NA2. The left tibiae suggest four adults in NA2, the highest count of individuals for this level based on post–cranial elements.

Examination of the identifiable metatarsals (Table 5) increases the possible MNI for the upper horizon to 5 or six (the identification of one right MT IV is uncertain since the specimen is represented only by the shaft). The possibility that Bronze Age individuals are present in this horizon must be considered: however, the metatarsals and metacarpals which are possibly Bronze Age were excavated only from square M15 and none of the right fourth metatarsals was found in that square. One partly fused metacarpal in NA1 indicates the presence of a late adolescent (ca. 16–18 years).

5. Age and sex of adults

Determination of the age and sex of individuals represented affects the final MNI. Both dental and post–cranial data are important here.

5.1. Dentition

Dental age estimates in Table 4 are based on examination of the degree of attrition of the adult teeth. The presence of widely differing levels of attrition can increase the possible MNI.

Three NA1 adults are represented by lower right lateral incisors which have wear of 4, 5 and 7 on a scale of 0 to 8 (Smith 1984; Lubell *et al.* 1989). Comparison with data on complete dentitions from Arruda, Feteira, Melides and Casa da Moura, suggests estimated ages ranging from at least 25 to over 50 for these three individuals. The three left lower central incisors have wear of 1, 3 and 3, suggesting one or two additional young adults and a subadult. A minimum of four adults in the upper horizon thus seems likely and is confirmed by the lower canines.

The teeth in the lower horizon indicate the certain presence of an adolescent (anterior dentition with wear of 1, 2 and 3) and of an older individual (cheek teeth with wear of 5, 5, and 7). The number of other adults present is arguable. There appears to be a young adult (perhaps 25 or 30) represented by three teeth with wear of levels 3 and 4 and also another individual, perhaps 30 to 40, represented by two teeth (both third molars with attrition of level 2). Two more teeth could belong to the very old individual, but seem more likely to represent a fourth adult, of middle age. The material from O11 listed in Table 4 appears to confirm the presence in NA2 of an old male and a young adult female.

Our analyses of Neolithic dentitions are not complete and so it is as yet impossible to assign the right upper PM^3 (wear level 5) and the upper I^2 (wear level 2) to any particular age group. It should be noted, however, that the incisor is heavily chipped and strongly facetted lingually, down to the cemento-enamel junction, conforming to what we have found in other Neolithic Portuguese anterior maxillary teeth: trauma and attrition of the lingual surface of incisors is extremely common in middle-aged adults.

We caution that wear patterns for the Portuguese dentitions are not yet established. Only Moita and Arruda have provided material that can be seriated satisfactorily, and there seem to be differences even between these two samples, which represent proximal groups in terms of time, geography and ecology. The Neolithic material is not comparable with them and as yet has not provided reliable data. Not only is more analysis needed, but the use of at least some of the Neolithic teeth for non-dietary functions, and the fact that the majority of them have been found loose, complicates interpretation.

5.2. Femora

Measurements of the femora can be used to assign sex to individual bones. The estimated maximum length of the femur catalogued as P12-133/O12-35 is 399mm (giving an estimated stature of 156.4cm if male: Trotter and Gleser 1958). By comparison with data for Arruda on the diameter of the head, the maximum diameter of the shaft and the circumference of the mid-shaft region, this femur almost certainly came from a male (Table 6). The other femora excavated at Caldeirão are also male in their dimensions; for example, the fragmentary femoral shaft P11-155, the measurements for which are also given in Table 6 to illustrate the method of sex assignment using femora.

Age can be roughly assessed from femoral radiographs by examination of the proximal trabeculae which alter with age (Nemeskéri *et al.* 1960; Singh *et al.* 1970). The proximal trabeculae of the P12–133/O12–35 femur have been determined as Grade III (Fig. 1, and cf. Bergot and Bocquet 1976). This method of age determination has a correlation of .706 with real age for males (Bocquet *et al.* 1978) and by regression, the age of this femur is 39.4 years with a possible range of 26 to 53. In our samples from Moita and Arruda, males with Grade III femora associated with dentitions, have attrition levels that are quite advanced. These levels are consonant with either the very old lower molars or the right second molar with attrition of grade 4 in the lower horizon.

Samples of femora, each 4mm thick, were removed from the anterior mid–shaft. These were embedded in epoxy resin and thin sections of 30–40 microns thickness were prepared for microscopic examination of the cortical bone. Microscopic examination of osteons and osteon fragments is believed to be an accurate indicator of age at death (Simmons 1985; Thompson 1979). Replacement of lamellar bone by secondary osteons and the subsequent increase in the number of osteons is an age–dependent characteristic of cortical bone. Unfortunately, in the Caldeirão samples (as in other prehistoric Portuguese samples we have examined) accumulation of calcite has altered the microstructure and observation of cortical structure is impeded. Therefore, it has not been possible to follow the procedures recommended by Thompson and other researchers.

We were able to prepare four thin sections. Each was examined three times for the number of complete secondary osteons within $1mm^2$ sectors (Table 7). P12–133/O12–35 appears to have no lamellar bone and large numbers of small osteons; it may be the oldest femur. O11–101 may be from a young individual, and P11–155 from one of middle age. The divergent results for O14–34 may be unreliable because the sample sectioned was distal to the mid–shaft and medial rather than anterior. Since no clear pattern emerges, the census of osteons without other data such as numbers of osteon fragments and osteon size, may not permit even simple age seriation.

For the Moita and Arruda samples (males and females analyzed together), cortical thickness (measured on the mid–femoral bone samples and adjusted for robusticity – cortical thickness/midshaft sagittal diameter) and age (as represented by dental attrition level) have a correlation of .71. The relationship cannot be entirely linear (Fig. 2a), but our samples are too incomplete and our variables not sufficiently precise to allow improved correlation coefficients with non–linear methods of analysis. It is certain that adjusted cortical thickness is reduced in extreme old ages (represented by the loss of all but a few marginal fragments of enamel on molar teeth).

The distribution of unadjusted cortical thickness values by proximal trabecular grades for all our Portuguese samples, shows clearly the curve of age–dependent cortical area data (Fig. 2b). From a mean of 4.9mm at the youngest trabecular grade, through the mean of 6.4mm at the midpoint of the distribution of the grades and back to 4.9mm at the grade of greatest trabecular rarefaction, the curve shows the expected increase into middle age and the subsequent decrease. Thus O11–101, which has the lowest cortical thickness, could be either a young individual as suggested above, or the oldest individual present. Bone density may help to resolve this uncertainty.

Bone density (sample weight/sample volume) is particularly difficult to study because of diagenesis. Nevertheless, our results from all sites are in general accord with an expected figure of 1.8 to 2.0 gm/cm³ (Mazess 1983). We find that the density of adult cortical bone is 1.62 gm/cm³ (n = 78, excluding Moita). The density of subadult bone is significantly different (.92 gm/cm³, n = 10: t P = .001). While the density figures for adults may result from a greater uptake into porous bone of minerals from the surrounding deposits, that is not relevant to the point under discussion: we can expect younger individuals to provide less dense bone samples. The low density of O11–101 in comparison with P12–133/O12–35 (Table 7), again suggests a young age.

Given all the problems, we can not yet discuss the ages of the Caldeirão femora with any certainty, beyond the indication that we have already given: the femora from NA1 are likely to be from adults of middle age, whereas one NA2 femur may be older (but not from the very old NA2 individual represented by the two very worn molars) and one from a young adult. In sum, on the basis of the femoral data, we have two males of middle age in the upper horizon and two adult males in the lower horizon, one older than the other.

5.3. Patellae

Three patellae were recovered. Two which could be a pair from the upper horizon, coincide exactly in their maximum thickness with the Moita mean of 20.4mm (Lubell and Jackes 1985:126) and the Arruda mean of 20.2mm, n = 30. One patella, found in the southern portion of the lower horizon deposits, is longer, wider and thicker than the Arruda mean and is therefore most likely to be a male.

5.4. Tibiae

Metrical data for six tibial fragments are given in Table 8 along with summary data for Mesolithic samples. The tibial shaft from NA1 (P11–151) is a very robust bone at both the cnemic and mid–shaft levels -- certainly an adult male. It is unusual in having a high mid–shaft index (transverse/sagittal: 74.2) indicating a very broad shaft. Our work so far suggests that Neolithic tibiae were often much broader (the shafts being more rounded) than those from Moita and Arruda but that, in fact, the Neolithic tibiae were very variable in their form. The measurable tibiae from NA2 have mid–shaft indices of 65.5, 58.1, 62.8, 69.0 and 66.7. They are all markedly narrower than the tibia from NA1 which is more than two standard deviations beyond the lower level mean of 64.4. All the tibiae are relatively robust, suggesting males, one in the upper level and four in the lower level.

5.5. Pelves

Pelves provide the most direct and accurate means of determining sex. Unfortunately, very few useful pelvic fragments are available from Caldeirão: P12–111, O12–30, O12–36 and O12–45 (lower horizon), all right fragments, join and represent a male. R11–6, also from the lower horizon, is a fragment of a left male innominate.

Age is usually assessed on the pubic symphysis, of which only one was present, a male right symphysis (P12/111) in the lower horizon. Age can be estimated using several methods; we used Todd (1920) and McKern and Stewart (1957). Multiple assessments using both methods suggest an age between 22 and 26 years.

Age can also be based on the pelvic auricular surface, and we used a preliminary (manuscript) version of the conclusions of Lovejoy *et al.* (1985). The male pelvis O12–45 from the lower horizon could be analyzed. There was: (a) no furrowing of the surface; (b) presence of islands of macroporosity over the whole surface; and (c) lipping of the apex of the auricular margin. These suggest an individual equivalent to Lovejoy's phase 6, giving an estimated age of 40–45.

R11–6, the left ilium of another male from the lower horizon, also has an auricular surface (the specimens are clearly not from the same individual). In this case, the features appear to suggest Lovejoy's phase 5, or an estimated age of 35–39. The major differences from O12–45 are a lack of macroporosity and minimal lipping.

5.6. Metacarpals, metatarsals and tali

Sex was assigned for unbroken metacarpals and metatarsals using stepwise discriminant analysis (SPSS Inc. 1983:623–645) of metrical data. Caldeirão specimens were compared with samples from Arruda and Moita that were associated with individuals for whom sex was determined from pelves or femora. The method used is explained by the following example. Five measurements were taken on Arruda fourth metatarsals and sex was assigned by association. Of the fourth metatarsals, 28 were called male and 22 female. The difference between male and female measurements was tested using F and t tests, and all measurements but one were significantly different ($P = .000$). Stepwise discriminant analysis of these data resulted in perfect discrimination, allowing the assignment of sex to the unknown Caldeirão bones. Fig. 3 shows the placement of the four complete Caldeirão fourth metatarsals amongst the Mesolithic specimens.

Using this method we can say that in NA1 there are two adult males (right MT IV) and two adult females (right MT II). One individual in NA2 is male and one is female (left MC I).

Discriminant function analyses of the left tali metrical data confirm the presence of two adult males and two adult females in the upper horizon.

5.7. Clavicles, scapulae and arm bones

Bones of the upper body provide fewer well-established sexually dimorphic characters and our available material is very meagre. One complete clavicle in the upper horizon (R12–4) was extremely small (109mm long and 9mm in diameter at the mid-shaft), well outside the range of the Arruda females. One right clavicle (R13–45) from the lower level, with a mid shaft diameter of 11mm, cannot be sexed on present evidence. Another (R11–14), this one a left, with a length of 144.7mm and a mid shaft diameter of 13.2mm, is equivalent to the most robust of the Arruda males.

Four measurable scapula fragments were present and it seems likely that they probably represent a male and a female in each horizon (Table 9).

The humerus is useful for sex determination, so it is unfortunate that only one small humeral fragment was available (R12–53 in NA1). This had a distal articular breadth of 40mm, a value falling almost directly on the population means for Moita (40.7, $n = 19$), Arruda (40.9, n = 33) and Melides (39.4, n = 67), making it unlikely that we will ever be able to determine the sex of this fragment.

Three radii could be measured. One from NA1 (P15–14) had a distal width of 29mm which is within the Arruda male range. There were two radii from NA2. For these we have the diameters of the head and neck. Both seem to fall within the male range established for Arruda and O12–38, with a neck diameter of 44mm, is almost certainly male.

Three ulnae from the lower horizon could be measured. Metrical data for the olecranon of O12–37 (left) suggest a male in comparison with those from Moita and Arruda (but these measurements have large coefficients of variation and may be unreliable). The other two fragments (both left, one from O11 and one from O12) were both measured at the highest point of the interosseus crest and in the sagittal plane at that same level. These measurements were evolved after observing that the Moita ulnae seemed to be highly dimorphic in terms of the development of the crests of muscle attachment. On the basis of the work done so far, it is likely that both these ulnae are male.

5.8. Summary of minimum number of individuals, age and sex

NA2 certainly contains at least four adults and an infant. Two of the adults are males of at least 40 years. One of the adults is likely to be female. The fourth may, in fact, be a late adolescent male. The tibial shafts indicate the presence of four males in this level. The teeth also provide evidence of four adults in this level, which would give a total of six individuals.

6. Disposition of bodies in the cave

NA1 thus appears to contain the remains of a number of individuals. However, because the bone fragments are scattered over 36 excavation units and the density is low (26.9/m3), it is impossible to reconstruct those individuals. Square O12 has the highest density of material, but in fact contains only two unrelated fragments (a hamate and a thoracic vertebra).

By examining the distribution of the bones within the deposits, we can gain no further data on the upper horizon beyond that already presented. For NA2, however, such an examination confirms the tentative conclusions of the adult MNI analysis. It is especially helpful in verifying the presence and characteristics of the three adult males, two healthy individuals in early middle age and a third arthritic and no doubt considerably older.

The lower horizon contains fewer individuals than the upper horizon but the remains are more concentrated (59.1/m3) and occur within only 12 excavation units. The greatest density of material (790) was found in Square O12 along the the north wall of the inner chamber.

Square O12 contained seven pelvic fragments representing the right and left innominates of an adult male who was at least 40 years of age. Data on the femoral cortex (Table 7) and proximal femoral trabeculae of the male femur P12–133/O12–35, also suggests an age of at least 40 years. Three fragments of a sacrum and central fragments of a lumbar spine were also found in O12. The sacrum was fused and probably male. One lumbar centrum (L.4?) had an anterior collapse of up to 7mm, reactive bone on the ventral surface of the centrum and osteophytes. Another lumbar vertebra was osteophytic. A mandibular condyle from the same level in O11 came from an elderly individual with arthritis. O11 also contained a large left lower first molar of an elderly individual (grade 7 wear).

These data suggest that two males are represented here, on the north side: one elderly (with arthritis and some osteoporosis: vertebrae, sacrum, mandibular condyle, first molar with grade 7 wear) and one middle aged (non–osteoporotic femur, pelvis, radius and ulna). Both bodies probably lay along the north wall of the inner chamber of the cave.

Arthritis was either common amongst this group or else the fragments of the elderly male were scattered widely. Evidence of an arthritic spine came also from squares on the southern side of the cave: an L.5 centrum from Q13 (horizon unknown), a lumbar centrum from R12 (with extreme osteophytosis and collapse) and an axis from Q12: the last two are both from the lower horizon. An arthritic first phalanx of the big toe was also found in Q12. Two lower molars were found, one (an M3) indicating the presence of an individual of advanced age. The evidence in general suggests the presence of one elderly male whose remains have been widely scattered, being found both in the northern and southern portions of the deposits. While the concentration of skull fragments in two squares along the southern wall may indicate a relative lack of disturbance, other evidence suggests considerable bioturbation.

The southern squares R11, R12 and R13 contain many skull fragments, mostly unidentifiable; some making up an adult occipital and partial left and right parietals, others forming a male frontal and left parietal and temporal. Almost two thirds of the human material from these squares is from the upper body (crania, shoulders, arms and hands), but the post–cranial fragments are more disparate than those from the north wall. The majority of identifiable pieces appear to represent males, but a few pieces in R12 (a scapula and a left first metacarpal and possibly a clavicle) indicate the presence of a female.

However, the two molars from R12 are by no means small. The tooth most likely to be female on the basis of measurements is the left lower first molar from O11 (O11–100). In fact, consideration of the teeth is very unlikely to allow us to identify individuals. When the 14 permanent teeth in the lower level are partitioned among the five individuals they have been identified as representing, it appears that even these small, dense, taphonomically stable elements of the human body, have been scattered from one side of the cave to the other. If this interpretation is not accepted, then it must be granted that no MNI calculation can be undertaken.

7. Population comparisons

7.1. Dental measurements

The bucco-lingual diameter can be accurately taken for both loose and *in situ* teeth, and it is less affected by attrition than the mesio-distal diameter. We can, therefore, assume that the bucco-lingual diameter provides a good basis for population comparison (although the small sample sizes available for Caldeirão mean that any conclusions must be considered tentative; see Tables 11 and 12).

Fig. 4 compares the data in Table 11 on bucco-lingual diameters of the Caldeirão mandibular teeth (excluding L15sc289 an Upper Palaeolithic molar which has a width of 9.2mm) with Mesolithic samples from Moita do Sebastião and Cabeço da Arruda (data collected by Meiklejohn: Meiklejohn *in litt.* December 1987 and see Lubell 1984) and Neolithic samples from Melides, Feteira and Casa da Moura (data collected by Jackes in 1986), all measured as part of our ongoing project on the Mesolithic-Neolithic transition. The inclusion of measurements taken by two individuals is justified in light of an inter-observer error test using 171 Melides bucco-lingual measurements, resulting in a probability of .000 for a departure from 0. While there are indications of a reduction in tooth size from the Mesolithic to the Neolithic, this is clearly demonstrated only in a comparison of Melides and Moita (apart from the large Melides central incisor, confirmed in a separate analysis by Meiklejohn *in litt.*). The other three Neolithic sites are very similar. This similarity is clearer when the Casa da Moura means are based on the large sample of partially analyzed loose teeth (e.g. the mandibular canine statistics are: mean 7.7, standard deviation 0.6, sample size 268). The mandibular P_3 shows the most consistent reduction from Mesolithic to Neolithic, but it is noteworthy that the Caldeirão mandibular P_3s are equivalent in size to those from Moita.

The maxillary teeth (Table 12), on the other hand, present consistent reductions for both the M^2 and M^3 and here the Caldeirão teeth are equivalent to those from the other Neolithic sites. However, the Caldeirão upper incisors and M^1s are well above the sample means, even for the Mesolithic sites (but the small sample sizes for Caldeirão preclude any significant comparisons).

In summary, while Caldeirão dental measurements mostly overlap those of the Mesolithic populations of Moita do Sebastião and Cabeço da Arruda, and are generally larger than those from Melides (Zambujal cave), they are closest in size to those from Casa da Moura and Feteira.

7.2. Measurements of the talus and calcaneus

Table 13 provides partial data on tali from five Portuguese samples. The maximum length is used to test whether Neolithic populations are smaller than those of the Mesolithic. In this case, Melides (and probably Feteira) is significantly different from Moita and Arruda, and the Caldeirão sample is too small for analysis. Stepwise discriminant analysis of the Moita and Arruda tali has enabled us to assign sex to the Mesolithic tali and those from Caldeirão. On the basis of the limited data available, it appears that Caldeirão individuals are smaller than the average for Mesolithic populations but perhaps larger than for some Neolithic ones.

The relatively large size of the Caldeirão individuals is again suggested by the few calcanei present, based on data for maximum calcaneal length in Table 14. However, the coefficients of variation support the possibility (established by discriminant function analysis using Arruda data for comparison) that all the measurable Caldeirão calcanei are male. The sample does not therefore allow population comparison.

7.3. Metatarsal and metacarpal measurements

On the other hand, we may conclude that the metatarsals and metacarpals include both males and females. Table 15 provides data on the mid-shaft transverse diameters of Mesolithic and Neolithic examples. This measurement was chosen for comparison because it provides the largest sample sizes and can be taken with consistency and accuracy. The Caldeirão bones again are relatively large, with the metacarpals broader than other Neolithic samples -- broader than Mesolithic means in some cases. For the Neolithic metatarsals we have additional data from Furninha collected in 1986. These data demonstrate that Mesolithic specimens are not necessarily larger than Neolithic ones, and that Caldeirão bones, like those from Furninha, may be larger than other Neolithic bones, and also larger than Mesolithic specimens.

The lack of a clear distinction between the Portuguese Mesolithic and Neolithic skeletal populations has previously been noted (Meiklejohn and Schentag 1984) on the basis of Moita, Arruda and Melides cranial data. Similarly, using t-tests on five metrical variables, we find no difference between the Arruda femoral data (n = 66) and those from Feteira (n = 26).

7.4. Non-metrical skeletal traits

The surface morphology of bones may present variations which are genetically determined. Such non-metrical variations in morphology may provide clues to the genetic affiliation of groups. Certain characteristics of the talus and calcaneus -- all variations in the form of the articular facets -- are examples of useful genetic marker traits.

We do not have sufficient data for a full analysis of genetic distance. Nevertheless, a general impression can be gained from the data in Table 16: Moita and Arruda bear similarities to each other; Melides and Feteira appear to have similar trait frequencies; Caldeirão may well be most similar to Arruda.

Variations in dental traits may be particularly useful in population studies, since dental characters are believed to be very stable. Table 17 summarizes some of the work (as yet incomplete) done by Jackes and Meiklejohn on Portuguese dental traits. Unfortunately, even for the Caldeirão teeth with the largest sample sizes (lower molars), no conclusions can be reached. Studies of genetic distance require much more complete samples than that provided by Caldeirão.

7.5. Trauma and Pathology

There is no sign of severe cranial or post-cranial pathology or trauma. In NA2 there seems to have been at least one arthritic spine: the dens of an axis has quite severe arthritic changes and two lumbar centra have osteophytosis. Arthritis is also evident on one mandibular condyle. One lumbar centrum shows signs of slight trauma; the anterior portion of the centrum has collapsed as a result of osteoporosis.

The upper level also has a lower lumbar centrum with osteophytes, as well as an eleventh thoracic vertebra with mild osteophytosis and a very small Schmorl's node (an indication of pressure from the vertebral disc on the end plate of the vertebra).

As discussed, it is not possible to determine whether the cave contained several arthritic individuals or the widely scattered fragments of one severely affected individual. Certainly, spinal osteophytosis or collapse was common. Fourteen lumbar central fragments were identified from throughout the cave, thirteen of them adult. Of the adult lumbars, five (36%) were pathological.

The upper horizon contains two second metatarsals with abnormalities. One (Fig. 5) shows an exostosis on the plantar surface of the distal shaft. The X–ray demonstrates that there was no infection involving the medullary canal, but suggests a thickening of the cortex. The other apparently sustained a fracture to the proximal end, through the plantar portion, resulting in arthritic changes to the proximal articular surfaces (Fig. 6).

8. Diet and health

8.1. Stable isotopes

The collagen extracted from human rib samples used to date two of the archaeological horizons was also analyzed for the stable isotopic fractions of $\Delta^{13}C$ and $\Delta^{15}N$. The values for the two samples are: $\Delta^{13}C$, −19.6 and −20.2; $\Delta^{15}N$, 8.8 and 8.7. These are almost precisely equivalent to the values determined for other Neolithic sites (Feteira, Fontainhas, Rocha Forte II) but different from those determined for ten Mesolithic samples from Arruda, Moita and Samouqueira (mean $\Delta^{13}C = -16.6$, $s = 1.16$; mean $\Delta^{15}N = 12.1$, $s = 1.8$). These figures suggest a Neolithic diet based largely on foods of terrestrial origin. This is in contrast to the Mesolithic diet as determined on the basis of coastal and estuarine sites, in which foods of marine origin were naturally more frequent.

8.2. Dental indicators

Dental pathology rates are often considered to be a reflection of diet. Table 18 records the frequency of caries in all observable permanent teeth for both Mesolithic and Neolithic samples. Despite differences in time and diet, the frequencies of caries in both Mesolithic and Neolithic samples fall within the same range. Thus, dental pathology rates in this instance cannot be attributed directly to dietary factors. Without sample sizes large enough to determine the age structure of the populations considered, dental pathology rates cannot be compared.

Furthermore, the data in Table 18 cannot be considered an entirely accurate measure of the rate of dental pathology because: (1) not all teeth are equally represented in each sample, but some teeth (e.g. lower molars) are more susceptible to decay than others (e.g. canines); (2) premortem tooth loss, which is a result of dental pathology, may affect caries rates because it reduces the number of observable teeth. The solution is to restrict observation to, e.g. lower molars, including premortem tooth loss with carious teeth as a measure of pathology. Under these conditions wide variations in pathology rates are still seen over both Mesolithic and Neolithic samples: e.g. 14% to 40% at Feteira (Levels 1 and 2 combined and Level 3 respectively), and 19% for Arruda to 30% at Moita (Jackes and Lubell 1986).

Unfortunately, the Caldeirão sample does not permit observation of premortem tooth loss; we can only examine caries rates for intact lower molars (Table 18). The apparent difference between the upper and lower levels, while probably a result of small sample size, may be no more than a reflection of the variation seen across the Mesolithic and Neolithic samples from 9.8% at Casa da Moura to 20% at Feteira, Layer 3. Therefore, Caldeirão seems to be in no way unusual when compared with other available Portuguese samples.

Enamel hypoplasia is a disturbance in growth during the period when tooth enamel is being formed. It too is interpreted as being the result of disease or malnutrition. Among the teeth which could be observed for enamel defects 10% (6/60) showed very slight hypoplasia. One upper central incisor and one upper canine showed lines of pits, and one lower canine had a circular defect of the type rarely seen in adults but occurring in around 40% of Portuguese Mesolithic and Neolithic deciduous canines. The other teeth displayed mild but definite defects in the form of a single groove around the tooth crown. Such grooves occur on canines with some regularity, and in our sample two of the three right upper canines showed defects and there was hypoplasia in three of the four left lower canines. Unless our canine samples are not representative, these figures suggest a marked increase of canine hypoplasia over that found at Moita and Arruda (Meiklejohn, pers. comm.).

8.3. Cranial and post–cranial indicators

Several other features of skeletal material may be of value in a general assessment of the health and nutritional status of an archaeological population.

Signs often interpreted as indicating anaemia following upon weaning (cribra orbitalia) are present on the roof of the left orbit of a child. We are at the moment considering an alternative explanation, that of over–long and too exclusive dependence on breast milk.

Harris lines are growth arrest lines which are normally interpreted as reflecting episodes of childhood growth disturbance caused by malnutrition or disease. These are quite commonly seen on our femoral radiographs of, for example, Arruda specimens but are seen on only one of the three X–rayed Caldeirão femora, P12–133/O12–35. About nine episodes of growth arrest are evident. The lines are discontinuous and faint, which might reflect osteoclastic resorption of the trabeculae since we consider this individual to be fairly advanced in age. Using age estimates derived from Hunt and Hatch (1981), we can suggest that the Harris Lines formed between the ages of 9 and 14, with major disturbances at 9.5, 10.5, 12 and, finally, 13.5 years (if we can assume that the adolescent growth spurt occurred between 12 and 14 years). Since major childhood illnesses would not be expected at these ages, there is a possibility of recurring periods of inadequate nutrition.

The thickness of the femoral cortex at the mid-shaft has been examined in the diagnosis of osteoporosis (Barnett and Nordin 1960). While superseded as a diagnostic tool (Singh *et al.* 1970) and subject to measurement error (Mazess 1983) it may have value as an estimate of cortical area in the form of Nordin's Index (the percent of the cortical bone in the mid-shaft transverse diameter). Identification of the shaft mid-point is critical to the accuracy of this measurement. This can be difficult with broken archaeological material, and both inter- and intra-observer errors occur, especially if observers are using several X-rays for the same bone. Nonetheless, we have shown that an experienced analyst can be accurate to within five percentage points if radiographic procedures are standardized.

The proximal femur reconstructed from two left femoral fragments (P12-133/O12-35 from the lower level) has a Nordin's Index of about 60. The Nordin indices for two additional Caldeirão femora, P11-155 (66) and O11-101 (63), are even higher. These figures are between the mean values for Moita (62.5 n = 19) and Arruda (56.7 n = 26) males, and higher than the adult sample means for Feteira (55.3 n = 14) and Melides (59.75 n = 16). Since cortical thickness is partly age-dependent, it is best to compare femora at the same stage of trabecular modification. Caldeirão P12-133 has a Nordin's index equivalent to that for our total sample with a proximal trabecular grade of III (60.5), above that for the Moita and Arruda male mean value for the Nordin Indices of femora in stage III (56 n = 5), but below that for the Feteira (62.5 n = 2) and Melides femora (61.5 n = 4).

Cortex width can be measured directly on samples removed from the femur (anterior mid-shaft), thus providing a possibly more accurate estimate of the amount of cortical bone than does the Nordin Index. The cortical thickness for three male femora is given in Table 7. We have found a relationship between cortical thickness and age as measured by dental attrition levels for males from both Moita and Arruda (Jackes and Lubell 1986; Lubell and Jackes 1988), allowing some speculation about diet and health (Palmer 1987). The information from Caldeirão is far too meagre to allow us to see any trend. Nevertheless, if our age determinations can be accepted, it seems likely that the cortical bone area for the Caldeirão femora is very satisfactory, indicating healthy, active and well-nourished individuals.

8.4. Palaeodemographic reconstruction

It seems evident that one individual at Caldeirão had reached an advanced age and that others were at least middle aged. Nevertheless, our age assessments mean that only 47% of those born alive survived to age 20. Since it is likely that many more individuals than we have identified here died before one year of age, death rates were probably quite high.

As we might expect, however, given the small sample size, the age distribution at death appears to be unrepresentative. Using childhood mortality quotients derived from model, modern, historical and large (n = >100) archaeological samples, we have developed a method which allows us to determine whether an archaeological age at death distribution is likely to be biased (Jackes 1987; Jackes in prep.). This method circumvents the common problem of the underrepresentation of young children in Neolithic sites.

If we were to assume that the 19 individuals determined on the basis of the MNI analysis (Table 10) represent the true age distribution at death of the parent population, we would have to accept that there was extraordinarily high juvenile mortality. In fact, it is clear that the Caldeirão sample is biased, and that the major bias is likely to be an underrepresentation of adults over age 25. The simple addition of adults will draw the childhood mortality quotients into line with other demographic data. If we add adults to a total of 30, the data are adjusted to meet demographic trends. Such an adjustment would lead us to interpret the Caldeirão mortality rates as low by archaeological standards, and similar that of the Dobe !Kung (Howell 1979). This being so, it is preferable to interpret the age at death profile as indicating that a number of adult individuals in the group were buried elsewhere. Since it is a question of an underrepresentation of adults rather than children, it is very unlikely that more individuals were laid in the cave than are represented by the skeletal remains recovered.

9. Conclusions

The lack of comparative data on Portuguese prehistoric anthropology, as well as the fragmentary nature of the human skeletal remains at Caldeirão, renders the conclusions of this report very tentative. The remains comprise 621 fragments, of which 316 are identified bones and teeth from horizon NA1 dated to 4776 cal BC and 296 are from horizon NA2, dated to 5231 cal BC (see Zilhão, chapter 5). Overall, the distribution of body parts indicates neither selective preservation, nor selective recovery. The material in the upper horizon is very widely dispersed, and we can therefore draw no conclusions regarding the original placement of bodies. By contrast, in the lower horizon, it is possible to suggest that an elderly male and a middle aged male both lay against the north wall of the cave, while it is probable (on much weaker evidence) that a female lay against the south wall.

In horizon NA1 there appear to be at least 13 individuals ranging in age from infancy to at least middle age. It seems likely that the adults comprise three females and two males. The lower horizon, NA2, seems to contain 6 individuals: one infant (on very meagre evidence), one adolescent and perhaps four adults over 25, one of whom is female, two are certainly male and the fourth probably male.

Based on the bucco–lingual measurements of teeth, there is a suggestion that the Caldeirão individuals, together with those from other Portuguese Neolithic sites, were smaller than Mesolithic individuals. The Neolithic samples do not, however, present an homogenous picture. The Caldeirão teeth may be most similar to those from Feteira. From skeletal evidence other than the teeth, we have no reason to conclude that the Neolithic populations of Portugal were uniformly smaller than the Mesolithic. It is possible that the Caldeirão people, post–cranially, were of the same size as the Mesolithic populations of Moita and Arruda.

Some of the data on non–metrical variations indicate that the Neolithic samples from Melides and Feteira, although geographically distant, were fairly similar. Apart from this, we as yet can see no pattern emerging from the information reported here. Genetic distance studies require more data than those provided by fragmentary material such as has been excavated at Caldeirão; more importantly, they must be based on a large body of comparative data and this is not yet available for Portugal.

While stable isotopes present a picture of a homogeneous Neolithic diet, distinct from the Mesolithic regime, the amount of information available is too restricted for us to come to any conclusions about the similarities or differences through time and across ecological zones. Certainly, the dental pathology rates do not allow us to make a similarly neat differentiation. Combined Caldeirão pathology rates are similar to those of Arruda and Casa da Moura, but lower than those of Moita, Feteira and Melides. Thus, no clear Mesolithic–Neolithic distinction can be made.

No Caldeirão material provides us with any suggestion of ill–health or malnutrition, apart from possible iron–deficiency in a young child. Cortical thickness of the femora suggests well–nourished individuals. Minor growth disturbances are suggested by Harris Lines and enamel hypoplastic defects, but there is no indication that the population was under any stress. There is no severe skeletal pathology: there are abnormalities in two metatarsals, both perhaps traumatic in origin, and the spinal pathologies are no more than the normal degenerative changes to be seen in any population in which individuals survive into old age. While the death rate amongst children was apparently quite high, some individuals certainly reached advanced ages, and it may be that the cave was used preferentially for the disposal of children at death. Thus, the apparent childhood mortality rate may be exaggerated.

Acknowledgements

We are grateful to Dr. J. Zilhão for the opportunity to study the Caldeirão human remains, and to Dr. M. Ramalha, Serviços Geológicos, Lisboa, for permission to study the collections from Moita do Sebastião, Cabeço da Arruda, Grutas de Melides, Gruta da Furninha, Casa da Moura and Fontaínhas. The analyses reported here were undertaken as part of a larger project dealing with the archaeology and human biology of the Mesolithic–Neolithic transition in Portugal, funded by Operating Research Grants 410–84–0030 and 410–86–2017 from the Social Sciences and Humanities Research Council of Canada, and additional funds from the Central Research Fund and the SAS Fund, University of Alberta. These grants provided the funds for AMS radiocarbon dating of human bone collagen samples at the Isotrace Laboratory, University of Toronto, as well as for the extraction of the collagen and the stable isotopic analysis of those samples undertaken by Dr. H.P. Schwarcz, McMaster University.

We thank the Department of Prehistory and Archaeology, University of New England, Armidale, Australia, and the Department of Anthropology, University of Alberta for providing computer facilities and funds. Dr. Miguel Ramos of the Centro de Pré–História e Arqueologia, IICT, Lisboa, kindly made available the laboratory facilities necessary for the preparation of bone thin sections as well as the photographs reproduced here as Figs. 5 and 6 which were taken by José Antonio Severino Rodrigues. We are grateful to Esther Palmer (University of Alberta) for help in the preparation and analysis of femoral thin sections, and to Dr. G.P. Weih (Victoria, Canada) for assistance during the analysis of these collections in Portugal. Pamela Mayne, Cidália Maria Pereira Duarte and Kirsten Jackes provided student assistance in a variety of ways.

TABLE 1

Representation of catalogued anatomical elements (before reconstruction)

	Total[a]			NA1		NA2	
	n	ss	n/ss[b]	n	n/ss	n	n/ss
skull vault	60			26		34	
hyoid	2			2			
teeth and jaw fragments	62			43		18	
ribs	77			28		49	
vertebrae							
cervical	(15)	7	2.1	(7)	1.0	(8)	1.0
thoracic	(24)	12	2.0	(11)	0.9	(13)	0.9
lumbar	(18)	5	3.6	(7)	1.4	(10)	1.2
total including unidentifiable	62	24	2.6	29	1.2	32	
sacrum	11			5		5	4.0
coccyx	1					1	1.0
pelvis	26			9		17	6.5
clavicle	7	2	3.5	1	0.5	6	2.5
scapula	12	2	6.0	4	2.0	8	2.5
humerus	6	2	3.0	3	1.5	3	1.0
ulna	5	2	2.5	1	0.5	4	2.0
radius	19	2	9.5	10	5.0	9	4.5
carpals	13	16	0.8	8	0.5	5	0.3
metacarpals	33	10	3.3	20	2.0	13	1.0
phalanges (manus)	71	28	2.5	36	1.3	31	1.1
femur	10	2	5.0	7	3.5	3	1.5
patella	3	2	1.5	1	0.5	2	0.5
tibia	17	2	8.5	8	4.0	9	4.0
fibula	13	2	6.5	3	1.5	10	4.5
tarsals	32	14	2.3	21	1.5	10	0.6
metatarsals	36	10	3.6	26	2.6	9	0.6
phalanges (pes)	31	28	1.1	15	0.5	16	0.5
unidentified phalanges	1			1			
unidentified long bone fragments	11			9		2	
TOTAL	621			316		296	
all hand bones	117	54	2.2	64	1.2	49	0.9
all foot bones	99	52	1.9	62	1.2	35	0.7
forelimb	147	60	2.5	78	1.3	65	1.1
hindlimb	142	60	2.4	81	1.4	59	1.0

[a] Excludes possible Bronze Age specimens (n = 6) but includes all bones and teeth not assigned to levels (n = 9).

[b] $n/ss = \frac{\text{number of catalogued specimens of a skeletal element}}{\text{number of that element in a single skeleton}}$

TABLE 2

Distribution of identified bones attributed to horizon NA1 (306 fragments). Densities in n/m^3

Square	Skull			Jaws & Teeth			Vertebrae			Ribs			Shoulder			Arm & Hand			Pelvis & Sacrum			Leg & Foot		
	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%
K16																1	4.7	1.6						
L15				2	3.4	3.1										1	1.7	0.6				1	1.7	0.6
L16				1	1.8	1.6																		
M14	1	2.7	2.6																					
M15				3	5.4	4.9																		
M16																1	21.3	7.4						
M18[a]				2			1									1								
N10	3	12.0	11.4	6	23.9	21.6	2	8.0	6.0	1	4.0	3.4				4	15.9	5.5				7	27.9	10.5
N13				1	5.0	4.5																		
N14																1	1.6	0.6				2	3.1	1.2
N15	3	15.8	15.0	1	5.3	4.8										3	15.8	5.5				2	10.5	3.9
O10	3	11.1	10.5	2	7.4	6.7				2	7.4	6.2	1	3.7	15.3	5	18.5	6.4	1	3.7	11.1	8	29.6	11.1
O11				3	8.5	7.7	2	5.6	4.2	1	2.8	2.3				10	28.2	9.8	1	2.8	8.4	4	11.3	4.2
O12							1	58.8	44.4	1	32.3	27.1				1	32.3	11.2						
O13							1	1.7	1.3							1	1.7	0.6				1	1.7	0.6
O14				5	9.3	8.4				3	5.6	4.7				6	11.1	3.8				8	14.8	5.6
O15				1	5.9	5.3										2	11.8	4.1						
P11	2	4.4	4.2				7	15.6	11.8	3	6.7	5.6				4	8.9	3.1	3	6.7	20.1	7	15.6	5.9
P12	1	2.5	2.4	2	5.0	4.5	3	7.5	5.7	1	2.5	2.1				7	17.5	6.1				1	2.5	0.9
P13							1	1.6	1.2													1	1.6	0.6
P14				2	2.6	2.3	2	2.6	2.0	1	1.3	1.1				5	6.6	2.3				11	14.5	5.4
P15				1	3.6	3.3	2	7.2	5.4							7	25.2	8.7	1	3.6	10.8	4	14.4	5.4
Q11	2	3.3	3.1	1	1.7	1.5	2	3.3	2.5	1	1.7	1.4				2	3.3	1.1	3	5.0	15.0	3	5.0	1.9
Q12	3	4.8	4.6	4	6.5	5.9	1	1.6	1.2	4	6.5	5.4				4	6.5	2.3	3	4.8	14.4	8	12.9	4.8
Q13				3	4.9	4.4				3	4.9	4.1				2	3.3	1.1	1	1.6	4.8	1	1.6	0.6
Q14				1	2.0	1.8				2	4.0	3.4	1	2.0	8.3	1	2.0	0.7				1	2.0	0.8
Q15										1	7.8	6.5				2	15.5	5.4						
R11	7	36.1	34.3				2	10.3	7.8	3	15.5	13.0	2	10.3	42.6	2	10.3	3.6	1	5.2	15.6	4	20.6	7.7
R12										2	16.4	13.7	1	8.2	33.9	2	16.4	5.7				6	49.2	18.5
R13	3	12.7	12.0	2	8.5	7.7	2	8.5	6.4							2	8.5	2.9						
R14																						1	25.6	9.6
Total	28	105.4	100	43	110.7	100	29	132.3	100	29	119.4	100	5	24.2	100	77	288.6	100	14	33.4	100	81	266.1	100
%	9.2			14.1			9.5			9.5			1.6			25.2			4.6			26.5		

[a] No volume estimate available

TABLE 3

Distribution of identified bones attributed to horizon NA2 (294 fragments). Densities in n/m^3

Square	Skull			Jaws & Teeth			Vertebrae			Ribs			Shoulder			Arm & Hand			Pelvis & Sacrum			Leg & Foot		
	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%	n	D	w%
N10							2	4.8	3.1	4	9.5	4.9				2	4.8	1.2				1	2.4	1.0
O10				2	2.6	5.8				4	5.2	2.7	1	1.3	2.3	4	5.2	1.3	1	1.3	0.4	4	5.2	2.1
O11				7	14.3	31.8	4	8.1	5.3	8	16.3	8.3	1	2.0	3.5	15	30.5	7.8				7	14.3	5.8
O12							3	78.9	51.5	3	78.9	40.3				8	210.5	53.7	11	289.5	91.9	5	131.6	53.1
P11	1	1.8	0.8													2	3.6	0.9				2	3.6	1.5
P12				1	1.9	4.2	6	11.3	7.4	1	1.9	1.0	2	3.8	6.7	8	15.1	3.9	7	13.2	4.2	16	30.2	12.2
Q11	1	1.5	0.6	1	1.5	3.3	1	1.5	1.0	4	5.9	3.0				2	3.0	0.8				4	5.9	2.4
Q12	2	4.6	1.9	2	4.6	10.2	4	9.3	6.1	12	27.8	14.2	2	4.6	8.1	5	11.6	3.0	1	2.3	0.7	8	18.5	7.5
Q13	1	2.2	0.9				4	8.8	5.7	1	2.2	1.1	1	2.2	3.9	7	15.4	3.9				3	6.6	2.7
R11	10	28.6	12.0	2	5.7	12.7	4	11.4	7.4	5	14.3	7.3	3	8.6	15.1	2	5.7	1.5	3	8.6	2.7	7	20.0	8.1
R12	5	24.0	10.1	3	14.4	32.0	4	19.2	12.5	7	33.7	17.2	2	9.6	16.8	5	24.0	6.1				2	9.6	3.9
R13	14	175.0	73.6										2	25.0	43.8	5	62.5	15.9						
Total	34	237.7	100	18	45.0	100	32	153.3	100	49	195.7	100	14	57.1	100	65	391.9	100	23	314.9	100	59	247.9	100
%	11.6			6.1			10.9			16.7			4.8			22.1			7.8			20.1		

Table 4

Catalogue of teeth in Neolithic horizons

Provenance	Tooth	Jaw	Side	Wear	Root	Age	Length mm	Breadth mm
M15sc152 NA1	di1	U	R	4	resorbing	6 years	6.4	5.2
N10sc128 NA1	I2	U	R	0	9	6 years	6.5	7.5
P12sc168 NA1	I1	U	L	0	9	5 years	9.0	7.4
O11sc 56 NA1	I1	U	L	1			9.4	8.4
O14sc234 NA1	I1	L	R	broken	11	6-7 years	5.1	5.9
Q12 174 NA1	I1	L	L	1			5.1	6.5
O14 39 NA1	I1	L	L	3			5.9	6.3
Q12sc313 NA1	I1	L	L	3			5.0	5.4
Q13sc206 NA1	I1	L	R	4			6.3	6.1
O14 42 NA1	I2	L	L	1	9	5-6 years	6.2	6.4
Q12sc198 NA1	I2	L	R	4			5.2	6.4
M15sc108 NA1	I2	L	L	4			6.0	6.6
L15sc170 NA1	I2	L	R	5			5.1	6.1
R13sc 24 NA1	I2	L	R	7		very old	5.6	7.2
O11 77 NA2	I2	L	L	2			6.1	6.5
R11sc176 NA2	I2	U	R	2			6.6	6.6
P12sc662 NA2	di1	U	L	0	8/9	7 months	—	—
P14sc 44 NA1	C	U	R	4			7.1	7.3
N13 76 NA1	C	U	L	1		adolescent	6.6	7.6
N10 13 NA1	C	U	R	1		adolescent	8.1	8.5
N10sc104 NA1	C	U	R	1	11	9 years	7.8	8.9
Q12 207 NA2	C*	U	L	1		adolescent	7.4	9.2
N13 76 NA1	C	L	R	1		adolescent	6.6	7.6
Q11 64 NA1	C	L	L	4			7.5	8.8
P15 11 NA1	C	L	L	3			7.0	8.0
O10 24 NA1	C*	L	L	5			—	7.3
Q13sc225 NA1	C	L?	R	7		very old	6.3	8.8
O11 71 NA2	C	L	L	3			6.7	7.5
Q14 7 NA1	P3	U	R	1	11	10 years	7.0	9.9
L16sc 30 NA1	P3	U	R	2			6.3	8.6
P12 98 NA1	P3*	U	R	4			6.8	9.4
N10sc127 NA1	P3	U	R	4			7.3	8.7
O14 67 NA1	P3*	U	R	5			6.3	8.8
Q12 207 NA2	P3*	U	L	1		adolescent	7.1	9.1
R11sc177 NA2	P3	U	R	5			6.8	9.0
O10sc218 NA1	P4	U	R	2			6.6	8.6
O14 67 NA1	P4*	U	R	5			6.0	8.9
P12 98 NA1	P4*	U	R	5			7.1	10.3
O10 107 NA2	P4	U	L	3			6.9	9.1
P14sc117 NA1	P3	L	R	1		adolescent	7.2	8.2
N15 34 NA1	P3	L	L	3			7.4	8.2
O10 24 NA1	P3*	L	L	4			—	7.6
O10sc268 NA2	P3	L	R	5			6.1	8.4
O10 24 NA1	P4*	L	L	5			—	8.2
N10sc123 NA1	dm2	U	R	2	resorbing	c. 8 years	9.0	10.4
Q11sc495 ?	dm1	L	R	?	?		8.1	7.0
L15sc141 NA1	dm2	L	L	0	6	11 months	9.3	8.7
O11sc 40 NA1	M1	U	L	2			11.3	12.1
O14 36 NA1	M1	U	L	1		child	10.2	12.6
M15 98 NA1	M2	U	L	1		adolescent	9.8	10.9
O11sc 54 NA1	M2?	U	L	3			8.7	10.8
Q12 194 NA2	M3	U	L	2			9.0	11.0
O15sc 36 NA1	M1	L	R	0	6	3-4 years	11.5	10.0
O10 24 NA1	M1*	L	L	6			—	10.2
O11 100 NA2	M1	L	L	4			—	10.3
O11sc144 NA2	M1	L	L	7		very old	10.7	11.0
O10 24 NA1	M2*	L	L	5			—	10.0
N10sc122 NA1	M2	L	R	4			11.3	10.8
R13 9 NA1	M2	L	R	5			10.4	10.1
Q13sc205 NA1	M2	L	L	1	broken	adolescent	10.8	10.1
R12 47 NA2	M2	L	R	4			10.5	10.4
O10 24 NA1	M3*	L	L	3			—	9.9
Q11sc284 NA2	M3	L	L	2			10.6	9.8
R12sc 71 NA2	M3	L	L	5			10.6	10.7

M18sc 24 NA1 symphysis of 4 year old with unerupted central incisors and left I2
M18sc 29 NA1 symphysis of 6 month old with right dc and di2 and crown of I2

* Tooth in bone, all other teeth are loose; all observed roots complete unless indicated.

TABLE 5

Numbers of identifiable metapodials

	Right					Left				
	I	II	II	IV	V	I	II	III	IV	V
Metacarpals										
Horizon NA1	1	3	1	1	2	1	2	1	—	—
Horizon NA2	1	1	1	—	1	2	—	1	1	1
Metatarsals										
Horizon NA1	1	4	2	6	3	2	2	2	1	—
Horizon NA2	1	—	2	—	2	—	1	3	—	2

NB: A left third metacarpal and a left second metatarsal have been excluded because the provenances were unknown. Included here are two juvenile specimens (Horizon NA1, R MC1, L MTII).

TABLE 6

Caldeirão femoral mid-shaft dimensions compared with Arruda means (measurements in mm)

		mid-shaft sagittal diameter	mid-shaft transverse diameter	maximum shaft diameter	mid-shaft circumference
Caldeirão					
P11-155 (NA1)	right	26	25	26	83
O10-169 (NA1)	left	29	25	-	87
O14-34 (NA1)	right	-	-	31	-
O11-101 (NA2)	right	27	24	29	81
P12-133/012-35 (NA2)	left	26	25	29	81
Arruda males					
mean		27.24	25.53	29.01	84.32
s		2.13	1.78	1.89	5.02
n		34	34	33	34
Arruda females					
mean		23.62	23.84	24.47	75.38
s		1.86	1.69	2.02	4.00
n		32	32	31	29
t		7.31	3.94	9.29	7.72
P		.00	.00	.00	.00

TABLE 7

Data from examination of Caldeirão mid-femoral samples

Specimen (horizon)		Number of complete osteons observed over 12 × $1mm^2$		Lamellar bone	Cortical thickness
		mean	s		mm
P12/133	(NA2)	6.92	2.06	none	6.18
O14/34	(NA1)	7.75	1.66	rare	nd
P11/155	(NA1)	4.25	1.42	rare	6.33
O11/101	(NA2)	6.42	1.88	common	5.32

TABLE 8

Measurements of tibial shafts for Caldeirão (top) and Mesolithic samples (bottom)

Provenance		Side	cnemic		mid-shaft	
			transverse mm	sagittal mm	transverse mm	sagittal mm
P11/151	NA1	right	24	36	23	31
P12/130	NA2	right	21	34	19	29
O11/74+P11/sc174	NA2	left	21	35	18	31
Q12/181	NA2	left	–	–	22	35
P12/151	NA2	left	–	–	20	29
R11/7	NA2	left	22	36	22	33
Moita males		right	22.6	35.6	19.7	30.7
		left	23.3	35.4	19.6	31.3
Moita females		right	19.2	30.4	16.2	24.9
		left	20.0	30.8	16.4	24.2
Arruda males		right	23.3	35.2	20.8	31.7
		left	22.6	34.2	19.9	31.2
Arruda females		right	19.5	31.9	17.1	27.8
		left	19.2	32.2	17.2	28.3

TABLE 9

Measurement of the scapular glenoid fossa breadth

P12/113	NA1	R	25 mm
R11/5	NA1	R	21 mm
R11/13	NA2	L	28 mm
R12/43	NA2	L	22 mm

Arruda males mean = 27.2 mm n = 13 s = 2.34
Arruda females mean = 23.9 mm n = 10 s = 1.29

TABLE 10

Caldeirão age at death distribution

Age years	NA1 n	NA2 n
0 — .9	1	1
1 — 4.9	1	
5 — 9.9	3	
10 — 14.9	1	
15 — 19.9	2	1
20 — 24.9	2	1
› 25	3	4
TOTAL	13	6

TABLE 11

Bucco-lingual measurements of Portuguese permanent mandibular teeth

	Moita[a]	Arruda[a]	Melides	Feteira[b]	Casa da Moura[c]	Caldeirão
M_3						
mean	10.5	10.2	9.5	9.8	9.4	10.1
s	0.7	0.8	0.5	1.1	0.5	0.5
n	32	41	17	24	24	3
M_2						
mean	10.7	10.5	9.8	10.2	10.1	10.3
s	0.6	0.6	0.6	0.6	0.6	0.3
n	60	69	28	36	39	5
M^1						
mean	11.1	10.9	10.4	10.5	10.8	10.4
s	0.5	0.4	0.5	0.7	0.5	0.4
n	65	65	37	36	48	4
P_4						
mean	8.4	8.2	8.0	8.0	8.1	8.2
s	0.6	0.4	0.4	0.5	0.5	—
n	54	59	10	21	28	1
P_3						
mean	8.1	8.0	7.2	7.6	7.6	8.1
s	0.4	0.6	0.5	0.6	0.6	0.4
n	24	31	17	22	32	4
C						
mean	8.0	7.7	7.1	8.0	7.4	8.0
s	0.6	0.7	0.9	0.7	0.5	0.7
n	46	44	13	33	22	6
I_2						
mean	6.6	6.5	6.0	6.5	6.3	6.5
s	0.3	0.4	0.7	0.4	0.3	0.4
n	44	41	9	21	18	6
I_1						
meam	6.3	6.2	6.5	6.0	6.1	6.0
s	0.3	0.4	0.4	0.4	0.2	0.4
n	41	33	8	23	10	5

[a] Data from Meiklejohn.
[b] In situ and loose teeth included.
[c] In situ teeth only.

TABLE 12

Bucco-lingual measurements of Portuguese permanent maxillary teeth

	Moita[a]	Arruda[a]	Melides	Feteira[b]	Casa da Moura[c]	Caldeirão
M_3						
mean	11.9	11.8	10.7	10.4	10.8	11.0
s	0.7	1.0	0.9	0.7	0.7	—
n	31	42	7	23	121	1
M_2						
mean	12.2	12.0	11.4	11.2	11.6	10.8
s	0.6	0.7	0.7	0.7	0.8	0.1
n	50	61	16	32	264	2
M^1						
mean	12.1	12.0	11.0	11.5	11.7	12.4
s	0.5	0.6	0.4	0.5	0.6	0.4
n	52	61	11	43	272	2
P_4						
mean	9.7	9.6	8.8	9.0	8.9	9.2
s	0.4	0.4	0.5	0.7	0.6	0.7
n	41	51	8	34	156	4
P_3						
mean	9.7	9.5	8.5	8.5	9.2	9.1
s	0.4	0.5	1.0	0.9	0.6	0.4
n	44	51	8	42	215	7
C						
mean	8.8	8.7	7.6	8.4	8.3	8.3
s	0.8	0.5	0.8	0.6	0.7	0.8
n	37	43	4	20	435	5
I_2						
mean	6.6	6.5	6.6	6.7	6.4	7.0
s	0.4	0.5	0.1	0.8	0.4	0.6
n	26	30	2	21	164	2
I_1						
meam	7.3	7.3	7.0	7.2	7.2	7.9
s	0.4	0.4	0.2	0.6	0.5	0.7
n	25	25	2	35	351	2

[a] Data from Meiklejohn.
[b] In situ and loose teeth included.
[c] No in situ teeth present. Molar data from sample for which two independent identifications were in agreement.

TABLE 13

Maximum length of Portuguese adult tali

				male			female		
Site	mean	s	n	mean	s	n	mean	s	n
Moita	52.3	3.6	33	54.6	2.6	11	43.0	1.4	2
Arruda	51.7	4.3	34	53.5	3.5	15	48.9	4.3	12
Caldeirão	50.7	2.1	5	51.9	0.2	3	49.0	2.8	2
Melides	48.9	2.6	35						
Feteira	48.2	5.1	9						

Moita and Melides: $t = 4.48$, $P = .00$
Arruda and Melides: $t = 4.94$, $P = .00$
Arruda males and females: $t = 6.01$, $P = .00$

TABLE 14

Maximum length of Portuguese adult calcanei

Site	mean	s	n	cv
Moita	74.2	5.6	20	7.5
Arruda	74.0	5.8	33	7.8
Feteira	70.5	3.9	8	5.5
Melides	71.7	3.8	31	5.3
Caldeirão	78.0	1.0	3	1.3

TABLE 15

Transverse mid shaft diameter of metapodials[a]

	Moita	Arruda	Caldeirão	Feteira	Furninha	Melides	Casa da Moura	Fontainhas
MC I								
mean	11.0	10.8	11.3	10.8	12.0	10.6	11.6	11.3
n	23	51	7	7	24	18	75	11
MC II								
mean	8.2	8.0	8.5	7.6	8.4	7.9	8.0	8.0
n	21	59	5	16	52	19	90	13
MC III								
mean	8.4	8.1	7.9	7.0	8.1	7.7	7.9	8.3
n	23	60	7	8	61	23	97	12
MC IV								
mean	7.3	6.5	—	6.2	6.8	6.4	6.4	6.4
n	11	55	—	2	39	12	76	10
MC V								
mean	7.7	7.6	7.2	6.7	7.7	7.3	7.4	6.9
n	12	48	4	7	31	12	85	7
MT I								
mean	13.0	12.2	13.2	12.6	13.5	12.6	13.0	12.9
n	28	50	4	13	82	45	148	23
MT II								
mean	7.4	7.4	7.7	6.8	7.6	7.1	7.2	7.6
n	19	45	12	12	50	28	113	13
MT III								
mean	6.9	6.9	7.4	7.1	7.4	7.2	6.9	6.9
n	21	50	7	9	60	32	118	10
MT IV								
mean	6.9	6.5	7.1	6.8	7.3	6.6	6.9	6.6
n	22	51	8	15	62	24	110	13
MT V								
mean	7.6	7.4	7.4	7.2	7.8	7.2	7.6	7.4
n	14	62	5	15	80	28	116	9

[a] For MT V, measurement is mid-shaft minimum.

TABLE 16

Facet variations in the talus and calcaneus

	Moita	Arruda	Caldeirão	Feteira	Melides
Talus					
medial extension of the superior facet absent	0/40	7/34 21%	2/4 50%	3/10 30%	0/34
lateral extension of the superior facet	18/38 47%	26/39 67%	2/5 40%	5/11 45%	23/35 66%
form of the anterior calcanear facet	n %	n %	n %	n %	n %
single	6 30	17 52	2 67	2 29	10 30
discrete	5 25	3 9	—	1 14	5 15
hourglass	9 45	13 39	1 33	4 57	18 54
lateral neck facet	0/45	2/37 5%	0/5	0/13	0/35
Calcaneus					
anterior-middle facets	n %	n %	n %	n %	n %
single	4 11	4 10	1 25	3 12	6 16
discrete	19 51	21 55	3 75	11 42	14 37
hourglass	12 32	13 34	—	11 42	17 45
no anterior facet	2 5	—	—	1 4	1 3

TABLE 17

Non-metrical variations of the lower molars

Observation	Feteira	Melides	Casa da Moura	Moita [a]	Caldeirão
Hypoconulid size					
M1, n	31	35	32	39	3
no 5th cusp %	10	20	9	31	33
‹ half size %	23	6	12		0
› half size %	58	49	72	} 69	33
full 5th cusp %	10	26	6		33
M2, n	19	30	32	43	5
no 5th cusp %	74	70	56	88	40
‹ half size %	5	13	22		20
› half size %	21	7	19	} 12	40
full 5th cusp %	0	10	3		0
M3, n	20	19	21	27	3
no 5th cusp %	30	42	57	59	100
‹ half size %	15	26	19		0
› half size %	35	16	19	} 41	0
full 5th cusp %	20	16	5		0
Cusp pattern					
M1, n	19	14	10	19	1
ML/BD %	31	64	78	94	0
+ %	44	36	0	0	100
MB/DL %	25	0	22	6	0
M2, n	14	18	17	30	1
ML/BD %	21	22	47	37	0
+ %	36	50	18	20	0
MB/DL %	43	28	35	47	100
M3, n	14	14	10	23	0
ML/BD %	7	50	40	52	0
+ %	21	7	10	9	0
MB/DL %	71	43	50	56	0

TABLE 17 (cont.)

Observation	Feteira	Melides	Casa da Moura	Moita [a]	Caldeirão
Enamel extensions of ≥ 1.5mm					
M1, n	30	40	nd	nd	3
%	7	5			0
M2, n	27	30	nd	nd	3
%	4	0			0
M3, n	17	12	nd	nd	1
%	6	0			0
Protostylid					
M1, n	36	38	45	52	4
absent %	97	97	100	100	100
buccal pit %	3	3	0	0	0
full cusp %	0	0	0	0	0
M2, n	31	29	44	51	5
absent %	100	97	100	100	100
buccal pit %	0	3	0	0	0
full cusp %	0	0	0	0	0
M3, n	22	17	25	30	3
absent %	86	100	100	90	100
buccal pit %	14	0	0	3	0
full cusp %	0	0	0	7	0

[a] Data from Meiklejohn in Lubell 1984.

TABLE 18

Dental caries in permanent teeth

Site	Caries (all teeth) n	Caries (all teeth) %	Lower molars with caries n	Lower molars with caries %
Moita	107/889	12.0[a]	29/155	18.7[b]
Arruda	85/1176	7.2[a]	21/225	9.3
Caldeirão				
Horizon NA1	1/45	2.2	0/7	0.0
Horizon NA2	3/12	25.0	1/5	20.0
Casa da Moura [c]				
lower molars			106/1080	9.8
maxillae	101/2276	4.4		
mandibles	125/2155	5.8		
all teeth	226/4431	5.1		
Feteira				
Layers 1 & 2				
lower molars			9/62	14.5
maxillae	11/135	8.1		
mandibles	16/149	10.7		
Layer 3				
lower molars			5/25	20.0
maxillae	6/75	8.0		
mandibles	4/49	8.2		
All levels				
lower molars			14/87	16.1
maxillae	17/210	8.1		
mandibles	20/198	10.1		
all teeth	37/408	9.1		

TABLE 18 (cont.)

Dental caries in permanent teeth

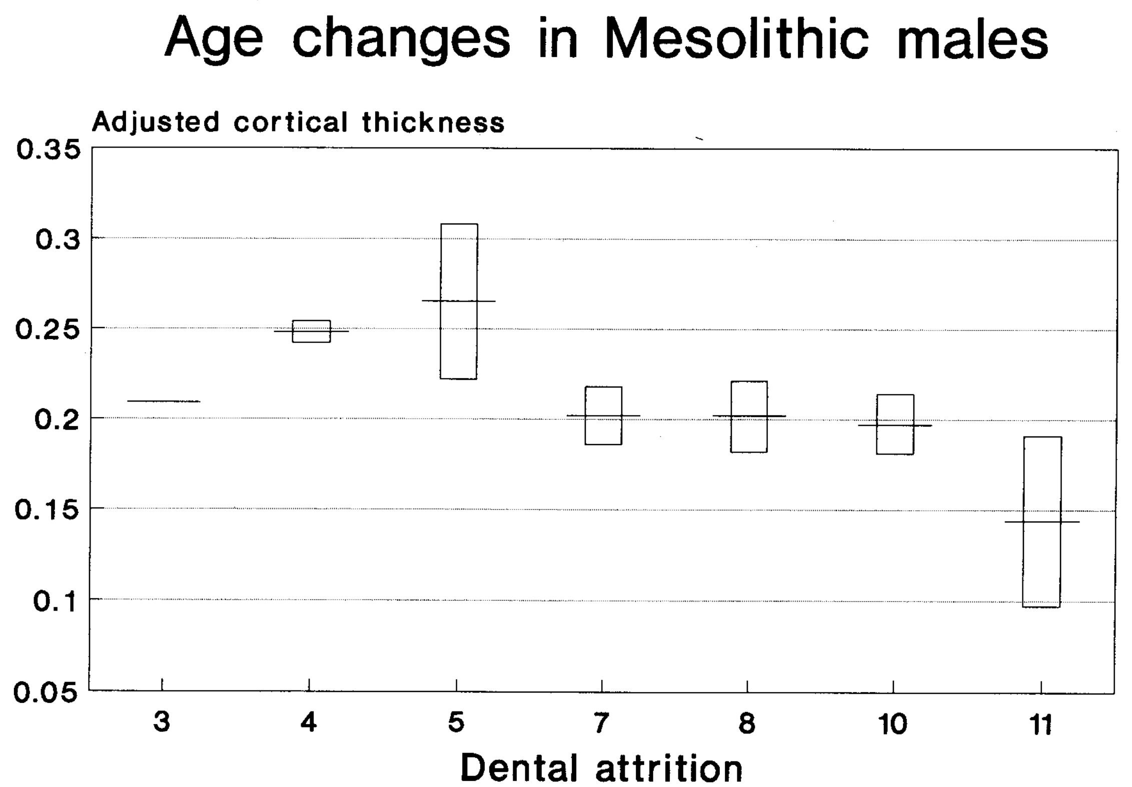
Site	Caries (all teeth)		Lower molars with caries	
	n	%	n	%
Melides (Zambujal)				
lower molars			14/75	18.7
maxillae	9/67	13.4		
mandibles	13/104	12.5		
all teeth	22/171	12.9		

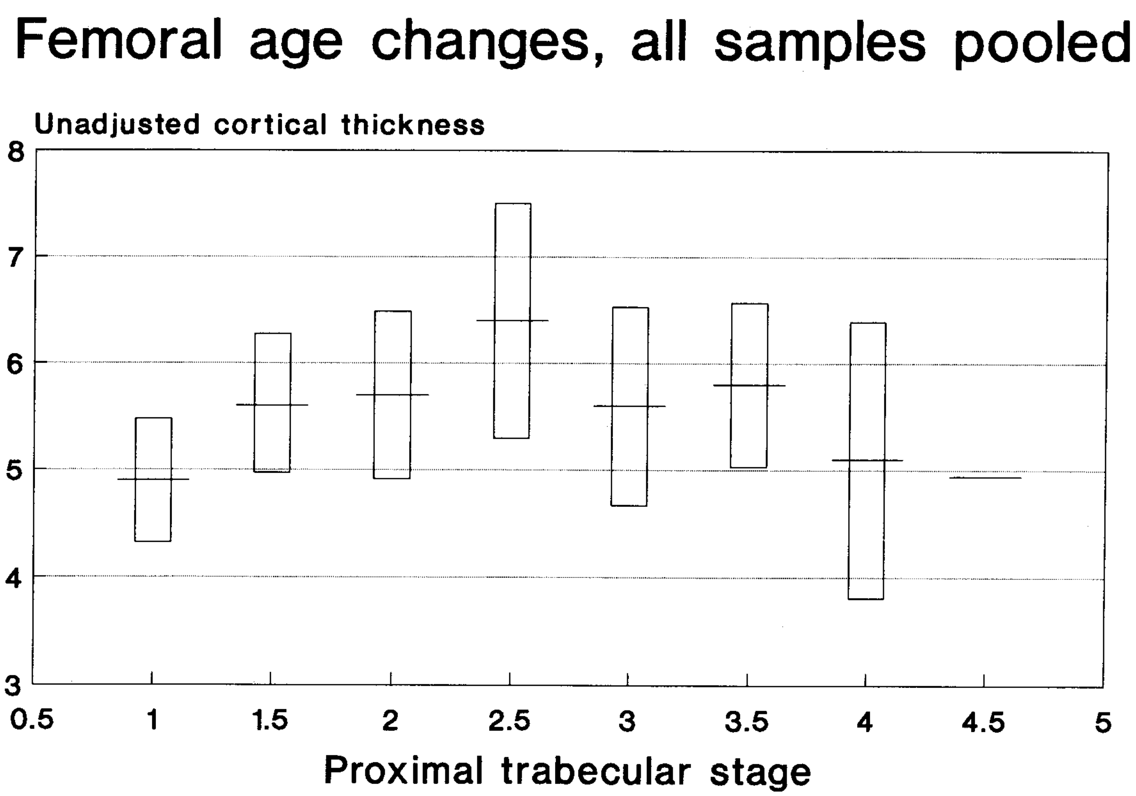
[a] Meiklejohn *et al.* n.d.
[b] Meiklejohn in Lubell 1984
[c] The data for Casa da Moura are preliminary

Fig. 1 - X-ray of the proximal portion of femur P12-133/O12-35, a male of at least 40 years. The proximal trabeculae show rarefaction in the neck, below the head and in the greater trochanter, indicative of normal age changes.

Fig. 2a - The relationship of dental attrition to femoral cortical thickness (adjusted for mid-shaft sagittal diameter), based on data from 24 Mesolithic males from Moita do Sebastião and Cabeço da Arruda. The ± 1 standard deviation ranges are shown.

Fig. 2b - The relationship of femoral cortical thickness and the proximal trabecular stage (Bergot and Bocquet 1976) for 62 individuals, males and females, from the Portuguese Mesolithic and Neolithic. The ± 1 standard deviation ranges are shown.





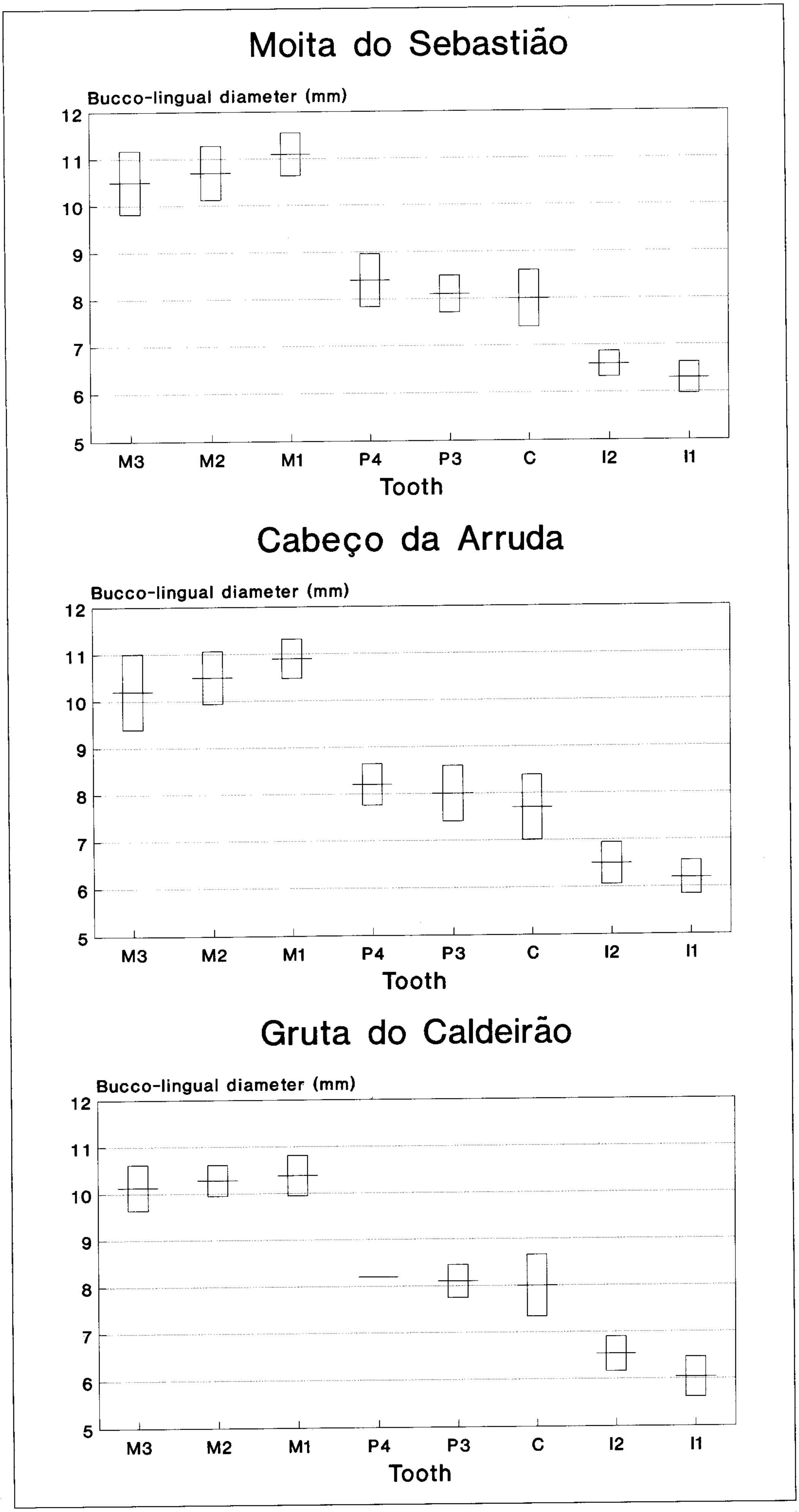
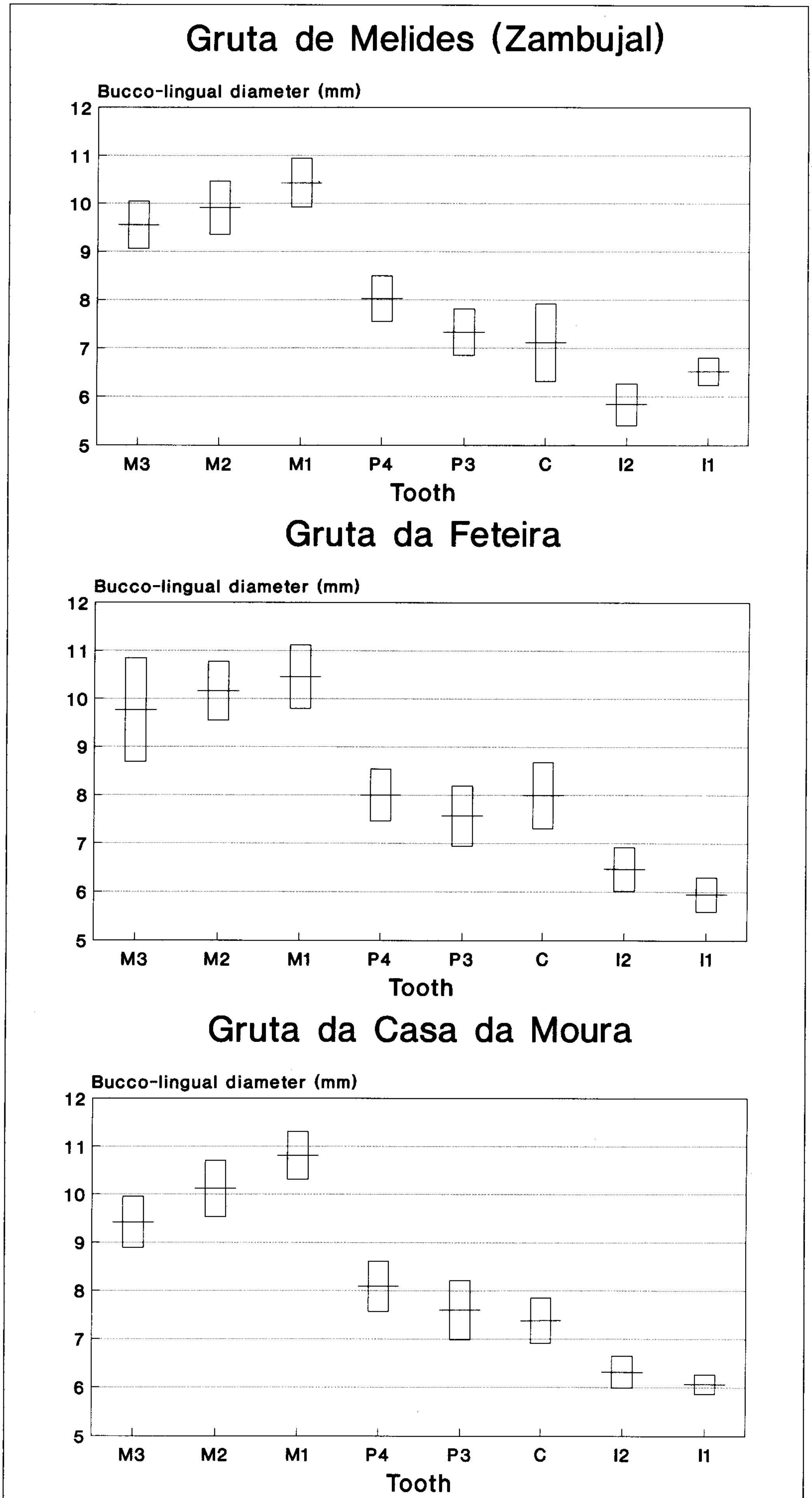


Fig. 4 - Bucco-lingual diameters for Caldeirão mandibular dentition compared with two Mesolithic samples (Moita and Arruda), and three Neolithic (Feteira, Melides and Casa da Moura) samples. The ±1 standard deviation ranges are shown.



Based on a sample of 75 adult mandibles

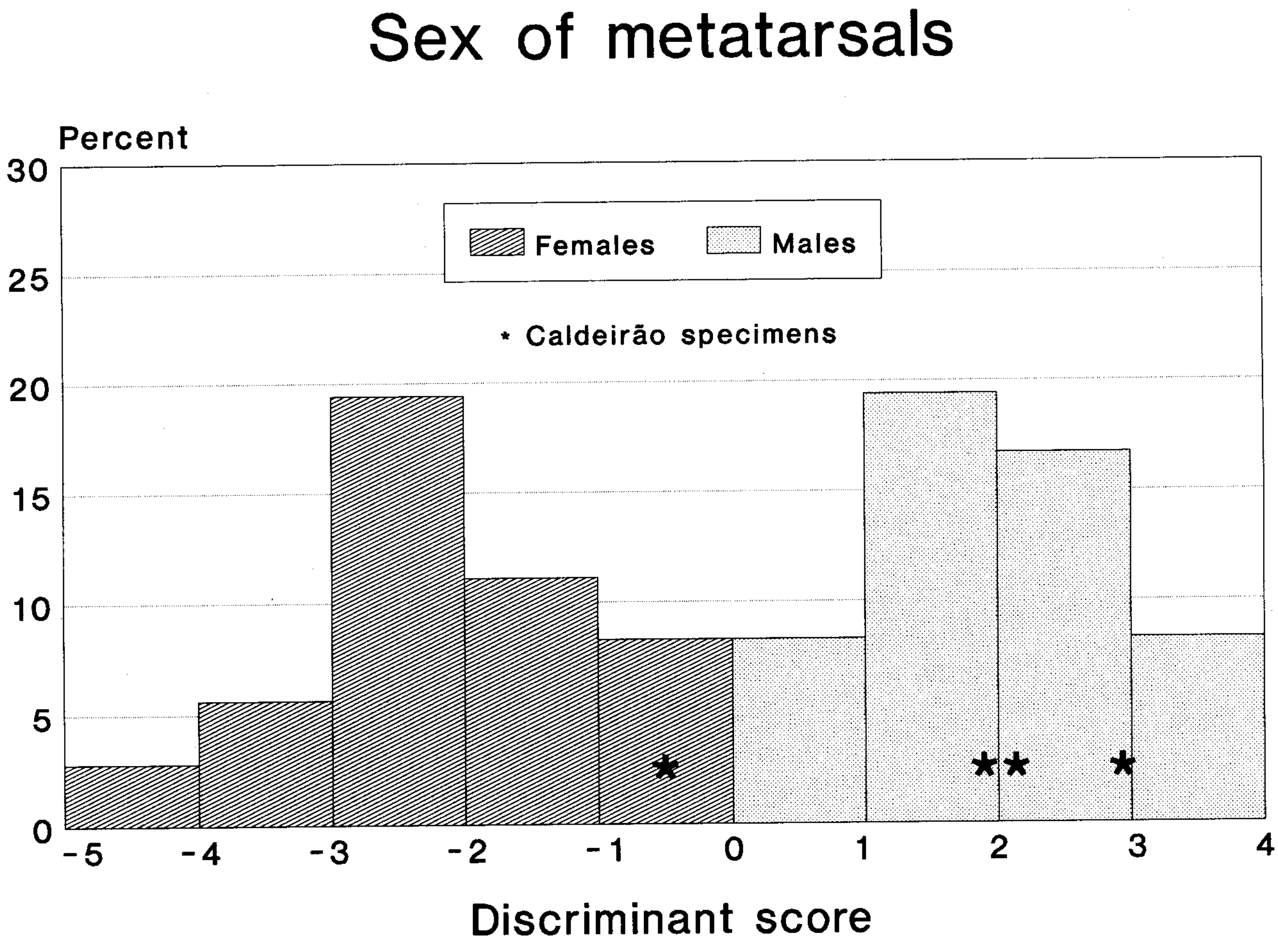


Fig. 3 - Caldeirão fourth metatarsals compared to Portuguese Mesolithic fourth metatarsals classified on the basis of discriminant function analysis as male or female. The black dot indicates the position of each Caldeirão specimen.

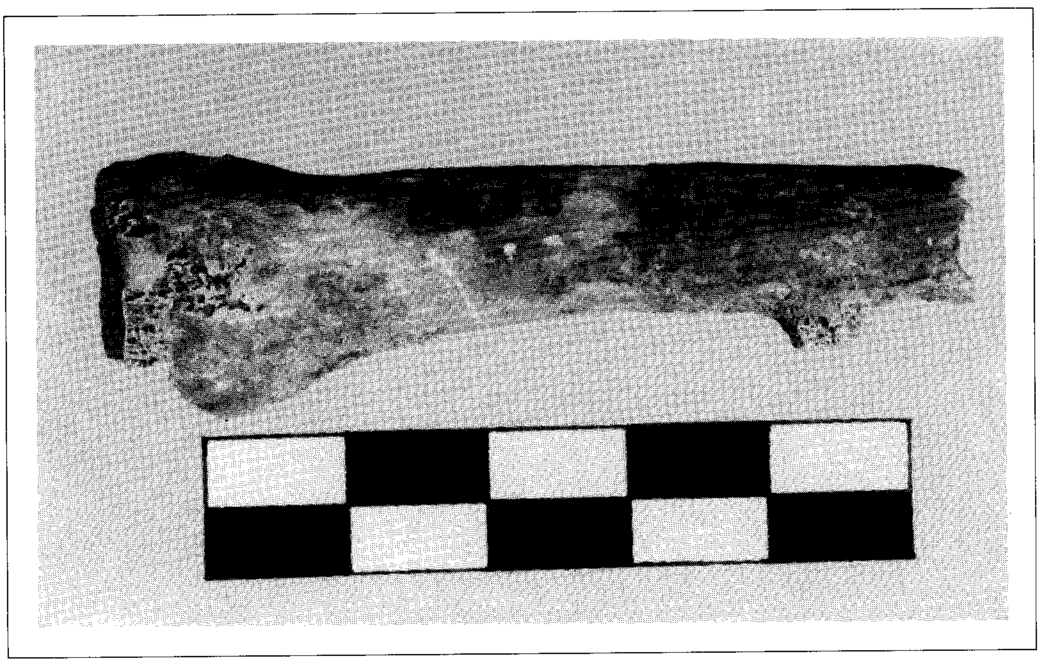


Fig. 5 - Specimen O10-65, a second left metatarsal, showing an exostosis on the plantar surface.

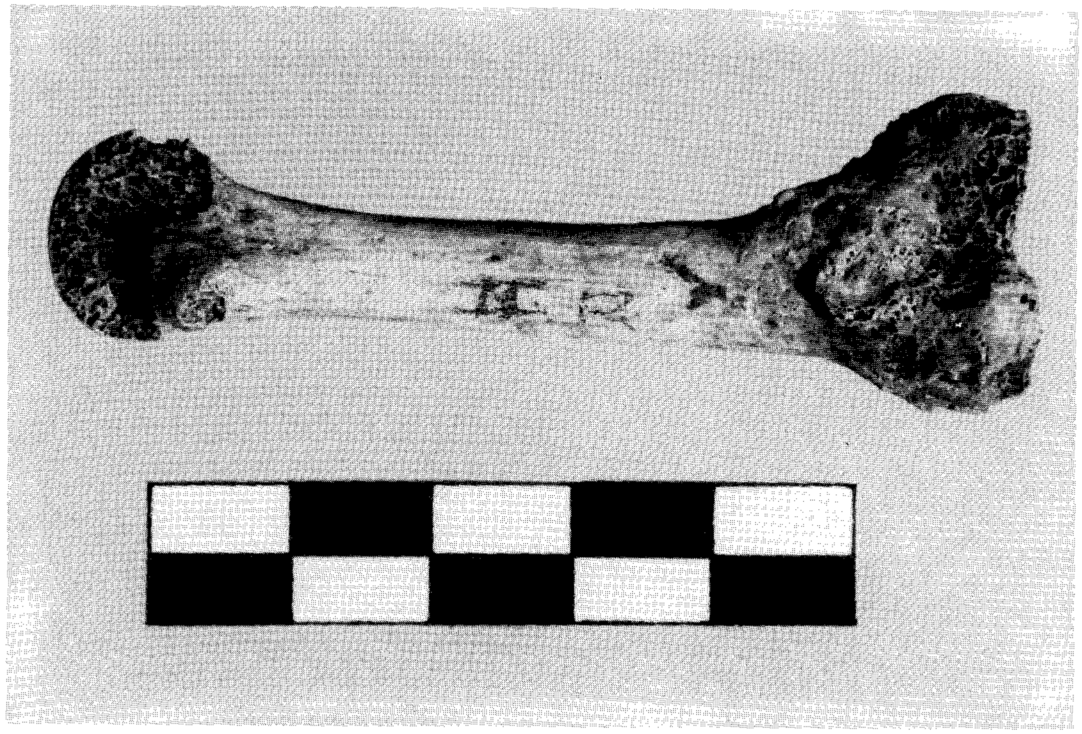
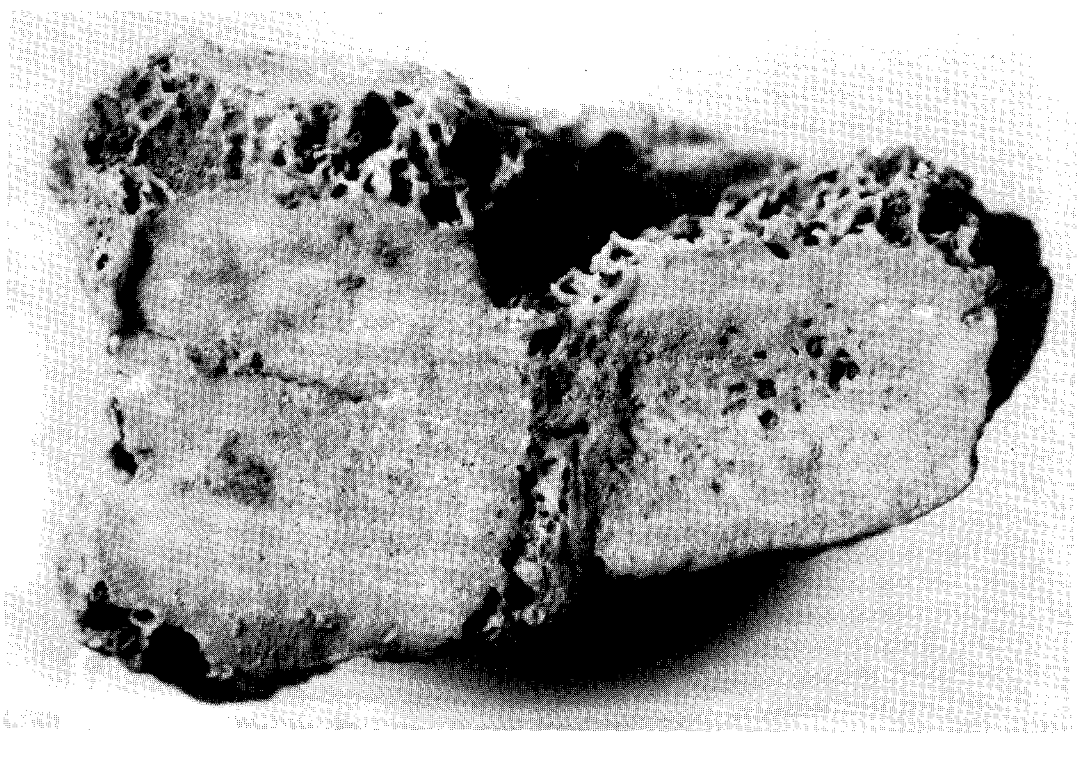


Fig. 6 - Lateral (a) and proximal (b) views of specimen O11-50, a right second metatarsal, showing an aparent fracture of the proximal end.



References

ANDERSON, D. L.; THOMPSON, G. W.; POPOVICH, F. (1976) -- *Age of attainment of mineralization stages of the permanent dentition*. «Journal of Forensic Sciences», 21, p. 191–200.

BARNETT, E.; NORDIN, B. E. C. (1960) -- *The radiological diagnosis of osteoporosis: a new approach*. «Clinical Radiology», 11, p. 166–174.

BERGOT, C.; BOCQUET, J.-P. (1976) -- *Étude systématique de l'os spongieux et de l'os cortical du femur et de l'humerus en fonction de l'âge*. «Bulletin et Mémoires de la Société d'Anthropologie de Paris», 3 (Série XIII), p. 215–242.

BOCQUET, J.-P.; NETO, M. A. Maia; ROCHA, M. A. Tavares da; MORAIS, M. H. Xavier de (1978) -- *Estimation de l'âge de décès des squelettes d'adultes par régressions multiples*. «Contribuições para o Estudo da Antropologia Portuguesa», 10(3), p. 107–113.

DELGADO, J. F. N. (1867) -- *Da existência provável do homem no nosso solo em tempos mui remotos provada pelo estudo das cavernas. I -- Notícia acerca das grutas da Cesareda*, «Estudos Geológicos», Commissão Geológica de Portugal, Lisboa.

DELGADO, J. F. N. (1884) -- *La grotte de Furninha à Peniche*. «Congrès International d'Anthropologie et Archéologie Préhistorique. Compte Rendu de la Neuvième Session à Lisbonne, 1880», p. 207–278.

FEREMBACH, D. (1974) -- *Le Gisement Mésolithique de Moita do Sebastião, Muge, Portugal. II, Anthropologie*, Lisboa, Direcção Geral dos Assuntos Culturais.

HILLSON, S. (1986) -- *Teeth*, Cambridge, Cambridge University Press.

HOWELL, N. (1979) -- *Demography of the Dobe !Kung*, New York, Academic Press.

JACKES, M. (1988) -- *Demographic change at the Mesolithic-Neolithic transition: evidence from Portugal*. «Supplemento della Rivista di Antropologia», Roma, LXVI, p. 141–158.

JACKES, M. (in prep.) -- *Paleodemography: problems and techniques of analysis*. in S. R. SAUNDERS; M. A. KATZENBERG (eds.) -- «The Skeletal Biology of Past Peoples: Advances in Research Methods», New York, Alan R. Liss.

JACKES, M.; LUBELL, D. (1986) -- *Mid-Holocene subsistence and demography in Portugal*. Paper presented at 19th Annual Chacmool Conference, «Diet and Subsistence: current archaeological perspectives». University of Calgary, 8 November 1986. Manuscript on file.

LOVEJOY, O. C.; MEINDL, R. S.; PRYZBECK, T. R.; MENSFORTH, R. P. (1985) -- *Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death*. «American Journal of Physical Anthropology», 68, p. 15–28.

LUBELL, D. (1984) -- *Progress report to Social Sciences and Humanities Research Council of Canada on Research Period I, Operating Grant 410-84-0030.* Manuscript on file.

LUBELL, D.; JACKES, M. (1988) -- *Portuguese Mesolithic-Neolithic Subsistence and Settlement.* «Supplemento della Rivista di Antropologia», Roma, LXVI, p. 231-248.

LUBELL, D.; JACKES, M.; MEIKLEJOHN, C. (1989) -- *Archaeology and human biology of the Mesolithic- Neolithic transition in southern Portugal.* in C. BONSALL (ed.) -- «The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985», Edinburgh, John Donald, p. 632-640.

McKERN, T. W.; STEWART, T. D. (1957) -- *Skeletal age changes in young American males.* Technical Report EP-45, Quartermaster Research and Development Command, Natick, Massachussets.

MEIKLEJOHN, C.; SCHENTAG, C. (1984) -- *The human skeletal material from the Neolithic site of Gruta do Zambujal, Melides, Portugal: preliminary description and comparison.* Manuscript on file.

MEIKLEJOHN, C.; SCHENTAG, C.; LUKACS, J.; SKINNER, M.; JACKES, M. K. (n.d.) -- *Localized enamel hypoplasia of deciduous canine teeth: evidence from prehistoric Pakistan and Portugal.* Manuscript in preparation.

MOORREES, C .F. A.; FANNINIG, E. A.; HUNT Jr., E. E. (1963) -- *Age variation of formation stages for ten permanent teeth.* «Journal of Dental Research», 42. p. 1490-1502.

NEMESKÉRI, J.; HARSÁNYI, L.; ACSÁDI, Gy. (1960) -- *Methoden zur diagnose des lebensalters von skelettfunden.* «Anthropologische Anzeiger», 24, p. 70-95.

NOGUEIRA, A. de Mello (1930) -- *Estação Neolítica de Melides, grutas sepulcrais.* «Comunicações dos Serviços Geológicos de Portugal», XVI, p. 41-49.

ROCHE, J. (1972) -- *Les amas coquilliers (concheiros) mésolithiques de Muge (Portugal).* «Fundamenta», VII, p. 72-107.

SIMMONS, D. J. (1985) -- *Options for bone ageing with the microscope.* «Yearbook of Physical Anthropology», 28, p. 249-263.

SINGH, M.; RIGGS, B. L.; JOWSEY, J. (1970) -- *A new method of evaluating bone loss in osteoporosis.* «Proceedings of Bone Measurement Conference, Conf - 700515», Washington, U.S. Atomic Energy Commission, Division of Technical Information, p. 199-202.

SMITH, H. (1984) -- Patterns of molar wear in hunter-gatherers and agriculturalists. «American Journal of Physical Anthropology», 63, p. 39-56.

SPSS Inc. (1983) -- *SPSSx User's Guide*, New York, McGraw -Hill.

THOMPSON, D. D. (1979) -- *The core technique in the determination of age at death in skeletons*. «Journal of Forensic Science», 24, p. 902-915.

TODD, T. W. (1920) -- *Age changes in the pubic bone, I: the male White pubis*. «American Journal of Physical Anthropology», 3, p. 285-334.

TROTTER, M.; GLESET, G. C. (1958) -- *A re-evaluation of stature based on measurements taken during life and of long bones after death*. «American Journal of Physical Anthropology», 16, p. 79-123.

ZILHÃO, J. (1984) -- *A Gruta da Feteira (Lourinhã)*, «Trabalhos de Arqueologia», 01, Lisboa, Instituto Português do Património Cultural.

Resumo

A análise da representação das diferentes partes do esqueleto humano no espólio osteológico recuperado nos níveis do Neolítico antigo da Gruta do Caldeirão demonstra que a sua fragmentação se deve a causas tafonómicas naturais e não a práticas de enterramento pouco usuais, e que a amostra não se encontra distorcida por fenómenos de recolha diferencial durante a escavação (Quadro 1). O horizonte NA1 apresenta um índice de fragmentação superior, o que se deve tanto ao facto de o NMI ser superior ao de NA2 como ao facto de ter sido mais afectado por fenómenos de bioturbação.

O NMI de NA1 é de 13: 6 juvenis, de idades compreendidas entre a infância e o início da adolescência (10-14.9 anos), dois adolescentes de maior idade (15-19.9 anos) e quatro ou cinco adultos. Com base nos dados obtidos a partir da análise da dentição, dos fémures, das pélves, dos metatarsianos e dos astrágalos, pode concluir-se que entre estes adultos se contam dois indivíduos de 20 a 20.9 anos (um do sexo masculino, outro do sexo feminino), e três outros de idade indeterminada, sendo dois do sexo masculino e um do sexo feminino.

Em NA2 foram contabilizados quatro adultos (dois do sexo masculino com pelo menos 40 anos de idade, um provavelmente do sexo feminino, o outro sendo possivelmente um adolescente tardio do sexo masculino), e uma criança. As tíbias, porém, indicam a presença de quatro adultos do sexo masculino, o que implica portanto um NMI de 6. No que respeita à distribuição espacial dos restos humanos de NA2, pode afirmar-se que no lado norte da sala do fundo, junto ao quadrado O12, foram encontrados diversos vestígios atribuíveis a dois indivíduos adultos do sexo masculino, um de idade avançada, com artrite e alguma osteoporose, e outro de meia idade. No que respeita ao primeiro, porém, outros vestígios foram igualmente recuperados contra a parede sul, nos quadrados R12, Q12 e Q13. Quanto ao indivíduo do sexo feminino, foram igualmente recuperados restos fragmentários tanto junto à parede sul (R12), como junto à parede norte (O11).

A comparação com as populações mesolíticas de Muge e com as populações de outras necrópoles neolíticas e calcolíticas do litoral centro e sul encontra-se limitada pelo estado fragmentário do material recuperado no Caldeirão e pelo facto de a análise dos

espólios destas outras jazidas não estar ainda concluída. No estado actual da questão pode no entanto dizer-se que não parece haver diferenças nítidas entre as populações mesolíticas e as populações neolíticas, e que, no que respeita a alguns índices (tamanho dos molares, tamanho dos astrágalos e calcâneos, tamanho dos metacarpianos e dos metatarsianos), os materiais da Gruta do Caldeirão parecem ocupar uma posição intermédia entre os do Mesolítico e os do Neolítico mais tardio (Quadros 11–15, Fig. 4).

A análise do teor em isótopos estáveis do azoto e do carbono sugere que as populações neolíticas do Caldeirão tinham uma dieta à base de alimentos terrestres, muito diferente da das populações mesolíticas estudadas. A análise da área cortical óssea dos fémures, por outro lado, indica que os indivíduos em causa eram activos, bem alimentados e saudáveis. A incidência da cárie dentária (Quadro 18) não difere significativamente da verificada nas populações mesolíticas, e as outras patologias identificadas (artrite, osteoporose) são comuns nas populações em que se atingem idades avançadas. As anormalidades identificadas em alguns metatarsianos (Figs. 5 e 6) são de origem traumática.

A análise paleodemográfica sugere que há uma sub-representação do grupo etário de idade superior a 25 anos, o que indica que os membros adultos do grupo terão sido preferencialmente sepultados noutro local. Ajustando os dados de forma a corrigir esta distorção obtem-se uma curva que indica taxas de mortalidade baixas em termos arqueológicos, e semelhantes às de populações actuais como os !Kung Dobe.