BIOLOGIE DU SQUELETTE HUMAIN ET LA TRANSITION MÉSO-NÉOLITHIQUE AU PORTUGAL

HUMAN SKELETAL BIOLOGY AND THE MESOLITHIC-NEOLITHIC TRANSITION IN PORTUGAL

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Résumé. – Les données provenant des collections ostéologiques humaines portugaises (NMI~580) datées entre 8 000 cal BP et 4 500 cal BP ont fourni des évidences d'une diminution dans la taille des dents qui n'est pas associée avec une diminution dans la taille du corps. La robustesse des éléments osseux postcrâniens ne montre pas une tendance définie à travers le temps. Les analyses multivariées de la forme, la mesure des os longs, des caractéristiques métriques des dents et du squelette, ainsi que les mesures crâniennes indiquent globalement des relations complexes entre les échantillons squelettiques du Mésolithique et du Néolithique portugais. Il n'y a aucune évidence consistante pour un remplacement complet de la population contemporaine de la transition économique. Les différences entre les échantillons mésolithiques de Moita do Sebastião et Cabeço da Arruda, ainsi que l'hétérogénéité dans les échantillons néolithiques de Casa da Moura, Feteira, Fontainhas, Furninha et Melides suggèrent que l'on a besoin d'une compréhension plus nette des différences à l'intérieur de la population mésolithique avant de pouvoir arriver à une conclusion définitive sur les rapports entre populations à travers la transition au Néolithique.

Mots clés : ostéologie, Portugal, Mésolithique, Néolithique, distance génétique.

Abstract. – Data from human skeletal samples (total MNI~580) from Portugal dating between 8,000 cal BP and 4,500 cal BP provide evidence of reduction in tooth size, but no associated reduction in overall body size. The robusticity of postcranial elements shows no clear trend through time. Multivariate analyses of shape and size of long bones, of dental and postcranial metrical characteristics, and of cranial measurements, all indicate complicated relationships amongst mesolithic and neolithic Portuguese human skeletal samples. There is no consistent evidence for a wholesale replacement of population associated with the economic transition. Differences between the mesolithic samples from Moita do Sebastião and Cabeço da Arruda, together with neolithic heterogeneity in the samples from Casa da Moura, Feteira, Fontainhas, Furninha and Melides, suggest that we need a much clearer understanding of mesolithic population differences before we can arrive at firm conclusions about population relationships across the transition to the Neolithic.

Key words : osteology, Portugal, Mesolithic, Neolithic, genetic distance.

PROBLEM

Is it possible to identify biological differences between two archaeological populations living in the same geographical area during a period of economic transition ? If identified, can these differences be reliably attributed either to population replacement or to the change in diet and lifestyle ?

MATERIALS AND METHODS

Data from three mesolithic and eight neolithic Portuguese human skeletal samples (total MNI~580 ; fig. 1 and 2) show a reduction in tooth size, but no associated reduction in overall body size. Robusticity of postcranial elements shows no clear trend through time.

L'Europe des derniers chasseurs, 5e Colloque international UISPP, 18-23 septembre 1995, p. 59-64.

Analyses of postcranial bone shape (indices of transverse and sagittal dimensions) and size (transverse shaft diameters), of dental and cranial measurements, and of non-metrical traits, all indicate that there is no simple explanation for the similarities and the differences amongst these samples.

The chronology shown in figure 2 is based on data given in Lubell *et al.* (1994, tab. 1), all determined on human bone collagen (with additional information on Caldeirão from Zilhão, 1992). The weighted mean of Casa da Moura II, III, IV is 5,006 ± 45 uncal BP (5,734 cal BP), but the date for Casa da Moura used in Lubell *et al.* (1994) is based on the weighted mean of all four available dates, including Casa da Moura I (6869 cal BP, see also Straus *et al.*, 1988). Our choice of date for Casa da Moura here is founded on direct dating of three skeletons which we assume represent the majority of individuals we analyzed, all excavated by Delgado (1867), and takes into account Zilhão's opinion that archaeologically the site should be given a younger, rather than an older, date. We assume that Casa da Moura and Furninha were contemporaneous : Zilhão (*in litt.* 10.12.95) states that at both sites « most of the

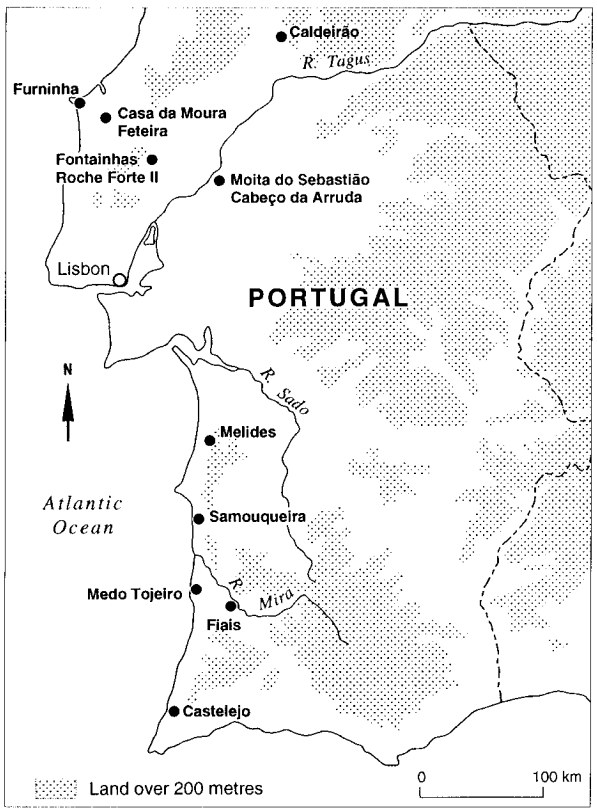

Figure 1. – Central and Southern Portugal showing location of sites discussed in text.

SITE	CALIBRATED YEARS BP	DATE	MNI
Mesolithic			
Moita do Sebastião	7597-8037	7900	79
Cabeço da Arruda	7224-7783	7600	97
Samouqueira	7224		2
Neolithic			
Caldeirão NA1	6668-6810		13
Caldeirão NA2	6965-7225		6
Furninha	est. 5500-6900	6000	43
Casa da Moura	5595-6869	5700	214
Melides (Lagares)	6144		29
Melides (Zambujal)	4989		51
Feteira (partial)	4660-5297		30
Fontainhas	4724		17

Figure 2. – Dates and sample sizes for sites discussed in text.

Site[a]	n	M_2 wear levels			
		2	3	4	5
Moita do Sebastião	12	0	4	6	2
Cabeço da Arruda	13	5	1	3	3
Furninha	8	5	2	1	0
Casa da Moura	15	4	7	3	1
Melides (Zambujal)	3	3	0	0	0

Table 1. – Wear on M2 when wear on M1 is 5 a. Fontainhas and Feteira are not included here, since n = 2 in each case. For Fontainhas, the two second molars are from one individual with extensive chipping and abscessing, and the left side wear appears greater than the right because of this trauma. For Feteira, the two second molars represent stratigraphic Levels I and III (more than 600 years). The Feteira sample used in the diagrams presented here is from Level I (Zilhão, 1984), dated at 4,660 cal BP. Levels II and III are represented by very small samples. Level II is dated at 5,297 cal BP, and Level III is undated.

archaeological material... is of late neolithic age », although an epicardial component exists in both. The mesolithic and neolithic sites analyzed here were all utilized over long time periods, perhaps as long as 2,000 years in some cases, possibly masking biological variations resulting from trends through time.

Figure 3 illustrates why, in this paper, we give Furninha an estimated date slightly older than Casa da Moura : no collagen remained in the Furninha sample submitted for dating, therefore no radiocarbon date is available, but on the basis of figure 3 a predicted date older than the Casa da Moura skeletal sample is reasonable. Data on percent of tooth surfaces with caries and the occlusal/approximal caries ratio suggest that Furninha lies on the trend line between Arruda and Casa da Moura (Lubell *et al.*, 1994, fig. 9a). No categorical statements can be made because analysis of wear on the M1, relative to the M2 wear, indicates that Furninha dentitions have a slightly slower attrition rate than those from Casa da Moura (tab. 1). It is important to have some indication of rates of wear, since attrition is a determinant of occlusal caries rates, but the paucity of dentitions *in situ* in the bone makes detailed comparisons of wear difficult. No cranial material suitable for craniometric study survived from Furninha, and no dental material was available in the sample from Melides (Lagares) ; thus we have lacunae in our information, hindering our analyses. Nevertheless, data regarding caries presented in Lubell *et al.* 1994 place the Furninha dental sample with Casa da Moura and distinguish it from later material representing the Neolithic of the Portuguese Estremadura (Feteira and Fontainhas).

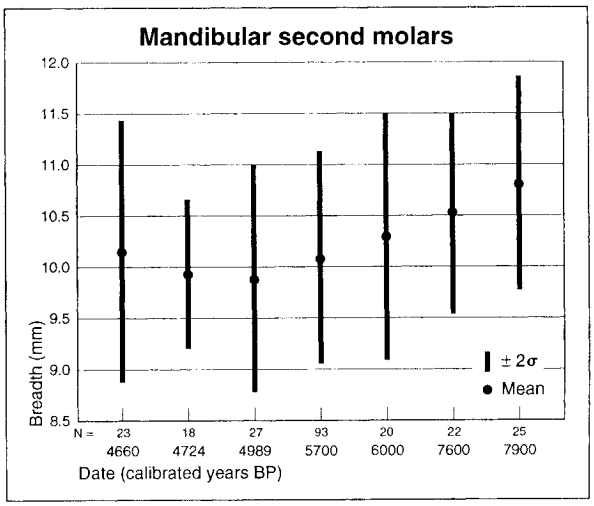

Figure 3. – Mean breadth (mm) of mandibular second molars.

ANALYSES AND RESULTS

Reduction in tooth size over time in archaeological populations appears to have been common during the Late Pleistocene and Early Holocene, and is often associated with the change from foraging to food production. In Portugal, a reduction has been observed within mesolithic populations by Meiklejohn (Meiklejohn, Schentag, 1988). The trend illustrated in figure 3 is based on lower second molars without major pathology or marked wear. The data used here come from teeth with wear levels of 0 to 5 (Lubell, Jackes, 1988, fig. 4), for which both length and breadth could be measured. Figure 3 and table 2 show that dental reduction continued across the transition into the Earlier Neolithic. While mean size changes, variances around the mean remain relatively homogeneous, suggesting that shifts in sexual dimorphism do not occur. Is the reduction in M2 dimensions simply a reflection of reduced body size ?

Femoral proximal shaft dimensions do not suggest reduced robusticity in neolithic populations (fig. 4 and tab. 2). Neolithic femora are variable, but always broader than mesolithic ones. However, long bones of the lower limb are susceptible to alterations in shape as a result of changes in activity. It is therefore necessary to analyze a post-cranial dimension which is neutral with regard to activity, and thus to examine the possibility that there is actually no change in skeletal robusticity over time.

The mid-shaft transverse diameter of third metatarsals is chosen as such a neutral dimension, and one for which adequate sample sizes are available. No trend is discernible (fig. 5).

If we examine the left humerus, a non-weight-bearing bone and less likely than the

Site	yrs cal BP	breadth of lower M2 (mm)			adult femoral proximal transverse diameter (mm)		
		Mean	s	n	Mean	s	n
Moita do Sebastião	7900	10.80	.524	25	30.18	1.862	63
Cabeço da Arruda	7600	10.52	.495	22	29.68	2.579	71
Melides (Lagares)	6144	-	-	-	31.67	2.099	24
Furninha	(6000)	10.29	.608	20	30.73	3.793	29
Casa da Moura	5700	10.09	.516	93	31.28	3.296	178
Melides (Zambujal)	4989	9.88	.522	27	30.78	2.938	36
Fontainhas	4724	9.93	.368	18	30.92	3.193	41
Feteira (level 1)	4660	10.16	.641	23	31.37	3.219	10

Table 2. – Breadth in mm of mandibular second molars and proximal femora.

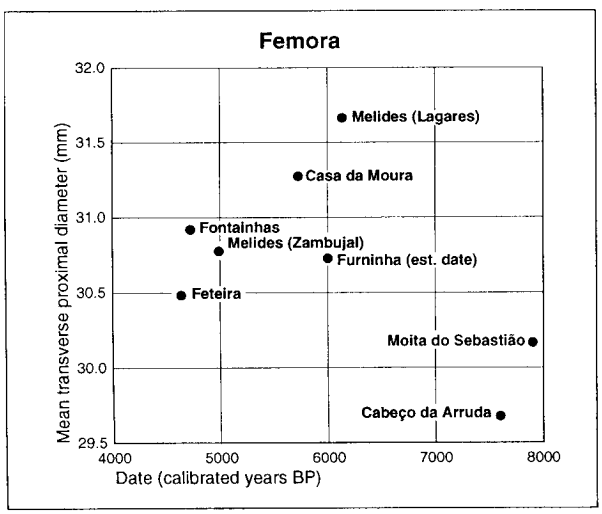

Figure 4. – Mean femoral transverse proximal diameter (mm).

right to be subject to activity-induced changes, there is again no trend (fig. 6). In fact, the situation is the reverse of what might be expected : the oldest sample (Moita do Sebastião) is the smallest. Furthermore, Moita is the only sample which differs significantly : Cabeço da Arruda, the other mesolithic sample, is clearly equivalent to the robust neolithic humeri dated around 6,000 cal BP.

Cluster analysis of humeral, tibial and femoral mid-shaft mass, and indices expressing shape, shows that the two mesolithic samples (Moita and Arruda) do not group together (fig. 7). The sites which contain the largest individuals (Lagares and Furninha) are clearly differentiated. The two mesolithic sites group in various ways according to the variables included in the analysis : they never

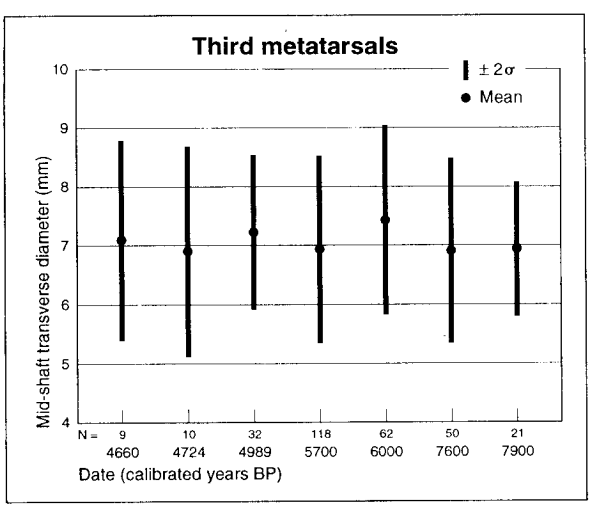

Figure 5. – Mean mid-shaft transverse diameter (mm) of third metatarsals.

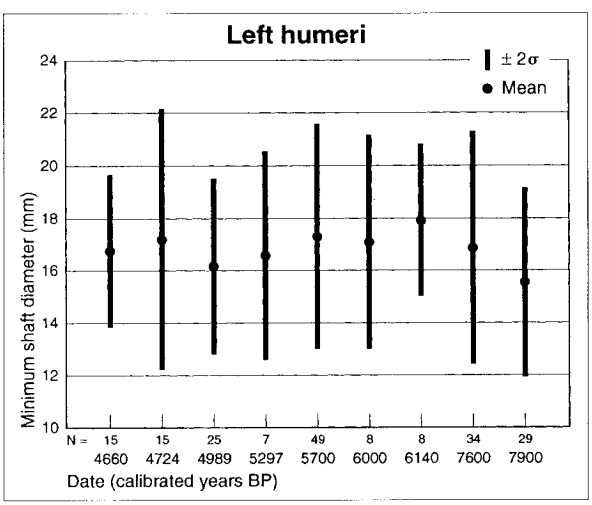

Figure 6. – Mean minimum shaft diameter (mm) of left humeri.

group together when long bone dimensions are used.

Analyses of cranial measurements also suggest that mesolithic populations of Central Portugal were neither homogeneous nor stable over time (fig. 8) : results again show no clear differentiation between mesolithic and neolithic samples, and lack of homogeneity within the Mesolithic. This result holds true even when other samples are introduced into the analysis as outliers, as, e.g., the mesolithic samples from Northern Europe used in this dendrogram.

Analysis of non-metrical traits provides more reliable evidence for genetic relationships. Figure 9 shows the results of an analysis of eight non-metrical traits which are assumed to be independent of environmental influences (Carabelli's cusp on M1 ; MB/DL cusp contact on M1, M2, and M3 ; cusp number on M2 ; left humerus septal aperture ; talus facet form ; calcaneus facet form), controlling for sample size by application of the city block measure. Figure 9 shows a close grouping of the mesolithic samples from Moita and Arruda, two sites located within 3 km of each other and overlapping in time. We would therefore expect them to demonstrate the genetic similarity shown by this analysis. The nearest neighbour to the mesolithic sites in the cluster diagram is Zambujal Cave at Melides, several hundred kilometers to the south and several thousand years later in time, thus suggesting genetic continuity south of the Tagus. Sites assumed to date around 6,000 cal BP from the Estremadura north of the Tagus then join the cluster. Our research does not therefore provide firm evidence for population replacement associated with the Mesolithic-Neolithic transition. Figure 9 suggests only that neolithic samples from north of the Tagus River dated after 5,000 cal BP are differentiated genetically from mesolithic samples, and that samples from sites south of the Tagus, whether Mesolithic or Neolithic, bear a closer genetic relationship to each other than they do to samples from sites north of the Tagus.

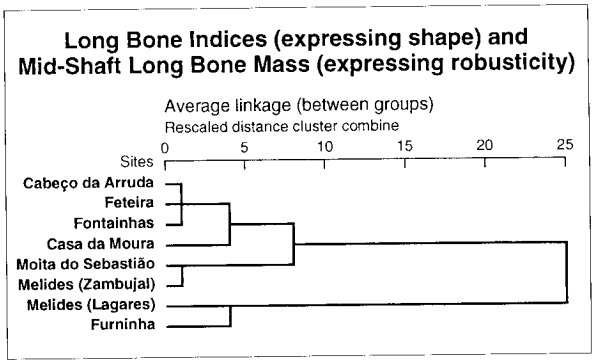

Figure 7. – Dendrogram of long bone shaft robusticity and shape.

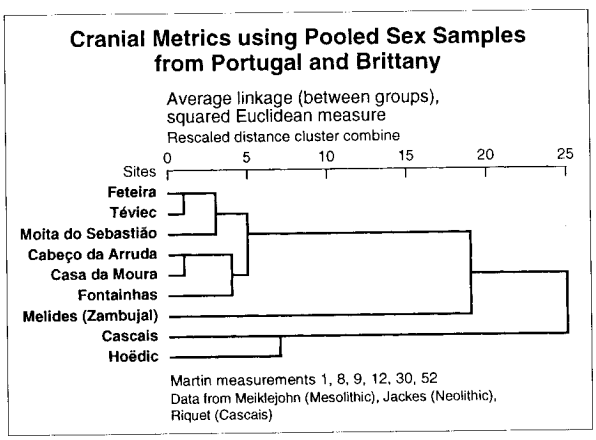

Figure 8. – Dendrogram of cranial metrics.

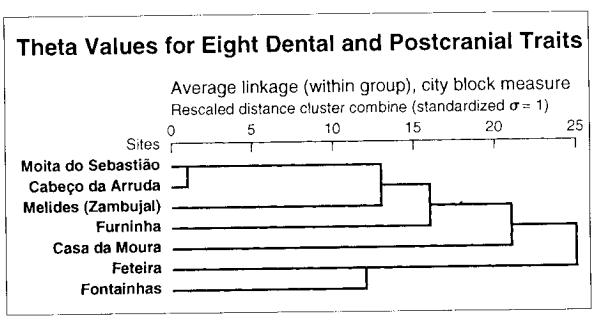

Figure 9. – Dendrogram of theta (q) values for dental and postcranial non-metrical traits.

SUMMARY AND CONCLUSIONS

Differences between the two mesolithic samples demonstrate the need for a clearer understanding of trends through time within the mesolithic population before we can arrive at firm conclusions about population relationships across the Mesolithic-Neolithic transition. While some data do indicate specific differences between mesolithic and neolithic

populations in Central Portugal, overall there is no clear major discontinuity between skeletal samples from the Mesolithic and the Neolithic, whether in skeletal size and shape, or in non-metrical characteristics.

We are convinced that trends established in the Mesolithic continued into the Neolithic (Lubell *et al.*, 1994). Neither genetic replacement nor economic change at the Mesolithic-Neolithic transition provide an all-inclusive explanation for the conflicting trends that we have identified of reduction, increase or stability in the size of skeletal elements, and of homogeneity and heterogeneity in shape and non-metrical characteristics in Portuguese skeletons dating between 8,000 cal BP and 4,500 cal BP. Despite the fact that we report on a relatively large sample of skeletal and dental material, from a relatively restricted geographical area, the data are still not sufficient to provide incontrovertible evidence for either population replacement or continuity. We hypothesize, based on palaeodemographic analyses, that there was biological discontinuity and hence heterogeneity among small relatively sedentary mesolithic bands (Jackes n.d.), which resulted in the heterogeneity observed in the neolithic samples we have studied. The hypothesized mesolithic heterogeneity, maintained within succeeding neolithic groups, cannot be ignored in any attempt to interpret the human biology of the transition.

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