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THE CONTRIBUTION OF ANTHROPOLOGICAL STUDY TO THE RECONSTRUCTION OF THE LIFE STYLE OF THE EPIPALEOLITHIC POPULATION OF TAFORALT (MOROCCO). PRELIMINARY REPORT

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Abstract: In this article the preliminary data of the anthropological study of the skeletal sample of Tafaralt cave (Morocco, 11-12000 years ago) are presented. Some dental traits (wear, caries, etc.) and morphological skeletal markers of activity (enthesis, development and accessory articular surfaces) were considered. The diet was probably constituted of cariogenic and abrasive foods and the Tafaralt population seems to have been organised as a complex society, with task specialisation both on a gender and on a skill basis.

Résumé : Cet article présente les données préliminaires de l'étude anthropologique effectuée sur la collection du matériel fossile humain provenant de la grotte de Tafaralt (Maroc, 11-12000 ans). Nous avons pris en considération certains traits dentaires (abrasions, caries, etc.) et des marqueurs squelettiques d’activité (enthèse, surfaces articulaires accessoires). Le régime alimentaire de la population de Tafaralt était probablement constitué par une alimentation abrasive et cariogénique. Cette population semble avoir été organisée en société complexe avec une spécialisation à la fois par sexe et par aptitude.

INTRODUCTION

The anthropological investigation of human skeletal remains can contribute to some extent to the reconstruction of cultural, economic and social aspects of past populations. The skeletal morphometrical features can provide information about physical activities, pathological conditions, diet and nutrition, etc. This information can then be interpreted, in light of age and sex distribution, in terms of the life style (amount of physical work, mobility vs. sedentism, etc.), health conditions, subsistence patterns, social organisation (division of labour, etc.). It is of particular interest to investigate these aspects during the transition period from final Pleistocene to early Holocene, when climatic changes (having consequences on the vegetation and fauna) caused a change in the subsistence patterns, and perhaps in movements/migrations of human groups. A complete anthropological analysis of the population of Tafaralt cave, in Morocco, dated at about 11-12 thousand years ago, is currently in progress with the purpose of investigating the microevolutionary processes that involved the Mediterranean populations in this period. In this paper we will present information derived from the preliminary data on the dental lesions and morphological markers of activity of the skeletons.

The study of jaws and teeth (caries, calculus, abscesses, amelogenesis defects, etc.) can provide some information about the dietary habits and subsistence patterns, the hygienic and health conditions of the mouth, stress suffered during childhood and some cultural aspects of the population.

The skeletal markers of activity are osseous features (enthesis, i.e. insertion sites for ligaments or muscles, accessory articular facets, etc.) caused, at least in part, by mechanical stress. Their study can allow for the identification of gross workload patterns, of division of labour patterns on a sexual or social basis and, in some cases, when skeletons are complete, the reconstruction of specific activities (especially as independent tests of hypothesis based on archaeological findings) (Robb 1994; Peterson 1998).

TAFORALT CAVE

The Tafaralt cave is situated at about 55 km N-W of Oujda, in Eastern Morocco, at an altitude of 750 m, in the mountainous massif of Beni Snassen (Roche 1953). The main excavation campaigns were carried out in the ‘50s by Jean Roche, who discovered an archaeological deposit covering a time span of about 10000 years (21900 ± 400 – 10800 BP; Roche 1976, cit. in Ferembach 1986), with Mousterian, Aterian and Iberomaurusian lithic industry, and a necropolis with evidence of funerary practices, corresponding to the Iberomaurusian levels (Roche 1953). Some of the skeletons were associated with mouflon horns or skulls. Some of the bones were covered with ochre.

In the Iberomaurusian archaeological levels snail shells, animal bones (Box, Gazella, etc.) and fragments of ostrich eggs have been found. The lithic instruments are prevalently flint microliths. Parure elements, some osseous points, interpreted as objects related to the working of leather, and a small rectangular stone mortar and a pebble used as a pestle for ochre have also been found (Roche 1953). In the surrounding area there is availability of fresh water and rocks (flint, quartzite, limestone, etc.) suitable for production of lithic tools.

The necropolis seems to go back to a period just after the transition from a more cold and humid climate, to a semi-
arid climate. The study of faunal remains and pollen has revealed the presence of a Mediterranean environment. The radiocarbon dating of the carbon from the upper level of the necropolis yielded an age of 11900 ± 240 years (Roche 1959). According to Roche (1959), the more recent inhumations could be contemporary to the archaeological level dated 10800 ± 400 years (14C). The necropolis may have been in use for more than a thousand years!

MATERIALS AND METHODS

The Taforalt skeletal collection was first studied in 1962 by Ferembach for sex and age diagnosis and morphometrical characteristics. Other aspects were investigated by other Authors: Poitrat-Targowa (1962) for dental features, Dastugue (1962) for paleopathological features, Zouak (1991) for metrical characteristics, Szwebel-Chikli (1993) and Riond (2000) for epigenetic traits, etc. In the present work we analysed some dental and morphological skeletal features that were not considered in the previous studies, or that were not studied with standardised methods.

Ferembach (1962) listed 28 multiple burials and about 185 individuals, 80 of which were adults (39 M, 31 F, 10 NI). The population was constituted of tall and robust people, with a mean height of 174 cm for males and 163 cm for females. The Taforalt population practised the avulsion of the central upper incisors (one or both) in all individuals of both sexes, between the 8th and the 11th year (Ferembach 1962).

The present unavailability of excavation details regarding the necropolis and the lack of a complete bone inventory in the Ferembach monograph of 1962, combined with a sometimes confused labelling of the single bones, makes it impossible, for most of the graves, either to recognise individuals, or to know if the burials were carried out simultaneously. As a consequence, for the postcranial bones, age diagnosis is extremely uncertain. Since the Taforalt population is rather dimorphic, the sex has been attributed by the Authors of the present article on a dimensional basis; it is then compared with the previous attributions (when available) by Ferembach (1962), Zouak (1991) and Riond (2000). For the long bones, only 17.8% of the attribution were different; in this case, the determinations of Zouak on a metrical basis have been considered.

The jaws and teeth of 44 adults (25 males- 356 teeth, 15 females- 163 teeth and 4 which could not be sexed- 78 teeth) were analysed. All teeth have been macroscopically examined for dental wear (according to Smith 1984), caries (according to Powell 1985), abscesses, ante mortem tooth loss, calculus (according to Brothwell 1981) and amelogenesis defects. Here we will present the first results regarding the dental wear, caries, abscesses and calculus. The sex distribution of the features observed was considered. To avoid an excessive fragmentation of the sample and in view of the uncertain age of many of the specimens we have not examined their age subdivisions.

Regarding the activity markers, we will refer in this article only to the morphological markers of the postcranial bones (in total 40 scapulae, 44 clavicles, 52 humeri, 43 radii, 54 ulnae, 55 femora, 52 tibiae, 30 coxal bones), especially to the entheses development and to the presence of accessory articular surfaces (new facets or extensions of articular surfaces). These features are most often related to microtraumas due to habitual activities, even if the age plays an important role in their morphology and development (Dutour 1992; Robb 1994, 1998; Mariotti 1998). Normally, the entheses consist of rough patches on the bone. In some cases, enthesopathies can be present at the insertion sites in two forms: osteophytes or osteolytic lesions.

The degree of enthesis development was scored following a standardised method (Mariotti 1998) that provides three grades: 1 for low or medium development, 2 for high development and 3 for very high development. For enthesopathies there is a similar scale in the case of presence, but in addition they could be absent. Accessory facets were scored as absent or present. The features considered were interpreted taking into account the side, sex and functional complex they belong to (shoulder, elbow, hip, knee, foot).

RESULTS AND DISCUSSION

The dentitions of the Taforalt population are characterised in general by heavy wear. This indicates a diet rich in abrasive material and hard fibrous food. The uncertainty of age diagnosis limits the interpretation of wear, that is strictly related to age. In a few cases, it is possible that some extra-masticatory use of dentition is present.

Dental caries affect the 13% (74/562) of teeth (M+F+NI). Most of the caries are on the occlusal surface of the tooth (34%, 25/74). The high frequency of occlusal caries associated to heavy wear is rather unusual. In fact the wear "cleans" the occlusal surface of the tooth of initial cariogenic sites (Powell 1985; Maat and Van der Velde 1987) and, in flattening the crests, it eliminates the sulci in which food is trapped and from which it is removed with difficulty.

The association of heavy wear and high incidence of caries is consistent with the consumption of fibrous vegetables, molluscs (rich in sand and grit) and very cariogenic foods, such as honey and sweet Mediterranean fruits (figs, etc.). It has also been suggested that a high caries frequency could be related to the low fluoride content of the ground water (Sealy et al. 1992). In any case, predisposing individual factors cannot be excluded.

Females are more affected by caries than males, considering both the incidence per tooth (M=9%, 31/339; F=19%, 28/149) and per individual (considering only the individuals with more than 7 teeth: M=52%, 11/21; F=82%, 9/11). This could reflect differences in the preparation and consumption of food (Larsen 1983, 1993, 1997; Lukacs 1996), but we cannot exclude the influence of pregnancies and nursing (Brasili et al. 2000).
Alveolar abscesses are present in the 48% (21/44) of individuals and in 10% (71/717) of the observable alveoli. They are related both to caries and heavy wear (Fig. 1). Considering the individuals, women are more affected than men (F: 53%, 8/15; M: 40%, 10/25), but the frequency per alveoli is higher in men (M: 10%, 43/421; F: 8%, 21/252). So the fewer males affected by this lesion are more severely affected. Males thus present a greater intrasexual variability. It is possible to think that some men, maybe the ones more involved in hunting activities, consumed a greater quantity of sweet energetic foods. This is supported by the fact that destructive caries are more frequent in the male teeth (M: 35%, 11/31; F: 18%, 5/28).

Calculus is present in 77% (426/551) of the teeth. This value is particularly high, also considering that the frequencies are always underestimated as calculus is easily detached from the tooth surface during manipulation of the specimens. Males are significantly more affected than females (M: 82%, 276/336; F: 63%, 89/142). The etiology of calculus is attributed to a variety of factors, such as poor oral hygiene (Borgognini Tarlitt and Repetto 1985; Hillson 1996), high consumption of carbohydrates (Scheie 1989; Hillson 1996; Lieverse 1999), and sucrose in particular (Roberts and Manchester 1995), a diet rich in protein (Hillson 1979). Thus, the data on the calculus are consistent with the interpretations previously given on the basis of caries and abscesses. In addition it is possible that men consumed more meat.

The activity markers will be analysed for each functional complex.

For the shoulder functional complex, the enthese of males are in general more developed than those of females (Fig. 2a). In females the left side is more developed. Males show a lower asymmetry. The shoulder joint is involved in all the wider upper limb movements. So, it seems that men performed wider upper limb movements than women. Moreover, these movements stressed the shoulder in a more symmetric manner.

The deltoid muscle is the most dimorphic, being more developed in males. But while males show a symmetric development, in females there is a clear prevalence of the left side. The deltoid is the principal abductor, but it is involved in all the shoulder movements. A left side dominance for the deltoid in females has been observed in other historic and modern skeletal series (Mariotti 1998; Belcastro et al. 2000) and was interpreted as the need to hold children with the left arm, using the right one for other occupations.

For the elbow functional complex (Fig. 2a), males are not so clearly more robust than females, even if the maximum degree of development (3°) is more frequent in males (Fig. 2b). In females the left side dominance is not so clear as it was for the shoulder.

The most dimorphic enthese are the right common insertion of the flexors on the humeral medial epicondylo, more developed in males, and the right brachialis insertion on the ulna, more developed in females. These muscles are all flexors of the elbow, but with some functional differences. The former are also flexors of the fingers and wrist, suggesting a strong grasp, as in tightly holding, for example, a stick or a spear. The brachialis is the most important flexor of the elbow, independently on the pronation or supination position of the forearm. The major effect is seen in the act of raising a load (Kahle et al. 1987).

All this suggests for the elbow functional complex a comparable amount of workload for both sexes, but a qualitative difference in the type of activities performed.

Finally we can note that for all the enthese of the upper limb, males are more variable, having a higher frequency of grade 3. This could mean, perhaps, that activities carried out by women were more homogeneous, while for men there was a greater task specialization.

For the lower limb, the main thing to note is that iliopsoas and soleus muscles are more developed in males (Fig. 3a). These muscles are very important for deambulation. The former is a flexor of the thigh, the latter responsible for the elevation of the calcaneum during walking. The development of Achilles tendon, also responsible for the foot plantar flexion, is more frequent in females (Fig. 4a), but the 3° degree (Fig. 3b) and
Figure 2. Frequency of upper limb enthese development in the adult males and females of Taforalt skeletal collection. The number of observations for each enthesis ranges from 6 to 14. a: high development (grades 2+3). b: very high development (grade 3).
Figure 3. Frequency of lower limb enthesis development in the adult males and females of Taforalt skeletal collection. The number of observations for each enthesis ranges from 7 to 16. a: high development (grades 2+3). b: very high development (grade 3).
the enthesopathies (left: M=69%, 9/13; F=43%, 3/7; right: M=57%, 8/14; F=29%, 2/7) are more frequent in males. The enthesopathy has been related to excessive walking and running, even if many other factors could be responsible for its presence (Dutour 1986, 1992; Larsen 1997). Thus men seem to have been more often subjected to prolonged and strenuous walking or running. In any case, women display a very high frequency of development (grades 2-3) of this enthesis in comparison with historic and modern skeletal collections studied with the same methodology (Mariotti 1998; Belcastro et al. 2000). So, a certain amount of stress from walking can be hypothesised for them too.

Sacroiliac accessory facets on the coxal bones have been found in 4 out of 5 females (80%), and in 1/12 males (8%). Trotter (1964) found a high frequency of these facets in African women known to carry children on their backs (F=31.6%; M=13.1%). Our female sample size is very small, but a similar interpretation can be proposed.

Regarding the frequencies of some facets generally interpreted as squatting facets, the sulcus tali facet (Trinkaus 1975) is more frequent in females (left: M=42%, 5/12; F=57%, 4/7; right: M=33%, 3/9; F=75%, 6/8). The frequencies of the tibial squatting facets are similar between sexes and sides (left: M=100%, 9/9; F=90%, 9/10; right: M=92%, 12/13; F=100%, 11/11), but are very high in comparison with historical and modern skeletal series (e. g. in a Sardinian sample of the beginning of the 20th c. a. frequency of about 25% for M and 50% for F was found, Mariotti 1998). These features could be related to the squatting position, but also to walking on irregular ground (Trinkaus 1975).

CONCLUSIONS

There are many problems that limit overall interpretation: the small sample size, the uncertainty of sex and age attribution, the unavailability of excavation details that could be useful in an attempt to reconstruct individual skeletons and the lack of precise information regarding the time span during which the necropolis was in use.

Bearing in mind these limitations, we can attempt to some hypotheses to explain the data obtained, taking into consideration also the archaeological findings.

The diet probably consisted of abrasive and cariogenic foods. It is possible to think of an intensive gathering of gastropods, fibrous vegetables, and very cariogenic wild fruits. Meat was probably an important food. Thus it seems that this population had a rather varied diet, suggesting an efficient environmental exploitation. The high sexual dimorphism showed by this population supports the idea of good health and nutritional conditions (Ferembach 1978; Laloue-Fox 1998). The sex differences reveal different dietary habits, maybe reflecting different roles in the society.

Regarding the enthesis development, the differences between males and females account for a division of labour on a sexual basis. Data on the upper limb enthesis reveal that males are more variable than females: they probably had more intrasexual task specialization. The features of the lower limb bones suggest that all in the Taforalt population were submitted to stress from prolonged walking or walking on irregular ground, but males were more mobile than females. Squatting was probably a habitual posture for both sexes, even if women seem to have passed more time in this position.

Ferembach (1986) hypothesised for the Taforalt population a sedentary life style, with much time passed in a sitting position. On the basis of the few faunal remains in comparison to the abundant shells, she thought these individuals not to be much involved in hunting, but instead in the collection of gastropods.

The hypothesis of a hunting-gathering-fishing economy, suggested by the faunal remains, is consistent with our results. Men could have been involved in hunting, in fishing, in the production of lithic instruments, in the transport of prey, etc.; women could have been involved in snail, egg and vegetable collection, transport of water, etc. As suggested by Roche (1953) on the basis of the presence of ossaceous tools, some individuals could also have been involved in the preparation of leather. A fully sedentary way of life, as hypothesised by Ferembach (1986), is not fully supported by this study.

The Taforalt population must have been organised as a relatively complex society, with task specialisation not only on a gender basis, but also on a skill basis. Unfortunately, given the great possible chronological range of the site, we cannot exclude that the variability observed could reflect possible diachronic changes in the dietary, activity and subsistence patterns. The attempt to associate postcranial bones in order to reconstruct individuals as well as overall anthropological analysis of the skeletons will help to obtain more details about the Taforalt society. This analysis is the topic of work currently in progress.

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Bibliography

BECOME, M.G., FACCHINI, F., NERI, R., MARIOTTI, V.,
2000, Skeletal markers of activity in the Upper Middle Ages
neolithic of Vicence-Campochiaro (Vilose, Italy). 12th
Congress of the European Anthropological Association, Cambridge,

BORGONOINI TARLI, S.M., REPETTO, R., 1985, Dietary
patterns in the Mesolithic samples from Uzzo and Molara caves
(Sicily) : the evidence of teeth. Journal of Human Evolution 14,
p. 241-254.

BRASILI, P., MARIOTTI, V., NERETTI, C., FACCHINI, F., 2000,
Nutritional habits of the Celtic population of Casalecchio di Reno
(Bologna, Italy) (4th-3rd c. BC) inferred from dental conditions.

University Press.

CHALMA, M.C., 1969, La carie dentaire chez les hommes
préhistoriques d’Afrique du Nord : Epipaléolithique et

DASTUGUE, J., 1962, Pathologie osseuse. In L’Nécropole
Epipaléolithique de Tafaralt (Maroc oriental). Études des

DUTOUR, O., 1986, Enthesopathies (lesion of muscular insertions)
as indicators of activities of Neolithic Saharan populations.
American Journal of Physical Anthropology 71, p. 221-224.

DUTOUR, O., 1992, Activités physiques et squelette humain: le
difficile passage de l’actuel au fossile. Bulletins et Mémoires de

FEREMBACH, D., 1962, La Nécropole Epipaléolithique de Tafaralt

FEREMBACH, D., 1978, A propos des Magdaléliens et des
Mésolithiques. Influence possible de modifications du milieu sur
l’évolution morphologique. Bulletins et Mémoires de la Société

FEREMBACH, D., 1986, Homo sapiens sapiens in Afrique : des
origines au Néolithique. In L’Homme, son évolution, sa diversité.
Manuel d’anthropologie physique, edited by D. Ferembach, C.

HILLSON, S.W., 1979, Diet and dental disease. World Archaeology
11, p. 147-162.

HILLSON, S.W., 1996, Dental Anthropology. Cambridge:
Cambridge University Press.

KAHLE, W., LEONHARDT, H., PLATZER, W., 1987, Anatomi
umana. Apparato locomotore. Milano: Casa editrice Ambrosiana,
v1.

LALUZFOX, C., 1998, Stature and sexual dimorphism in ancient

LARSEN, C.S., 1983, Behavioural implications of temporal change in

LARSEN, C.S., 1995, Biological changes in human populations

LARSEN, C.S., 1997, Bioarchaeology: Interpreting behavior from
the human skeleton. Cambridge: Cambridge University Press.


LUKACS, J.R., 1996, Sex differences in dental caries rates with
the origin of agriculture in South Asia. Current Anthropology 37
1), p. 147-152.

competition. International Journal of Anthropology 2(4), p. 281-
292.

MARIOTTI, V., 1998, Ricerche metodologiche sugli indicatori
scheletrici morfologici di attività. Tesi di Dottorato in Scienze
Antropologiche, Università di Bologna.

MEKLEJOHN, C., SCHEIWALD, C., VENEMA, A., KEY, P.,
1984. Socioeconomic change and patterns of pathology and
variation in the Mesolithic and Neolithic of Western Europe: some
suggestions. In Paleopathology at the origins of agriculture, edited
Press Inc., p. 75-100.

PETERSON, J., 1998, The Natufian hunting commum: spears,
atlatls or bows? Musculoskeletal and armature evidence.

POITRAT-TARGOULA, M.J., 1962, Pathologie dentaire et
maxillaire. In La Nécropole Épipaléolithique de Tafaralt (Maroc

POWELL, M.L., 1985, The analysis of dental wear and caries
for dietary reconstruction. In The Analysis of Prehistoric Diets, edited
Press, p. 281-331.

RIOND, M., 2000, Les caractères discrets du membre inférieur de
la population épipaléolithique de Tafaralt (Maroc oriental): intéré
et applications de la méthode. Mémoire de DEA, Museum
National d’Histoire Naturelle, Institut de Paléontologie Humaine,
Paris.

ROBB, J.E., 1994, Skeletal signs of activity in the Italian Metal
Ages: methodological and interpretative notes. Human Evolution

ROBB, J.E., 1998, The interpretation of skeletal muscle sites: a
statistical approach. International Journal of Osteoarchaeology
8, p. 363-377.

ROCHE, J., 1953, Note préliminaire sur les fouilles de la grotte de
Tafaralt (Maroc oriental). Hespéris, Archives Barbères et Bulletin
de l’Institut des Hautes études marocaines, p. 28

ROCHE, J., 1959, Nouvelle datation de l’épipaléolithique marocain
par la méthode du carbone 14. Comptes Rendus des séances de
l’Académie des Sciences t. 249, p. 729-730.

ROCHE, J., 1976, Cadre chronologique de l’Épipaléolithique
marocain. IXe congrès UISPP. Nice, Colloque II. Chronologie et
synchordon dans la préhistoire nord-méditérannée, p. 153-
167 (cit. in Ferembach, 1986).

SCHEI, A.A., 1989, The role of plaque in dental calculus
formation: a review. In Recent Advances in the Study of Dental
47-55.

SEALY, J.C., PATRICK, M.K., MORRIS, S.A.G., ALDER, D.,
1992, Diet and dental caries among later stone ages inhabitants
of the Cape Province, South Africa. American Journal of Physical
Anthropology 88, p. 123-134.

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

SZWEBEL-CHIKLI, C., 1993, Les caractères discrets. Définition
et interêt. Mémoire de DEA, Museum National d’Histoire
Naturelle, Paris.

TRINKAUS, E., 1975, Squatting among the Neanderthals: a
problem in the behavioral interpretation of skeletal morphology.
Journal of Archaeological Science 2, p. 327-351.