Funerary practices of the Iberomaurusian population of Taforalt (Tafoughalt; Morocco, 11–12,000 BP): new hypotheses based on a grave by grave skeletal inventory and evidence of deliberate human modification of the remains

Valentina Mariotti a,*, Benedetta Bonfiglioli a, Fiorenzo Facchini a, Silvana Condemi b,1, Maria Giovanna Belcastro a

a Laboratorio di Bioarcheologia ed Osteologia Forense - Antropologia, Dipartimento di Biologia Evoluzionistica Sperimentale, Università di Bologna, Via Selmi 3, 40126 Bologna, Italy
b UMR 6578 – Anthropologie biologique et culturelle, CNRS/Université de la Méditerranée/EFS, Faculté de Médecine – Secteur Nord, 51 Boulevard Pierre Dramard, 13916 Marseille Cedex 15, France

ABSTRACT

The Iberomaurusian necropolis of Taforalt (Morocco, 11–12,000 BP), excavated by Roche in the 1950s, contains 28 multiple graves. The osteological collection has been the focus of many anthropological studies and has been used as a comparative sample for other paleoanthropological investigations. The presence of particular sepulchral structures and the use of ochre testify to complex funerary practices, which have not been adequately investigated thus far. Unfortunately, neither the excavation records nor detailed descriptions of the graves are available today. The aim of this study is to investigate the funerary practices of the population based on examination of the human osteological collection (Institut de Paléontologie Humaine, Paris). The bones of adolescents and adults were inventoried to analyse the contents of each grave and the distribution of intentionally modified specimens (ochre-dyeing, cutmarks). The minimum number of individuals was also calculated.

The results suggest that the necropolis is a group of primary and secondary burials, even within the same “grave,” of about 40 adolescents and adults. The previous estimate of 86 individuals by Ferembach in 1962 appears to be an overestimation. The presence of red ochre and cutmarks on some bones suggests various rituals, which denote a certain profundity of thinking about life and death. It is possible that the Taforalt cave was a special, perhaps sacred, place where particular rituals were celebrated or where more occasional social or religious events took place. Comparison with other Iberomaurusian and Capsian sites provides evidence of cultural continuity in North Africa for a long period of time. The present study demonstrates that re-examination of human osteological collections deriving from ancient excavations, for which a lack of adequate documentation of the context of the specimens is fairly common, can also provide information about aspects like funerary practices, which are usually investigated on the basis of other sources.

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Introduction

The Taforalt (Tafoughalt) human skeletal collection, housed at the Institut de Paléontologie Humaine (IPH) in Paris, derives from excavations of the Taforalt Cave carried out in the 1950s by J. Roche. The cave is about 55 km NW of Oujda (eastern Morocco) at an altitude of 750 m in the mountainous massif of Beni Snassen (Roche, 1953a, 1963, 1976). The cave is oriented east to west and opens to the east. Its shape is almost trapezoidal, with a length of ca. 31 m and a width of 30 m at the opening but narrowing toward the bottom. The cave is situated at the confluence of two important natural communication routes: the coastal plain in an east to west direction and the Moulaya Valley in a north to south direction (Roche, 1953a, 1963, 1976). The cave was discovered in 1908 by Dr. Pinchon, but the first excavations were performed by Ruhlmann in the years 1944, 1945, and 1947. From 1951 to 1955, Roche carried out a systematic excavation of the cave. Further investigations were conducted from 1969 to 1979 to acquire detailed information about the archaeological and geological aspects (Roche, 1976; Raynal, 1979–1980). Since 2003, the excavations have been continued by a team of researchers from the INSAP (Institut National des Sciences de l’Archeologie et du Patrimoine de Rabat), in collaboration with...
the University of Oxford and the Mohamed I University. In 2005, about 10 new graves were discovered in the cave (Aouraghe, pers. comm.). These are not considered in the present study.

Archaeological evidence from the cave shows the presence of Mousterian, Aterian, and Iberomaurian industries (Roche, 1953a; Bouzouggar et al., 2007). The human remains belong to the Iberomaurian phase and originate from two necropolises (28 multiple graves, Ferembach, 1962) situated at the bottom of the cave (Roche, 1953a, b, 1963, 1976). The Iberomaurian occupation (Epipalaëolithic levels) covers a time span of about 11,000 years (21,900 ± 400 BP-10,800 ± 400 BP14C on charcoal; Roche, 1976). However, based on new dating on cave sequences at Taforalt and other sites, Bouzouggar et al. (2008) think that the earliest Iberomaurian is unlikely to date much before about 18,000 BP. Radiocarbon dating of charcoal from the upper level of the necropolis yielded an age of 11,900 ± 240 years (Roche, 1959, 1976). Unfortunately, there is no direct dating on the human bones, but according to Roche (1959), the most recent burials could be contemporary with the archaeological level dated to 10,800 ± 400 years (14C).

The term Iberomaurian was coined in 1909 by Pallary to identify a stone and bone tool industry, including utensils, jewellery, and objects for the preparation of dyes, found in the southern Iberian Peninsula and North Africa (Roche, 1963), although the relationship between the industries of the two continents has largely been refuted by later studies. Nevertheless, the term Iberomaurian is widely used to indicate a series of blade-based industries distributed in the Maghreb, mainly in the coastal areas, including cultures very distant in space and time (Roche, 1963; Ferembach, 1986a; Barton et al., 2005). Two sites attributed to an eastern variation of Iberomaurian have been identified in Cyrenaica (Libya; Lubell, 2001). The presence of this culture and its practitioners in Nubia (Egypt and Sudan) has been proposed by some authors but is the subject of debate (Ferembach, 1985, 1986a; Dutour, 1988; Groves and Thorne, 1999; Irish, 2000). Iberomaurian is also called Oranian or Mouilhan, from La Mouillah (Algeria), the type site of the industry (Balout, 1954; Briggs, 1955; Barton et al., 2005; Bouzouggar et al., 2008). Although other terms have been proposed to replace “Iberomaurian” (Epipalaëolithic: Roche, 1963; late Upper Palaeolithic: Barton et al., 2005), the name remains in widespread use to indicate both the type of industry and the people who created it (Irish, 2000).

The anthropological study of the human remains from Taforalt was entrusted to D. Ferembach, who published the first results in 1959 (Ferembach, 1959). The definitive study, with the contribution of J. Dutour for palaeopathological conditions and M.-J. Poitrat-Targowa for dental alterations, was published as a monograph in 1962 (Ferembach et al., 1962). Throughout the years, the Taforalt collection has been the focus of many anthropological studies (Dastugue, 1958a, b, 1959a, b; Chapineaux, 1974; Zouak, 1991; Szwebel-Chikli, 1993; Riond, 2000; Balzeau and Badawi-Fayad, 2005; etc.). Indeed, it has been fundamental for reconstruction of the peopling of North Africa, for studies on the origin of modern humans, and as a comparative sample for other paleoanthropological investigations (Ferembach, 1962, 1985, 1986a, b; Bräuer, 1984, 1992; Dutour, 1988; Bräuer and Rimbach, 1990; Bermudez de Castro, 1991; Lahr, 1994; Lahr and Wright, 1996; Groves and Thorne, 1999; Irish, 2000; Kéfi et al., 2005; Voisin, 2006; etc.), as well as for reconstruction of the life-style of the Iberomaurians (Ferembach et al., 1962; Ferembach, 1986a; Mariotti et al., 2002, 2004a; Belcastro et al., 2003; Bonfiglioli et al., 2004). Its extraordinary importance is due to several factors:

1) Numerical size of the sample: about 86 individuals according to Ferembach (1962);

2) State of preservation: the bones are generally well preserved, both in terms of completeness of single bones and condition of the bone surface, very important for the assessment of features such as enthesis development, some pathological signs (subperiostal reactions, etc.), and traces of manipulation of the cadaver (cutmarks, etc.);

3) Chronological position in the transition from the late Pleistocene to early Holocene;

4) Signs of cultural practices, including intentional evulsion of one or both upper central incisors practised before or during adolescence (Briggs, 1955; Ferembach, 1962, 1986a), cranial trephination (Dastugue, 1959a, 1962), red ochre use (Roche, 1963), and the treatment of corpses (Merriman, 2003; Belcastro et al., 2006a, b). Burial context: the skeletons/bones were found in graves organised in different manners, attesting to the presence of funerary rituals with evident symbolic importance (association with mouflon horns or skulls, ochre use, etc.; Roche, 1953a, b, 1963).

Since 1999, our research group has conducted a complete anthropological analysis of the Taforalt human skeletal remains to investigate the cultural, economic, and social aspects of the population. The first investigations dealt with dento-alveolar lesions and skeletal markers of activity (Bonfiglioli et al., 2004; Mariotti et al., 2004a), characters for which we have standardised scoring methods (Mariotti, 1998; Bonfiglioli, 2002; Belcastro et al., 2004; Mariotti et al., 2004b, 2007) already used for the study of prehistoric, protohistoric, and historical collections (Belcastro and Mariotti, 2000; Belcastro et al., 2001, 2006c; Mariotti, 2001; Mariotti and Belcastro, 2001). In these first studies, we became aware of a fundamental gap in the information available in the literature: the unavailability of excavation details specifically regarding the human remains. Despite the detailed stratigraphic and archaeological information (Roche, 1953a, 1963, 1976), there were only a few mentions of the graves (cf. Roche, 1953a, b, 1963). Roche (pers. comm.) left the “cahier de fouille” with the Moroccan authorities and it can no longer be found. Since we are dealing with multiple graves and we do not know the position of the bones when they were excavated, it is often impossible to recognise individuals. This poses two problems. The first concerns the interpretation of the bio-archaeological data, since all the features (skeletal markers of activity, pathological signs, etc.) should be interpreted in the light of the overall individual condition, especially the age and sex. Attribution of these two biological parameters to single postcranial bones not associated with cranial or pelvic remains is rather uncertain. The second problem concerns the study of funerary practices. This subject is very important since we identified some incongruities in the grave numbers recorded on the single bones (in Roman numerals). In particular, some bones probably belonging to the same individual have different grave numbers (also noticed by Roche, 1953a, b, 1963).
found in each grave. In the absence of adequate documentation of the original positions of the specimens, such an inventory constitutes the only “datum” available for the study of funerary practices, providing indications of the presence or absence of complete individuals (i.e., of a possible selection of buried parts), and the distribution of bones with signs of deliberate interventions, such as ochre-dyeing and cutmarks. It is worth noting that a complete inventory of this type has not been made thus far. A review of the first remains discovered in 1951–1953, essentially covering the first six graves, was published by Balout in 1954. The only inventory currently available for the material from Roche’s excavations in the 1950s is that of Ferembach (1962). However, that inventory only lists the bones necessary for calculation of the number of individuals in each grave, and thus, is incomplete and not suitable for our purposes (e.g., the scapula is never listed and the side of the long bones is often omitted). Nevertheless, the Ferembach (1962) inventory has been a constant reference. In fact, Ferembach may have had access to first-hand knowledge of the positions of the bones at the time they were excavated, as some of her statements suggest (“Nous réservons à l’Abbé J. Roche la description des tombes et de la disposition des squelettes”—“We reserve to Abbé J. Roche the description of the tombs and of the disposition of the skeletons”—Ferembach, 1962: 5: although the publication of this description is not known).

Our inventory was conceived as a critically structured data set (state of preservation, etc.), which would allow us to extrapolate new information about the number of individuals and the degree of representation of the respective skeletons in each grave. On the basis of our data, we recalculated the minimum number of individuals (MNI) for each grave and for the entire necropolis. We also provide preliminary synthetic information about signs of deliberate interventions, such as ochre-dyeing and other forms of manipulation of the cadaver or more or less skeletonized remains. These aspects, already partly analysed (Belcastro et al., 2006a, b), will be dealt with in detail in specific future papers. We have only focused on adolescent and adult specimens since they are the best preserved. Finally, the funerary practices revealed by our study are compared with those of other circum-Mediterranean populations of the late Pleistocene-early Holocene in order to identify common elements. Such elements would provide useful information for the debate on the peopling of North Africa in this period.

The Taforalt necropolis: available information about burial context

The only indications about the excavation of the Taforalt necropolis come from its discoverer J. Roche, especially in the publications of 1953 (Roche, 1953a,b) and in the 1963 (Roche 1963) paper on the Moroccan Epipaleolithic. Neither a map of the necropolis nor a detailed description of it (e.g., structure and orientation of the graves, position of the skeletons or single bones, grave goods, etc.) is available today. What we know is that the necropolis occupied the dark bottom area of the cave (west extremity), and that it was stratigraphically isolated from the rest of the site by a large rock that fell from the roof at the end of the Aterian occupation and by an exploration trench from the excavations by Ruhlimann in the 1940s (Roche, 1953a, b, 1963).

The only somewhat detailed information concerns the discoveries of 1951 and 1952, when excavation of the necropolis was still in progress. In 1951, remains belonging to at least two individuals (anterior part of the skull of a child of ca. 7 years, a male skull with evidence of dental evulsion, and a humerus of an adolescent of ca. 15 years) were found in “level A” (Iberomaurusian), while “level D” (Aterian) yielded a parietal fragment, the only human specimen referable to the Aterians (Roche, 1953a, b). These remains are no longer identifiable on the basis of the ID numbers of the material housed at the IPH. In 1952, two skeletons in a clear burial context were found in “level B”: “skeleton 1” was under a stone slab and it was overlain with mouflon (a type of caprovid) horns, while “skeleton 2” was situated slightly above the first one, resting on its side with the legs tightly folded (Roche, 1953a, 1963). Attention was focused on this part of the cave where the roof markedly lowers, making habitation of the area impossible. The base of “level A” contained a “véritable ossuaire ibéromaurisien” (real Iberomaurusian ossuary; Roche, 1953a, b), the excavation of which yielded the remains of about 10 individuals. In particular, Roche described a burial of infants where the bodies rested one on top of another, with the head facing west. Three mouflon skulls were arranged on their chests in the form of a star with the horns on the outside; they were held in place by a stone placed centrally. The flexed skeleton of a neonate was also found in this grave (Roche, 1953a, b). Unfortunately, it is impossible to identify today the skeletons cited in these papers. The only possible reference is that the bones of the first six graves bear the date “1952” and, according to the inventories of Balout (1954) and Ferembach (1962), the infant grave (the only one described in some detail) is probably number IV.

The systematic excavation of the necropolis took place in 1954–1955 (Roche, 1963). In 1959, Roche first described the necropolis as occupying two cavities containing the remains of ca. 170 individuals. It consisted of inhumations “emboîtées les unes dans les autres” (boxed one into the other; Roche, 1959). “Necropolis I” had an approximately elliptical shape, with the major axis oriented east and west and 10 m long and the minor axis oriented north to south and 7 m long (Roche, 1963). The excavation of “necropolis II,” situated at the west end of the cave, had “begun” (Roche, 1963): it seems that it was not completed (cf. Roche, 1976). The 28 multiple burials that correspond to the ID marks on the bones are only cited in Ferembach (1962). According to the author, the progressive numbering of the graves reveals their relative antiquity (Ferembach, 1962: 94). Yet, the numbering could also be related to the order of excavation. Unfortunately, we do not know how the graves were arranged. Were they superimposed or co-planar? On a single occasion, Roche (1963: 48) mentioned six levels of the necropolis, which he planned to relate to the levels of the rest of the site in a future paper, but we are not aware of its publication. In the last case (co-planar), if the Iberomaurusians began to bury the corpses in the part nearest the bottom and thereafter progressively closer to the centre, the graves with the lowest numbers would be the most recent ones.

The peopling of North Africa between the Pleistocene and Holocene

The origin of the Iberomaurusians and their relationship with the preceding (Aterians) and subsequent populations (Capsians, Neolithic populations, etc.) have been widely debated in archaeological and anthropological circles. From the archaeological point of view, a discontinuity between the Aterian culture (ca. 40,000–20,000 BP) and the Iberomaurusian culture is generally recognized (Roche, 1963; Ferembach, 1985, 1986a; Débénath et al., 1988; Balout, 1987; Débénath, 2000). However, recent studies propose a rather different time span for the Aterian (ca. 73,000–40,000 BP), and note that blade-based industries were present in some areas before the Iberomaurusian (Barton et al., 2007). Thus, the relationship between these two cultures is still poorly understood. The relationship between the Iberomaurusian (ca. 20,000–10,000 BP), a more ancient civilization mainly in the coastal area, and the Capsian (ca. 10,000–7,500 BP), with sites in inland areas, is

From the anthropological perspective, the Iberomaurusians are identified as the Mechta-Afalou or Mechehta-el-Aribi type, characterized by strong robusticity, relatively great mean height (at Taforalt: 174 cm for males and 163 cm for females), and a cromagnoid morphology (in fact, they are also called “African cromagnoids.”) Chamla, 1978; Bianchi et al., 1980; Ferembach, 1985, 1986a, b; Dutour, 1988; Petit-Maire, 1988). Some more gracile specimens were indicated by Chamla (1978) as “Mechtoids.” The Iberomaurusians present some similarities with the Aterians, defined by Ferembach (1986a) as “archaic cromagnoids.” The Capsians, partly contemporaneous but then surviving the Iberomaurusians in inland regions, were a more heterogeneous population in which a robust component, represented by the Mechta-Afalou type or Mechtoids, was flanked by a more gracile protomediterranean type, probably of eastern origin (they present affinities with the Natufians of Palestine; Chamla, 1978; Ferembach, 1986a). This distinction has been questioned by Lubell (1984), who postulated a single, highly variable population.

An evolutionary lineage connecting the middle Pleistocene specimens (Ternifine, Salé, etc.), the Maghrebian Mousterian prototypes (Djebel Ihroud), the Aterians (Témara, Dar-es-Soltane 2, etc.), and the Iberomaurusians has been proposed (Ferembach, 1985, 1986a, b; Bermudez de Castro, 1991), and mtDNA data from 21 specimens of the Taforalt collection support this view (Kéfi et al., 2005). Lubell (1984, 2000, 2001) also saw anthropological continuity between the Iberomaurusians and Capsians. The most detailed studies of the origin of the Iberomaurusian are by Ferembach (1985, 1986a, b; Debénath et al., 1986), who excluded an origin from the Near East, Egypt, or Spain via Gibraltar. She considered the Aterians, or their progenitors, to be the common ancestors of the European cromagnoids and the Iberomaurusians, hypothesizing their passage from North Africa to Europe around 50,000 years ago, following the marine regression of the Wurm II, and their return to Africa through the Strait of Sicily around 25,000 years ago following the marine regression of the Wurm III. Hence, the Iberomaurusians would derive from Italian cromagnoids, in turn derived from the “archaic cromagnoids” of North Africa. After arriving at the Tunisian coast, they would have forced the Aterians, who remained in Africa and evolved more slowly, toward the west. This would explain the apparent spread of the Iberomaurusian culture in Morocco from east (Taforalt) to west (Témara) in a period of around 7 millennia (Roche, 1976). One part of the Iberomaurusians would also have moved toward Egypt, reaching the Sudan (Ferembach, 1986a), although the presence of the Iberomaurusian culture and the Mehcha-Afalou type in Egypt and Sudan is the subject of debate (Groves and Thorne, 1999; Irish, 2000). According to Ferembach (1986b), this hypothesis agrees with the archaeological data since the Iberomaurusian culture has been defined by Camps (1974, in Ferembach, 1986b) as “African Epigravettian”; but the Gravettian, unknown in Africa, is known in Italy at around 25,000 years (Paglicci Cave, Cala, and Calanca). This hypothesis is not devoid of objections (Barton et al., 2007). Petit-Maire (1988) maintained that the African cromagnoids could have derived from the Aterians by rapid evolution induced by climatic changes, and that “cultural change could haveparalleled genetic change.” In Ferembach’s reconstruction, protomediterranean bearers of the Capson culture would have arrived from the Near East at the beginning of the 8th millennium. During the Neolithic and the Metal Ages, the Iberomaurusians were forced into mountainous zones, then into the Aterian and the Canaries-Soldán. The Mechta-Afalou type seems to have survived for a long time, especially to the south, where it is found in Neolithic contexts and its characteristics are found in historical populations like the Berbers and Guanches (Dutour, 1988; Raimbault and Dutour, 1990; Debénath, 2000; Irish, 2000). Dutour (1988) considered it plausible that the Maghrebian and Sahara Malian cromagnoid populations derived from a protomechtoid-Aterian or more ancient-common ancestor. Interestingly, both the Iberomaurusians and Capsians practised evulsion of the incisors in adolescence (Briggs, 1955; Ferembach, 1986a), while evidence of this custom is not found in the Nubian and Hassel Abiod (Mali) Mechtoid specimens (Dutour, 1988).

Materials and methods

The material consists of adolescent and adult specimens from the Taforalt human osteological collection housed at the IPH, Paris, deriving from the excavations conducted by J. Roche in the 1950s. The infant specimens, already analysed by Merriman (2003), will be dealt with in future studies.

For the investigation of funerary practices, we carefully inventoried the material on the basis of the grave numbers recorded on the single bones. The specimens, excluding the hand and foot bones for which the survey is still in progress, were examined for signs of deliberate interventions such as ochre-dyeing and cutmarks. For each bone, we recorded whether it had been completely/extensively versus partially dyed with red ochre, if there were only traces of colour, or if colouration was absent. Each bone was analysed macroscopically for cutmarks or other intentional alterations. For each presumed sign, we carried out a scanning electron microscopy (SEM) analysis to make a correct diagnosis. A sharp, elongated groove, with transversal V-shaped section containing within its edges multiple, fine, parallel striations oriented longitudinally, was considered a true cutmark (Shipman and Rose, 1983; White, 1992). The presence or absence of ochre and cutmarks was recorded in the inventory. On the basis of the possible attribution of the bones to individuals, we created tables showing the degree of completeness of the skeletons in each grave and the distribution of ochre and cutmarks in each individual, in each grave, and in the whole necropolis. We then calculated the minimum number of individuals (MNI) for each grave and for the whole necropolis.

Inventory

The inventory (Table 1 in Supplementary Online Material [SOM]: supplementary data associated with this article can be found in the online version at doi: 10.1016/j.jhevol.2009.01.001) derives from a careful revision and criticism of the material currently available to the IPH, Paris. The bones are divided by grave. For each grave, the specimens are presented in a table with nine columns reporting the type of bone, the ID mark, the side (for paired bones), the state of preservation, the presence or absence of ochre and cutmarks, the attribution to individuals established by Ferembach (1962; when present), the sex and age attributed by us, and notes (if DNA extraction was performed, publications dealing with the specimen, etc.). For all the paired bones, we verified the pairing on the basis of morphological and size criteria. In some cases, we attempted to attribute different bones to the same individual when it was possible to verify their articulation, or on the basis of other elements such as the presence of pathological conditions (see grave XV) or cutmarks (see grave V; Fig. 1). For the attribution of bones to the same individual, we also considered the mtDNA analyses in the few cases in which it was possible (Kéfi et al., 2005). This information is also indicated in the notes. Our data, particularly the ID mark, side, and sex diagnosis, were compared with those of Zouak (1991) and Riond (2000) regarding, respectively, the long bones and the bones of the lower limb (excluding the foot).
The attributions of sex and age were based on the criteria reported in Ferembach et al. (1980). Sexing the postcranial bones, which could not usually be associated with the relative cranial and pelvic bones, presented some difficulties. The sex diagnosis was rather reliable when there was evident dimorphism, but in some cases it was only tentative (M? or F?) or not possible (NI = not identified). In the case of cranial bones, the degree of wear on the teeth, scored according to Smith (1984), provided useful information for attribution of relative age (individuals with less worn teeth will be younger than those with more heavily worn teeth). The specimens were attributed to young adult (YA), mature adult (MA), or old adult (OA) age classes, corresponding roughly to < 35 years, 35–50 years, and > 50 years (Buikstra and Ubelaker, 1994). For long bones, we observed the metaphyseal characteristics (degree of diaphysis-epiphysis fusion, persistence of the line of fusion) and the general appearance of the bone (thickness of cortical bone or density of spongy bone in the case of broken bones, etc.). When it was possible to suggest an age range, the following age classes were considered: young (Y = diaphysis-epiphysis fusion incomplete; this age class includes individuals from adolescence to ca. 25 years of age, when most of the secondary ossification centres have fused. For the clavicle, the age can reach 30 years—cf. White and Folkens, 2000), young adult (YA = persistence of the fusion line), mature (MA), and old adult (OA).

It should be noted that the biological age was attributed to the single bones and not to the individuals (not identifiable in most cases). For instance, no skull was attributed to the first age class (Y) since the available skulls had the sphenoccipital synchondrosis closed or not recordable (nr); at most, they could be included in the YA class. However, it cannot be excluded that they belonged, for example, to an individual whose clavicles had unfused sternal centres, and thus, classifiable as Y. In such a case, bones belonging to the same individual would be classified in different age classes. Therefore, in the attempt to reconstruct the individuals present in each grave, we did not usually consider the age class attributed to the single bones. The sex was considered only in unambiguous cases.

Minimum number of individuals (MNI)

The MNI was calculated for each grave and for the whole necropolis. In the former case, we considered the possible associations between the various bones (a left bone and a right bone that were very different were considered as two individuals), as suggested by White and Folkens (2000). In some cases, the data on ochre and cutmarks were also helpful in finding associations of bones not of the same type (e.g., ulna and radius of grave V, see SOM Table 1 and Fig. 1). In the latter case, given the large quantity of bones and the consequent difficulty in attempting all the associations, we calculated the MNI by considering the number of the most frequent element (for the paired bones, we considered the highest number of bones of the same side), also including the few long bones whose ID mark does not include the grave number (listed at the end of the inventory—SOM Table 1). Therefore, the overall MNI does not represent the simple sum of the MNI for each grave. For the cranial specimens, we counted respectively the neurocrania and splanchnocrania, considering the mandibles separately. Finally, we compared our data with those provided by Ferembach (1962).
Results

Inventory

The adolescent and adult human osteological material of the Taforalt collection refers to 26 graves, plus some specimens whose ID mark does not indicate any of the 28 graves indicated by Ferembach (1962) and thus, were probably recovered in other contexts. The inventory of this material is reported in SOM Table 1. Before reporting the information that the inventory provided about funerary practices, it is necessary to explain some problems concerning the ID marks recorded on the single bones (never cited in the inventory of Ferembach 1962, except for some cranial specimens, but cited by Dastugue to identify the pathological specimens in the same monograph). All the bones are marked “Taforalt 1968-1” in black India ink, then “Taf” or “TT” followed by a Roman numeral indicating the grave (e.g., TT XX; the latter is missing in only a few specimens reported at the end of SOM Table 1). There are often other symbols (the date “1952” for the first six graves) in black India ink and/or ballpoint pen and/or grey or red pencil (e.g., “TT IX-B;” TXXV-23 bis: SOM Fig. 1). The meaning of these symbols is obscure. Clearly, they do not refer to an identification of individuals, since many paired bones often have different ID marks (see SOM Table 1; e.g., right and left radii IX-28 and IX-24). This is only possible for the cranial parts, often marked “Cl,” “C2,” etc., although there are some incongruities also in this case (see SOM Table 1; graves XV, XVII, XIX). In other cases, there are contradictory marks, which often seem to be due to subsequent corrections. For example, the humerus marked “TT IX-40” (in India ink); “TT IX-40” (in pencil), was probably attributed to grave IX (after 1962) since it is the counterpart of TT IX-30. The attribution of the two humeri to grave IX instead of grave XI is perhaps justified by the fact that a practically complete individual is obtained in this way. We have found several other cases of contralateral bones whose ID marks refer to different graves (humeri, patellae, and femora XIX/XX; femora XIX/XII). Doubts about the ID numbers of some specimens were already expressed by Ferembach. For example, the bones referable to a female individual probably affected by congenital dwarfism (Ferembach, 1962: 100–102) are generally marked XX, except for some marked XIX. Ferembach (1962) believed that the last mark was given during the excavation to bones that were “déplacés légèrement dans la terre” (slightly displaced on the earth).

During our attempt to reconstruct individuals in order to correctly interpret the bioarchaeological data, it seemed that the problems of the ID marks could not be attributed exclusively to carelessness or mistakes during or after the excavation. Besides the fact that Roman numerals can easily give rise to errors and confusion (especially between IX and XI, XIX and XVI, etc.), we could not exclude that parts of the same individual were found in different graves as a result of deliberate interventions related to particular funerary practices of the Taforalt population. To test this hypothesis, we summarized in Table 1 the parts of the skeleton attributable to the same individual represented in each grave (such associations are generally verifiable only for paired bones or for those that can be articulated, and thus never for skulls and associated postcranial bones, except the atlas). Most of the 26 graves examined contain incomplete skeletons of several individuals, often represented by “scattered” bones. For grave XV, Ferembach (1962) stated that it was a “charnier” (ossuary), while for graves XVI, XVII, XIX, and XXV the long bones were cited together (with regard to grave XVI: “Comme pour la sépulture précédente, l’appartenance exacte à un individu des divers os longs n’a pu être précise”). As for the preceding grave, the exact attribution of the long bones to one individual could not be assessed [Ferembach, 1962]. Six graves (II, III, VI, XIII, XXIII, XXVIII) lack cranial elements. In seven graves, there are mandibles without any part of the corresponding skulls (V, XVIII, XXI, XXII: the mandible is the only cranial element; I, XI, XVI: the mandible cannot be associated with any of the cranial elements present). Only graves III, X, and XXII might contain bones of a single individual (F in III, M in the others), in the first two cases very incomplete. For grave X, the presence of only two specimens (calotte and tibia) suggests secondary burial of the bones, probably after being subjected to ritual practices (ochre-dyeing, notching on tibial shaft; SOM Fig. 2). For the other graves, there may have been primary burials from which bones were removed and transferred to secondary burials. In particular, the individual of grave XXII is missing only the cranial, cervical vertebrae, and right humerus.

In some graves, there was probably a selection of bones: grave 1 contains cranial remains of at least five individuals, whereas the postcranial bones refer mainly to the lower half of the skeleton of an adolescent; grave VI contains only eight long bones (humeri, femora, and tibiae); grave X only a calotte and a tibia; in graves XII and XIII, no paired bone is coupled with the contralateral one (except the two coxal bones forming the complete pelvis in XII); moreover, of the 21 graves with single copies of paired bones (considering only the long bones and shoulder girdle bones), five contain elements of only one side (left: XXIII; right: I, XI, XV, XXIV), while one side prevails in two graves (VII: 7 right, 1 left; XVIII: 4 left, 1 right) and grave II contains only the left unpaired bones of the upper limb and the right unpaired bones of the lower limb.

In some cases (in addition to the above-mentioned ones of paired bones), bones belonging to the same individual bear ID marks of different graves. In the case of calotte X-C-A and the left and right zygomatic bones (respectively VII and R-XI sep. A), which are all dyed with ochre, it was determined that they all belong to the same individual. In fact, the right zygomatic XI articulates with calotte X, while on the left zygomatic VII (smaller than the right one and considered female by Ferembach) the ochre-dyeing on the orbital wall of the frontal process seems to be the continuation of the dyeing on the orbital cavity of the frontal. In addition, the ochre-dyed right tibia X could belong to the ochre-dyed individual of grave XII, as it is similar in size to the left fibula XII (note that the absence of the contralateral bone prevents verifying this supposition). As noted by Ferembach, most of the bones of the “dwarf” bear the mark XIX, although some are marked XIX (left patella XIX-2, right tibia XIX-10 [XX in pencil], left fibula XIX; right femur XIX [XX in pencil]).

The fact that the grave numbers of bones attributed to the same individual are (with a few exceptions) close to one another suggests that skeletal elements belonging to the same individual (even more or less shifted with respect to the anatomical position) have been erroneously attributed to different graves, as proposed by Ferembach (1962). Interestingly, Roche (1959) described the burials as “boxed one into the other.” Therefore, at the time of discovery, at least some of the graves were probably not well delimited and identifiable. Such a situation could derive from re-use of the same grave or from accidental encroachment during subsequent burials, since the burial zone occupied only a recess of the cave. However, deliberate removal of bones from the primary burial for ritual purposes, perhaps even on the occasion of a later burial, could also explain the unclear situation in which both the graves and the remains they contained were found. In view of the repetitive nature of some patterns (e.g., absence of the skull, bones of only one side, etc.), the latter possibility appears more probable. The cases of contradictory ID marks could derive from the fact that bones with a certain grave number, but recognized as belonging to an individual from another grave, were marked anew on the assumption that a marking error was made during the excavation. In light of the
preceding observations on the presence of incomplete skeletons and selected bones in the graves, it is plausible that the bones were originally in different graves.

The case of grave XXI is noteworthy in this regard. In addition to some male bones, it contains most of a female skeleton (mandible, some male bones, it contains most of a female skeleton (mandible, some thoracic bones). While the bones of grave XXI, may have been buried in one or more different graves. The presence of primary burials is documented in some cases (the grave of the infants and probably those of “level B,” described by Roche in 1953; grave XI, whose photograph is reported in Ferembach et al., 1962). In other cases, it seems likely on the basis of the preserved skeletal parts (grave XXII). In still other cases, the interpretation of grave XXI: is it a primary burial, as suggested by the fact that most of the skeleton was recovered, or a secondary burial, as suggested by the almost complete absence of thoracic bones? We could add that in grave VI, only containing eight long bones and thus, probably a secondary burial, two paired tibiae are incomplete at the proximal extremity. Other cases of paired bones that both present approximately the same pattern of rupture are in grave XIX (femoral diaphyses XIX-b and XIX-a), XX (ulnae of the “dwarf” lacking the distal part: note that the hands are not in the grave), XXV (fibulae XXV-c, XIX, and XXVII (scapulae in two similar fragments and two male tibiae). All these graves present incomplete individuals and scattered bones (Table 1); therefore, they likely contain at least some elements in secondary burial.

The presence of primary burials is documented in some cases (the grave of the infants and probably those of “level B,” described by Roche in 1953; grave XI, whose photograph is reported in Ferembach et al., 1962). In other cases, it seems likely on the basis of the preserved skeletal parts (grave XXII). In still other cases, the most common burial “model” seems to be the grave of skeletal parts derived from dismemberment of a fresh cadaver or a body left in the open to decompose. These possibilities will be discussed further ahead.

**MNI**

While our MNI estimations for each grave (Table 1) largely confirm those of Ferembach (1962), the value for the whole necropolis (Table 2, SOM Fig. 3) is much lower (86 individuals according to Ferembach vs. about 40 according to our calculations).

The MNI for each grave is reported in Table 1. The minor discrepancies with the data of Ferembach (1962) are mainly due to the different attribution of the bones to individuals. For example, grave I contains the cranial remains of three males and two females and the postcranial remains of one male, one female, and an adolescent. Ferembach refers to the total number of individuals as

### Table 1

<table>
<thead>
<tr>
<th>MNI</th>
<th>Cranial skeleton</th>
<th>Postcranial skeleton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grave</td>
<td>Present</td>
<td>Skull</td>
</tr>
<tr>
<td>I</td>
<td>3M, 2F</td>
<td>3M, 2F, 1Y</td>
</tr>
<tr>
<td>II</td>
<td>2M, 1Y</td>
<td>2M, 1F, 1Y</td>
</tr>
<tr>
<td>III</td>
<td>1F</td>
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</tr>
<tr>
<td>V</td>
<td>1–3M, 1F</td>
<td>1M, 1F</td>
</tr>
<tr>
<td>VI</td>
<td>2M, 1Y</td>
<td>1M, 1Y</td>
</tr>
<tr>
<td>VII</td>
<td>1M, 1F</td>
<td>1F</td>
</tr>
<tr>
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<td>1M, 1F</td>
</tr>
<tr>
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<td>1M</td>
<td>1M</td>
</tr>
<tr>
<td>XI</td>
<td>3M, 1F</td>
<td>1F, 1F</td>
</tr>
<tr>
<td>XII</td>
<td>3M, 1NI</td>
<td>4M, 1NI</td>
</tr>
<tr>
<td>XIII</td>
<td>1M, 1F</td>
<td>1F, 1F, 1Y</td>
</tr>
<tr>
<td>XIV</td>
<td>2M</td>
<td>2M</td>
</tr>
<tr>
<td>XV</td>
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<td>6M, 1F</td>
</tr>
<tr>
<td>XVI</td>
<td>3F</td>
<td>3F</td>
</tr>
<tr>
<td>XVII</td>
<td>2M, 2F</td>
<td>2M, 1F</td>
</tr>
<tr>
<td>XVIII</td>
<td>2F, 1M</td>
<td>1F</td>
</tr>
<tr>
<td>XIX</td>
<td>3M, 4F</td>
<td>1F, 2NI</td>
</tr>
<tr>
<td>XX</td>
<td>1M, 1F</td>
<td>1F, 2NI</td>
</tr>
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<td>XXIV</td>
<td>1M, 1F</td>
<td>1F, 1NI</td>
</tr>
<tr>
<td>XXV</td>
<td>2F, 4F</td>
<td>2F, 4F</td>
</tr>
<tr>
<td>XXVII</td>
<td>2M, 1F, 1Y</td>
<td>1M, 1F, 1NI, 1NI</td>
</tr>
</tbody>
</table>

* M — male; F — female; Y — young (adolescent); NI — not identified; C — cranium; NC — neurocranium; mx. — maxilla; md. — mandible.
* # — without maxilla; — fragmentary; ¼ — 2ygomatic bones (VII and XI probably associated to neurocranium X; IX probably associated to mandible from the same grave); *Occipital condyles probably associated to skull XVI; ** Individual probably affected by dwarfism (Ferembach, 1962).

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three males, two females, and the adolescent, whereas it is possible that the postcranial bones of the adolescent correspond to one of the five individuals identified on the basis of the cranial remains (see considerations in Materials and methods). Hence, our MNI is only three males and two females. Similar reasoning explains other discrepancies: we cannot exclude that bones of unidentified sex (adults or adolescents) associated with other identified individuals (male or female) that are lacking those elements do not belong to them, even without knowing exactly to which ones (see graves VIII, XII, XIII, XX, XXIII). In other cases, there is agreement on the MNI but not on the identification of males, females, and adolescents (graves XIX, XXVII). In the case of grave V, the different sizes of the male ulnae and fibulae of the two sides led us to infer two different (graves XIX, XXVII). In the case of grave V, the different sizes of the male ulnae and fibulae of the two sides led us to infer two different individuals, while Ferembach attributed them to a single individual in different graves. It is likely, therefore, that the estimation of 86 adults and adolescents by Ferembach (1962), thus far the “official” value for the Taforalt necropolis, is an overestimation.

**Ochrage**

Only completely/extensively or partially ochre-dyed bones are considered; bones with only a trace of dye are not discussed since the colouring could be due to chance contact with the pigment, which soaked the soil of some levels of the necropolis (Roche, 1963: 151).

Coloured bones were found in 13 graves, plus two bones without a grave number (Table 3). Only grave XII contains an individual whose skeleton (incomplete) is completely dyed (skull, vertebrae, different ribs, scapula, clavicle, radius, ulna, and fibula). Other than this, the coloured bones are mainly cranial specimens (eight individuals, counting calotte X and zygomatics VII and XI together), followed by pelvic bones (three individuals), clavicles (four bones), hands (two individuals?), ribs (one individual?) and, with only one coloured bone in the whole necropolis, humerus, ulna, femur, and fibula. Moreover, the dyed bones are scattered in different graves and only in three cases are referable to a single individual: a second individual in grave XII, with both skull and pelvis coloured; cranial specimens X-VII-XI and tibia X (which could belong to this individual or to the ochre-dyed and more complete one in grave XII); the male of grave XXII (the only one with an almost complete skeleton of a single individual, see above), with the two clavicles, pelvis, and some ribs coloured. The dyed bones are usually completely or almost completely coloured. Only four cranial specimens, one pelvis, the scapula, the four clavicles, and the hand bones are partially coloured. The dyed bones for which a sex diagnosis is possible are mostly from males, except the right humerus of grave XVII, the right ulna of grave XX (“dwarf”), and the hands of grave XXIII. When the paired bones are both present (graves XVII, XX, XXII, XXIII, and XXV), usually only one bone of the pair is coloured, always the right (the exceptions are the above-mentioned grave XXII and the hands of grave XXIII). However, this could be by chance, in view of the small number of cases.

It seems that the ochre was applied after decomposition, on disarticulated bones already cleared of soft tissues. For example, tibia X is completely dyed except on the distal articular surface and surrounding area (SOM Figs. 2 and 4). In some cases (especially for cranial bones), the ochre-dyeing must have occurred after rupture of the bone (deliberate or due to taphonomic processes; Fig. 2; Belcastro et al., in preparation). In a maxillary fragment of grave XII, there are accumulations of ochre inside the wear fossae of the molars (SOM Fig. 5). These observations confirm the hypothesis of deliberate removal of bones to be dyed from the graves. It remains to be established whether at least some of the bones to be subjected to this ritual were left out in the open to be cleaned. In the case of skull X-VII-XI, the calotte and two zygomatics may have been buried in different graves after the ochre-dyeing (again, unless there was confusion during the excavation and subsequent marking of the specimens). In the few specimens with both ochre and cutmarks (graves VIII and XII; Table 3), the ochre seems to have been applied after the cutting (Fig. 3).

**Table 2**

<table>
<thead>
<tr>
<th>Cranial skeleton</th>
<th>NC</th>
<th>SC</th>
<th>Mandible</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scapula</td>
<td>24</td>
<td>26</td>
<td>50</td>
<td>26</td>
</tr>
<tr>
<td>Clavicle</td>
<td>26</td>
<td>23</td>
<td>49</td>
<td>26</td>
</tr>
<tr>
<td>Humerus</td>
<td>31</td>
<td>28</td>
<td>59</td>
<td>31</td>
</tr>
<tr>
<td>Ulna</td>
<td>32</td>
<td>25</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>Radius</td>
<td>25</td>
<td>23</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>Femur</td>
<td>25</td>
<td>34</td>
<td>2</td>
<td>61</td>
</tr>
<tr>
<td>Patella</td>
<td>19</td>
<td>21</td>
<td>40</td>
<td>21</td>
</tr>
<tr>
<td>Tibia</td>
<td>24</td>
<td>29</td>
<td>53</td>
<td>29</td>
</tr>
<tr>
<td>Fibula</td>
<td>27</td>
<td>28</td>
<td>55</td>
<td>28</td>
</tr>
</tbody>
</table>

* NC = neurocranium; SC = splanchnocranium (superior part).
The fact that dyed bones are present in graves VII to XXVII suggests that rituals involving ochre were practised throughout all, or almost all, the necropolis’ period of use. Indeed, the symbolic use of ochre seems to be very ancient and distributed over a broad geographical area (d’Errico, 2003; Hovers et al., 2003). In particular, this pigment was commonly used (also in association with burials) by the Iberomaurusians and Capsians of North Africa (Roche, 1963; Balout, 1987), but also by European populations of the Upper Palaeolithic, Mesolithic, and Neolithic (May, 1986; Binant, 1991; Guerreschi, 1992; Gimbutas, 1997; Alciati et al., 2005; Formicola, 2007). Blackish or brown traces were also observed on some bones, both skulls and long bones. These traces should be studied to determine if they are due to taphonomic conditions or to intentional events (fire or other pigments).

Cutmarks

From their macro- and microscopic characteristics, the cutmarks seem to have been produced by flint blades, probably during ritual dismemberment, defleshing, or evisceration. They were found on two skulls, two left femora, one pelvis, the ribs and vertebrae of one individual probably affected by dwarfism (Ferembach, 1962). The bones in brackets are those found in grave XIX. Specimens probably belonging to the same individual. CO — completely or extensively dyed with ochre; PO — partially dyed with ochre; CT = cutmarks present. Cranial skeleton: SK — skull; C: cranium; CA — calotte; SF — superior part of the face; MD — mandible; LZ — left zygomatic bone; RZ — right zygomatic bone; FR — fragments. Pelvis: C = complete; I = incomplete; FR — fragments.

The Table 3 provides the distribution of ochre-dyed bones and bones with cutmarks in the different graves of the Taforalt necropolis. * Only the graves with at least one intentionally treated specimen are indicated. For each of these graves, we report all the bones present for the individuals to which the treated specimens presumably belong (at least as MNI). L — left; R — right; ? — bones present, but of uncertain attribution to the individual in question; X — for sternum, vertebrae, ribs, hands, and feet — at least some elements present. # — this grave was defined as an ossuary by Ferembach (1962) and it contains bones of several individuals that cannot easily be associated. However, the cutmarks are on a femur that presents characteristic articular alterations (eburnation) also observed in a pair of patellae, humeri, ulnae, and radii. For this reason, we infer that these bones all belong to the same individual. a — individual probably affected by dwarfism (Ferembach, 1962). The bones in brackets are those found in grave XIX. * Specimens probably belonging to the same individual. CO — completely or extensively dyed with ochre; PO — partially dyed with ochre; CT = cutmarks present. Cranial skeleton: SK — skull; C: cranium; CA — calotte; SF — superior part of the face; MD — mandible; LZ — left zygomatic bone; RZ — right zygomatic bone; FR — fragments. Pelvis: C = complete; I = incomplete; FR — fragments.
individual, one right scapula, one left clavicle, ulna, and radius (Table 3). All these bones, except the clavicle, have been attributed to males. The notches on tibia X, produced after ochre-dyeing (SOM Fig. 2), are not considered here; in fact, supposing their “authenticity,” they do not present the characteristics of cutmarks and fall within another category of practices, probably involving rituals and symbolism not related to treatment of the cadaver. Other signs of more doubtful interpretation, including some that seem to be due to carnivore or rodent teeth, are not discussed here but will be dealt with in a future paper.

Specimens with cutmarks belong to only five graves (V, VIII, XII, XV, XXVII), two of which (V, XII) contain most of the specimens, probably part of the same individual. Graves VIII, XV, and XXVII contain only one bone with cutmarks, respectively a skull, a left femur, and a left clavicle.

A detailed analysis and interpretation of the morphology and position of the cutmarks are beyond the scope of this paper, but will be dealt with in other manuscripts being prepared by our research group. Nevertheless, some important observations should be reported. Grave V contains a right scapula, left radius, ulna, and femur with cutmarks. The radius and ulna are clearly associated, and the cutmarks are in the distal part of both bones (on the diaphysis and in the metaphyseal region; Fig. 1). Therefore, they should be related to disarticulation of the hand. The femur presents cuts on the neck, presumably from an attempt to disarticulate the bone from the pelvis (Belcastro et al., 2006a, b; incidentally, the cutmarks are in a similar position in the left femur of grave XV).

This grave should contain (as the MNI) the incomplete skeletons of a male and a female (Table 1), and it would be the former that presents cutmarks. But, as mentioned above (Results, MNI), the morphological analysis of the pairs of male ulnae and fibulae suggests the presence of two males, since the specimens of the two sides strongly differ in robusticity. The DNA analysis conducted on the two ulnae (V-7 and V-20) and on the male humerus (V-5) yielded the same sequence. Hence, the two ulnae in particular, and by analogy the two fibulae, could belong to the same individual, with strongly asymmetric development, but also to two related individuals (Kefi et al., 2005; was Ferembach aware of the original position of the bones when she postulated a single individual even in the case of such evident asymmetry?). The mtDNA analysis (Kefi et al., 2005) also revealed that humerus V-5 and femur V-18 (plus specimen V-27, of whose existence we are not aware) have different sequences, and thus, would belong to different individuals. If this analysis is correct, there would be two or three males, of which two have cutmarks. In this grave, the female is represented especially by skeletal elements of the upper part of the body (without cranium), and the male(s) only by a few bones, mainly from the upper part but also from the lower limbs, without the skull and pelvis (only the proximal part of the femur is present). Therefore, deliberate manipulation of the bodies/skeletons is likely. The bones may have been in a primary burial (the missing bones being later removed), or in a secondary burial. This grave could contain dismembered body parts in primary deposition as well.

Grave XII also presents a concentration of cutmarks, found in a skull, cervical vertebrae, ribs, and pelvis, probably of a single ochre-dyed individual. Hence, grave XII is a particularly interesting case, and it will be dealt with in a specific study (Belcastro et al., preparation). The individual of grave XII with cutmarks on the pelvis lacks the femora, while grave V, in which the cutmarks are on the femur, is missing the pelvis (the same cannot be established for grave XV since, being an “ossuary,” there are remains of a pelvis but they cannot be associated with the femora). Ochre and cutmarks are associated in only two individuals: in the male skull VIII and in the male of grave XII (Table 3), where the cutmarks were produced before the dyeing (Fig. 3).

The presence of cutmarks, even if only in a small number of bones and individuals, confirms the hypothesis of deliberate separation of the parts of a single individual and their burial in different places, given the lack of complete skeletons in the graves. The fact that bones with cutmarks are limited largely to graves with numbers below XV may indicate that practices involving treatment of the cadaver with sharp objects were mostly used in a short period of time. If Ferembach’s hypothesis about the antiquity of the graves in relation to their numbering is correct, such practices would refer to the most recent period. The distribution of cutmarks in the graves could be random, but it might also reveal an evolution of the rituals through time, perhaps in relation to other changes in the way of life of the population.

Discussion

Despite the possibility of some erroneous ID marks and confusion induced by the poor choice of Roman numerals to identify the graves, the data and observations presented thus far suggest that the funerary practices of the Taforalt Iberomaurusians included complex rituals, including the recovery and secondary burial of some body parts or bones. The close agreement between the MNI values for the necropolis based on different skeletal elements suggests that the remains of many individuals were divided among different graves. This is even more likely considering that our MNI value (35–40 individuals) is less than half the value obtained by summing the individuals in each grave (86 individuals; Ferembach, 1962). Our value is clearly a minimum value, whereas Ferembach’s MNI is likely an overestimation.

The analysis of the skeletal parts present in each grave (SOM Table 1 and Table 1) and some associations of bones found in different graves confirms this thesis. It seems that many of the graves contain both primary burials, incomplete because of the subsequent removal of bones (or perhaps, in some cases, the burial of a dismembered body), and secondary burials of skeletal parts. The presence of cutmarks on a small number of specimens suggests that separation of the bones usually occurred in already largely skeletonized remains. The dyeing of bones probably took place after decomposition of the soft tissues and eventual treatment of the corpse (Fig. 3 and SOM Fig. 4). This suggests that the funerary practices also involved rituals carried out well after death, on remains recovered from primary burials or from other places. It should be noted that when cadavers are left in the open to decompose, the bones usually bear signs of carnivore or rodent teeth, although their absence could be due to some protection provided to the body (Haverkort and Lubell, 1999). In the Taforalt collection, such signs were observed in only a few doubtful cases. This aspect will be considered in detail in a future paper.

At present, the recovery of bones from largely decomposed corpses in primary burials seems to be the most common event. The fact that some of the stones forming the “structure” of the graves at some Maghrébian sites (Afalou, Cumbnata, Taforalt, etc.) might be a kind of signpost for this purpose was proposed by Haverkort and Lubell (1999). They noted that the burial of skulls separately from the body (probably after decomposition since they lacked cutmarks) is documented for the contemporary Natufians of the Near East, where piles of stones (rock cairns) or individual stones had exactly this meaning (Kuijt, 1996; cf. also Bocquentin, 2003). For Taforalt, we cannot exclude the re-use of graves, whereas the partial disruption of graves due to accidental encroachment during later burials seems improbable or only sporadic. A similar possibility was invoked to explain the arrangement of skeletons 2 and 3 of Dar-es-Soltane 2 (Morocco, 16,500 ± 250 BP; Debénath, 2000). The first, almost complete, is of a female ca. 20 years, buried in a strongly flexed position on a stone and covered
with smaller rocks. A pebble with a concave surface bearing traces of colorant was found near the body. The other skeleton is represented by fragmentary bones, with only the vertebral column and hands in anatomical connection, with the skull missing but the mandible present. According to Debénath (2000), the bones of this second skeleton may have been moved to make room for burial of the first body. However, in the light of our findings for Taforalt, the removal of the cranium for a ritual use, also involving its interment elsewhere in a secondary burial, would be a reasonable interpretation of the discovery. The site of Ifri n’Baroud (Morocco) also contains an Iberomaurusian primary burial (ca. 12,500 BP), with the skeleton of a female in a flexed position, but missing the skull, superior part of the vertebral column, right upper limb, left humerus, and some bones of the hands and feet (Ben-Ncer, 2004). Scattered teeth and a mandible without the ramus were found about 20 cm above the grave. Although this finding has been interpreted as the result of ancient damage due to the digging of a pit hearth, the unusual similarity with the situation of some graves at Taforalt and with the one at Dar-es-Soltane suggests that it could be the result of sacred or ritual practices. Also of interest is the discovery of a single skull, probably female, in a cave at Taza (Algeria), in a layer with an Iberomaurusian industry radiocarbon dated to 16,100 BP (Meier et al., 2003).

It can be inferred that the skull was the object of particular rites or cults for the Iberomaurusians, as also appears likely for the subsequent Capsian populations (Vallois, 1971; Haverkort and Lubell, 1999). At Taforalt, six graves are lacking cranial elements, seven graves present the mandible without the relative cranium, and in some graves the skulls seem to have a special meaning (e.g., grave I, with cranial remains of five individuals and postcranial bones mainly of only one person; grave X, with only a calotte and a tibia). Only two skulls present cutmarks: in grave VIII, where the cutmarks cannot be associated with separation of the skull from the body since the posterior part of the skull is not preserved; in grave XII, where the situation is more complex and the possibility of perimortem violence and other ritual practices on adults and subadults is being evaluated (Belcastro et al., in preparation). As mentioned above, recovery of the skull following decomposition seems more likely or more common.

Particular attention for this part of the skeleton has also been hypothesized for the Algerian Iberomaurusian site of Afalou-Bou-Rhummel, excavated by Arambourg between 1928 and 1930 (Arambourg et al., 1934) and again starting in 1983 (Hachi, 1996). This site contains a grave (level III; Arambourg et al., 1934) with an adult skeleton in a supine position with the skull of an infant under the feet. Near the skull was a pile of crumbled hematite and a bone point. According to Arambourg (1934), the site would have acquired a sacred nature after this burial, probably of an important person, leading to a period of abandonment, as indicated by a layer of sterile clay. However, the site presents other interesting elements for comparison with what we observed for Taforalt. It consists of a shelter under rocks, formed by the collapse of the north wall of an ancient doline, whose chimney connects the roof with the overlying plateau. In a level with an Iberomaurusian industry and abundant remains of marine and terrestrial shells (level I), Arambourg (1934) found an accumulation of human bones on a surface of 3 x 4 m by 0.5 m deep, set against the end wall of the shelter. The accumulation was below a hearth formed of large flat stones with butchered mouflon bones nearby bearing apparent traces of calcination, like many of the human bones (Arambourg, 1934). A count of the skulls showed the presence of 48 individuals (nine subadults: four from 2 to 6 years; three from 12 to 18 years; two of undetermined age; 39 adults: 25 M and 14 F). The number of postcranial bones was much lower than expected on the basis of the number of skulls (Boule et al., 1934). Only eight skeletons (two very incomplete) were found in anatomical connection. They were in flexed positions, with different orientations. Two of them were lacking all bones of the forearm and hands. The rest of the material consisted of a disorderly heap of skulls and postcranial bones. The centre of the accumulation of bones was situated below the opening in the roof, which led Arambourg (1934) to hypothesize that the bodies fell through the chimney. However, it was difficult to determine if this was the site of a common burial or an ossuary where the cadavers were accumulated after decomposition in the open. Arambourg even hypothesized the massacre of one tribe by another. In any case, life must have resumed quickly since there is no separation between the “ossuary” and the overlying archaeological stratum (Arambourg, 1934). The new excavations (Hachi, 1996) yielded other human remains situated under a jutting rock shelf far from the opening in the roof, which according to Hachi (1996) belonged to the same formation as the preceding discoveries (“couche V”, > 13,120 ± 370 BP – N.B. the levels of Hachi [1996] are different from those of Arambourg [1934]). This seems to invalidate the hypothesis of formation of the “ossuary” by the precipitation of bodies through the chimney of the doline, although the stratigraphic relationships between the old and new material should be further clarified. Based on the skulls, there were at least eight individuals in an area of less than 2 x 1.5 m. Only the vertebral columns (often flexed) were in anatomical connection with the ribs. The bones of the lower limbs, in apparent disorder, were resting on those of the thorax, and many feet were near the pelvis. These observations suggest burials in a strongly flexed position. Hence, the apparent disorder of the lower limbs may have been due to successive burials (Hachi, 1996). This possibility could also have occurred at Taforalt and Dar-es-Soltane.

There are many interesting similarities with what was found at Taforalt: presence of hearths, association of mouflons with the graves, huddled up position of the bodies, location of the burials in recesses unsuitable for habitation (at Afalou, at least for the recently discovered remains), objects related to the preparation of ochre, and so on. For our study, the most intriguing similarity is the presence of many skeletal elements not in anatomical position and the lack of some bones in the articulated skeletons. Albeit a different burial context (the Afalou deposit has been identified more as an “ossuary” than as a group of graves, although it should be mentioned that Roche initially considered the Taforalt site a “real Iberomaurusian ossuary” [Roche, 1953a, b]), it appears that the Afalou site also contains both primary burials (in addition to the grave of level III) and secondary burials. The higher number of skulls than postcranial bones also suggests the secondary burial of bones recovered elsewhere, as hypothesized by Arambourg (1934), or the treatment of cadavers. To assess the last possibility, it would be necessary to look for cutmarks in the Afalou collection. The fact that both sexes and all age classes are represented at both sites is also striking, even though the Afalou deposit has been interpreted as the result of a single event, even a massacre (although the most recent discoveries may lead to new interpretations), while at Taforalt the presence of graves suggests the prolonged use of the necropolis. Arambourg’s observation of the sudden resumption of life at the site after the burial of about 50 individuals is interesting; indeed, we also wondered how the living could coexist with the dead in such proximity at Taforalt, even though we are fully aware that our current hygienic, cultural, and moral standards make it difficult to understand the motivations of populations so ancient and different from us. Actually, a coexistence of living and dead at Taforalt is also striking, even though the Afalou deposit has been interpreted different from those of Arambourg [1934]). This seems to invalidate the hypothesis of formation of the “ossuary” by the precipitation of bodies through the chimney of the doline, although the stratigraphic relationships between the old and new material should be further clarified. Based on the skulls, there were at least eight individuals in an area of less than 2 x 1.5 m. Only the vertebral columns (often flexed) were in anatomical connection with the ribs. The bones of the lower limbs, in apparent disorder, were resting on those of the thorax, and many feet were near the pelvis. These observations suggest burials in a strongly flexed position. Hence, the apparent disorder of the lower limbs may have been due to successive burials (Hachi, 1996). This possibility could also have occurred at Taforalt and Dar-es-Soltane.

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last part of the Iberomaurusian occupation; which lasted about 10,000 years). What did the cave represent for the populations that buried their dead there? According to Roche (1963: 233), there is not enough information to establish whether it was a place of permanent or seasonal habitation. Was it a kind of sacred place or sanctuary, frequented only on special occasions, perhaps a meeting place of several tribal groups that lived apart for some of the year? The traces of hearths, wildlife, and manufactured objects of various types and uses (jewellery, stone and bone tools, objects related to the use of ochre, etc.) do not solve the problem, since even for temporary inhabitation the people would have brought with them their usual subsistence activities (eating, dressing, etc.), as well as the ritual, magic, sacred, or religious practices that characterized their social life. Important in this regard is that the Taforalt necropolis contains all the elements of a population (sexes and age classes, including the infants not considered here) without apparent selection. Therefore, it seems to represent the burial site of the Iberomaurusian group that frequented the cave around 12,000 years ago, perhaps for many generations.

According to Roche (1959), the use of the necropolis continued for about 1740 years (the interval between the extreme limits of radiocarbon dating: 12,140 to 10,400 BP). Ferembach (1962) probably used this calculation when she noted that the cave was “inhabited” for around 1500 years, corresponding to ca. 50 generations. According to Ferembach (1962), the Taforalt population was a strongly endogamous isolate, as shown by the incidence of some pathological alterations and discontinuous traits, and fairly homogeneous anthropologically (Mechta-Afalou type), albeit with pathological alterations and discontinuous traits, and fairly homogeneous anthropologically (Mechta-Afalou type), albeit with a certain variability due to the long duration of the group. Ferembach (1962, 1986a) hypothesized that the Taforalt population was sedentary, dedicated to harvesting gastropods whose remains abound in the cave, more than hunting; moreover, on the basis of some skeletal characteristics (squatting facets on the lower limb bones, low frequency of fractures, frequent spondylosis), she postulated that they spent a lot of time crouching or sitting on low stools, which forced the knees and ankles into hyperflexion (Ferembach, 1962, 1986a; Chopineaux, 1974). However, considering the strong development of the entheses (influenced by the intensity of motor activity, although a genetic component cannot be excluded), the life of the population was characterized by a certain mobility; indeed, many indicators of squatting can also result from walking on steep or uneven terrain, as the area surrounding the cave seems to be (Mariotti et al., 2004a).

Considering the good state of preservation of the bones, our estimate of about 40 individuals seems low for the Taforalt necropolis to have been the cemetery of the population for 50 generations, even considering the new graves discovered in 2005 (in fact, even the 86 individuals estimated by Ferembach would be insufficient). Therefore, either the time period of the necropolis was shorter or it was not systematically used to bury all members of the group, but only a few of them. In this case, given the apparent lack of selection of people buried there (although possible selection on social or ritual grounds can no longer be determined), we must hypothesize a seasonal occupation of the site or its sacred or ritual nature (in this regard, it would be interesting to know the exact original location of the bones without grave numbers).

Havercort and Lubell (1999) maintained that the study of funerary practices is useful to reconstruct the social organization and palaeoeconomy of ancient populations. In particular, they noted that treatment of the cadaver, including dismemberment, defleshing, and evisceration (indicated by cutmarks on the bones), could be associated with a nomadic or semi-nomadic lifestyle, related to the need to facilitate the transport of corpses to the burial site, possibly after a period in the open to favour decomposition. On the basis of graves containing selected bones, some bearing cutmarks (in five adults of their small sample, also including a child of ca. 11 years and a neonate), they attributed this type of lifestyle and funerary practices to the Algerian Capsians of Site 12 (8000 BP), hunter-gatherers who frequented fields on a seasonal basis and who buried their dead, dismembered and beheaded, in carefully selected sites, excavated in 1930. Based on the photos and excava­tion notes, the burials at the site were interpreted as primary and the incompleteness of the skeletons was attributed to the fact that not all the parts were transported.

Can the scenario postulated for the Capsians of Site 12 also represent the situation at Taforalt? With regard to the type of economy, we cannot exclude that hunting and gathering plants played a certain role in addition to the collection of gastropods (the main activity of the group according to Ferembach, 1986a; Mariotti et al., 2004a). Hunting and mollusc collecting could be practised seasonally or perhaps alternated on a seasonal basis. According to Lubell and co-workers (1976), terrestrial molluscs are only available in some periods of the year. Further information to support or refute this hypothesis must come from the study of faunal and botanical specimens. A list of the animal species (molluscs, fishes, birds, and mammals) found at Taforalt was reported by Roche (1953a, 1963). He notes (1963: 235) that animal remains are only a few with respect to the length of occupation of the site, inferring low meat consumption. However, only a quantitative study and analysis of the age, sex (for the mammals) parts represented, and eventual traces of butchery can provide evidence to assess the seasonality of the provisioning activities and the relative importance of the various species as food sources. A hunter-gatherer economy and seasonal occupation of Iberomaurusian sites are generally recognized (cf. Lubell, 1984, 2001). Balout (1987) defined the Iberomaurusians as “mouflon hunters.” The presence of mouflons in association with the graves suggests that hunting was an important activity, notwithstanding the exploitation of other possible food sources offered by the environment. In any case, Lubell (1984) noted that the “Epi-Paleolithic populations of the Maghreb had, from an early date, achieved an effective, successful, and, above all, flexible subsistence adaptation to their environment(s)...” provided by hunting/gathering and shellfish collection. In this regard, there was intense exploitation of the coastal biotope (molluscs, shellfishes) already in the upper Aterian, following the change to a drier climate (Debénath et al., 1986).

It is more difficult to hypothesize a nomadic or semi-nomadic lifestyle for the inhabitants of Taforalt based on the evidence of treatment of the cadaver indicated by cutmarks. In fact, they occur on only a few, often isolated bones, and thus, their meaning seems to be more ritual than functional (i.e., to facilitate the long-distance transport of the dead for the sole purpose of preserving the remains for burial; in grave V, the hand was disarticulated!); the latter function would probably have resulted in the discovery of more complete skeletal parts. Nevertheless, it is worth noting that the cutmarks at Taforalt are mostly found on male specimens from a few graves, perhaps especially referable to the last phase of the necropolis. Is it possible to postulate a change in mortuary practices, maybe related to some change in the life style? Is it possible to postulate a non-permanent occupation of the site (seasonal or related to particular social events), at least in the last period?

Perhaps the model of occupation of the cave changed in the course of time, for some reason becoming increasingly sporadic until it was abandoned for good. In fact, despite the particularly favourable position of the cave (Roche, 1953a, 1963, 1976), there is no trace of later use as is documented elsewhere (Témara, Clun­nata, etc.; cf. Briggs, 1955; Debénath, 2000; Lubell, 2001). Roche (1963: 49) noted that “...la grotte, après le départ des derniers Epipaléolithiques, offrait des conditions d’habitat toujours très favorables. Est-elle devenue un sanctuaire? un lieu sacré?” (...the
cave, after the departure of the last Epipaleolithic, still offered very favourable habitation conditions. Did it become a sanctuary? A sacred place?). Interestingly, according to the botanical and faunal data, the climate of the region was similar to the current one, perhaps a little wetter. However, mild climatic oscillations could have characterized the period of Epipaleolithic occupation of the cave. The study of molluscs suggests that there were somewhat drier phases corresponding to the formation of the intermediate archaeological levels (Roche, 1963). Could these changes have led to a less regular occupation of the site? Was such occupation reduced to the celebration of funerary, ritual, or sacred ceremonies as suggested by Roche? It seems quite probable that there were privileged places for burial of the dead and associated rituals, who would have been transported there when their death occurred far away. Taforalt, and perhaps also Afloua, and other Iberomauranian sites could represent such places. In any case, the Taforalt cave undoubtedly represented a place of special meaning for the population, which chose to preserve a memory of itself.

Complex and diversified ritual practices related to death, including secondary burial of skeletal parts recovered from primary burials or from the remains of bodies left to decompose in the open, treatment of the cadaver, the use of ochre, and perhaps particular attention for certain parts of the skeleton (e.g., the skull), seem to be common to diverse populations and cultures over a long period of time (around the Pleistocene-Holocene transition) and over a broad geographical area corresponding to North Africa (Iberomaurians and Capsians) and the Near East (Natufians). This provides food for thought regarding the relationship between the Iberomauranian and Capsian civilizations. Our study of the human osteological collection of Taforalt seems to show cultural kinship between geographically distant Iberomaurian populations in terms of some aspects of the funerary practices; it also supports the idea of some form of continuity or communication with the subsequent Capsian culture, as hypothesized by Hachi (1996) on the basis of the industries and as suggested by the diffuse practice of evulsion of the incisors. Briggs (1955: 21) reported the peculiarity of the graves in the Capsian “kitchen middens,” which sometimes present individuals in a contracted position but often as heaps of bones, incomplete skeletons, and even isolated bones. Briggs believed that the available data were insufficient to speculate on the reasons for these findings, but in the light of our results, those observations could be re-interpreted in the context of a certain continuity of death-related cultural practices. Indeed, Lubell (1984, 2000, 2001) postulated continuity between Iberomaurian and Capsian populations on the basis of both anthropological and cultural evidence.

Once again, the most difficult problem to solve is the relationship with the Aterians, for which some cranial specimens are available (Tébasta, Dar-es-Soltane 2, El Harhoura) but no postcranial bones and no evidence of deliberate burials (Debénath et al., 1986; Debénath, 2000). At Dar-es-Soltane, the remains of at least three individuals were grouped in an area of ca. 0.25 m² (Debénath et al., 1986). However, despite this interesting observation, evidence of the Aterians is still too scarce and uncertain to be taken into serious consideration.

**Conclusions**

Knowledge of prehistoric funerary practices is mainly based on the context in which human remains are discovered (possible sepulchral structures, grave goods, faunal or botanical remains, position of the dead or of their parts). However, a lack of detailed documentation of such contexts is fairly common for material deriving from ancient excavations (Haverkort and Lubell, 1999). The consequent loss of information is largely irretrievable, but the present study demonstrates that a critical and systematic analysis of the human osteological collections housed in museums or other institutions can provide information about such aspects, which are usually investigated on the basis of other sources. In our case, the critical inventory of the specimens in the human osteological collection of Taforalt was not only a means to guarantee their conservation, via the possibility to control the material and prevent the loss of specimens in subsequent studies, but also an important source of information about the funerary practices of the population. The hypotheses concerning these aspects were based on analysis of the skeletal parts present in each grave, on the MNI for each grave and for the whole necropolis, and on the distribution of specimens with signs of deliberate interventions such as ochre-dying and cutmarks.

The results of our study suggest that the Taforalt necropolis is a group of primary and secondary burials (even within the same “grave”) of about 40 individuals. Hence, the 86 adolescents and adults estimated by Ferembach (1962), thus far the “official” datum on the number of individuals in the collection, is likely an over-estimation. The presence of incomplete skeletons at different sites suggests that the intentional removal of bones from primary burials was a common practice among Iberomaurian populations. This may also have occurred when graves were used again for other burials, as suggested by the frequent recovery of specimens belonging to more than one individual in the same burial context. Accidental encroachment into a grave during later burials cannot explain per se the recurrence of such finds at different sites. We can also infer the use of the removed bones in ceremonies or rituals with strong symbolic meaning, which could have ended with their secondary burial in other places. This could explain the presence of isolated bones (especially, but not exclusively, skulls) and/or bones not in anatomical connection, which is frequent at other Iberomaurian sites. Complex rituals involving treatment of the cadaver and bones were probably practised at Taforalt, in which the use of red ochre must have had particular symbolic meaning (cf. Roche, 1963). Some of these practices directed toward single bones (e.g., ochre-dying and the secondary burial of certain skeletal parts) took place long after death, and thus, were at least partially unrelated to the death of the individual.

Therefore, it is possible that the Taforalt cave was a special, perhaps sacred place for the celebration of particular ceremonies or more occasional social or religious events, including rituals with strong symbolic meaning, closely related, through the tangible, inexorable, and mysterious signs of death, to the life of the group. In the relationship with death revealed by the Taforalt finds, Roche (1963) saw evidence of religious sentiments among the Iberomaurians.

The comparison with other Iberomaurian sites demonstrated common cultural aspects related to funerary practices, in addition to other locally developed aspects. The detailed exploration of these aspects will be fundamental to interpret the mutual relationships of these populations, which inhabited a very large area for several millennia. Many elements of the funerary practices revealed at Taforalt could constitute evidence, especially in comparison with Capsian populations, of cultural continuity in North Africa, as hypothesized by Hachi (1996) and Lubell (1984, 2000, 2001). A more profound investigation of these topics and a clarification of the relationships with the preceding Aterian populations depend on new discoveries; indeed, excavations carried out with modern methods should provide much new information that will confirm or refute our hypotheses. Also of fundamental importance will be the systematic analysis of specimens housed in North African and European institutions and museums, whose “vitality” and scientific importance should be reassessed. Our method to acquire information about Iberomaurian funerary practices from the human osteological collection of Taforalt could be successfully applied to
many other skeletal series deriving from old excavations in order to obtain interesting and unexpected details of the life of past populations.

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Appendix. Supplementary data

Supplementary data associated with this article can be found in the online version, at doi: 10.1016/j.jhevol.2009.01.001

References


