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Middle Palaeolithic burial is not a dead issue: the view from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh

Inferences of purposeful Middle Palaeolithic (MP) burial are almost universally accepted, despite published arguments that the pre-1960s discoveries are equally well explained by natural processes. In the modern human origins debate (perhaps the most hotly disputed question in palaeoanthropology) inferences of MP burial are crucial in arguments for an early Upper Pleistocene emergence of modern humans. The present paper contributed to that debate by re-examining a number of post-1960s excavations of MP hominid remains. Because these were excavated with meticulous attention to depositional circumstances and stratigraphic context, most palaeoanthropologists consider these inferences of purposeful burial to be based on irrefutable evidence. This paper focuses on the reasoning behind such claims, especially the assumption that articulated sketetal material is *prima facie* evidence for deliberate burial. First it reviews a range of processes operating in caves and rockshelters that condition the probability of articulated skeletal material preserving without hominid intervention. Processes such as deposition, decomposition, and disturbance are inherently more variable in caves and rockshelters than is usually acknowledged. The first section concludes that purposeful protection is not necessary to account for the preservation of articulated skeletal remains. The second part of the paper examines the published record from Qafzeh, Saint-Césaire, Kebara, Amud and Dederiyeh, where the majority of the remains claimed to have been buried are fragmented, incomplete, and disarticulated. This re-examination suggests that in all of the post-1960s cases of putative burial, the hominid remains occur in special depositional circumstances, which by themselves are sufficient to account for the preservation in evidence at these sites. This conclusion severely weakens arguments for purposeful burial at the five sites. Moreover, the equivocal nature of the evidence in the more recent cases renders even less secure the similar claims made for discoveries of hominid skeletal remains at La Chapelle-aux-Saints, Le Mousterier, La Ferrassie, Teshik-Tash, La Grotte du Régourdou, Shanidar, and several others. Finally, by highlighting the equivocal nature of the evidence, this paper underscores the ongoing need for palaeoanthropologists to specify as wide a range of taphonomic processes as possible when interpreting the archaeological record. This will aid in producing robust inferences, and will bring about increasingly accurate knowledge of when hominids became human.

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The report of my death was an exaggeration.

(Mark Twain, cable from Europe to the Associated Press: *The Oxford Dictionary of Quotations*, 1979)

> Occasionally, to the delight of paleontologists, the entire skeleton of a long-dead animal is preserved, with every bone present and in place. Such an event occurs only in special circumstances: the body of the animal must have come to rest in a place where it could lie undisturbed for a great many years; it must have been rapidly covered with a suitable enclosing matrix, and it must have been preserved and strengthened by percolating solutions of appropriate chemical composition. More usually, the animal's body is subjected to the destructive influences that characterize any natural environment. The skeleton becomes disarticulated—broken down into its individual parts, each of which has then to contend with the attention of carnivores and with the forces of decay and disintegration.

(Brain, 1981:11)

Introduction

This paper examines recent claims for purposeful Middle Palaeolithic (MP) burial, to see if natural processes can be ruled out as an explanation for preservation of the hominid remains. The first part considers a range of taphonomic processes that determine whether or not a hominid's remains will be preserved, and in what condition. The second part looks at published excavation reports from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh. When the published observations are examined from a taphonomic perspective, it becomes clear that there are perfectly plausible, indeed satisfying, natural explanations for the hominid remains.

Background

Palaeoanthropologists are deeply divided on the question of when hominids became human (see e.g., Binford, 1985; Wolpoff *et al.*, 1988; Marshack, 1989; Mellars, 1989, 1995; Lindly & Clark, 1990; McBrearty, 1990; Dettwyler, 1991; Duff *et al.*, 1992; Stiner & Kuhn, 1992; Gamble, 1993; Hayden, 1993; Schepartz, 1993; Stringer & Gamble, 1993; Trinkaus & Shipman, 1993; Wynn, 1993; Klein, 1994; Lieberman & Shea, 1994; Mithen, 1995, 1996; Willermet & Clark, 1995; Noble & Davidson, 1996). There is much disagreement about how to interpret the archaeological record for what it can tell us about the cognitive abilities of MP hominids (i.e., both the archaic and the modern morphospecies that made the same kind of stone artefacts—Mousterian with or without the Levallois technique). In this debate inferences of purposeful MP burial strongly support arguments for an early emergence of humanness (i.e., before about 40 to 60 ka ago), because most palaeoanthropologists believe that hominids buried their dead as early as 100 ka ago, based on the inferences of purposeful burial at Qafzeh Cave (Vandermeersch, 1981; Valladas *et al.*, 1988).

Because it is widely accepted as good evidence for humanness, purposeful burial has become a crucial datum in the modern human origins debate. There has been much discussion of the behavioural and cognitive implications (see e.g., Peyrony, 1921; Bouyssonie, 1954; Bergounioux, 1958; Binford, 1968; Vandermeersch, 1976; Harrold, 1980; Shackley, 1980; Chase & Dibble, 1987; Bar-Yosef, 1988; Gargett, 1989*a*; Noble & Davidson, 1989, 1991, 1993; Smirnov, 1989; Tillier, 1990; Belfer-Cohen & Hovers, 1992; Defleur, 1993). Obviously the timing and emergence of purposeful burial are important to the debate. Yet despite the importance that

purposeful MP burial assumes, there has been little critical scrutiny of the evidence for it.

Claims of purposeful burial should be capable of withstanding examination, informed by knowledge of formation processes and taphonomy. After all, related questions have spawned intense argument, and launched scores of archaeological, ethnoarchaeological, and ethological studies—e.g., whether or not hominids hunted prior to about 40 ka ago. In contrast there has been very little interest in the taphonomy of hominid burial. Since the early twentieth century, when archaeologists began explicitly to argue that Neandertal remains had been purposefully buried (e.g., Bouyssonie *et al.*, 1908), there has been nearly universal acceptance that MP hominids buried their dead. Only in the last twenty years have doubts been raised about some of the best-known claims, such as the Shanidar flower burial and the Teshik-Tash circle of horns (e.g., Binford, 1981; Davidson & Noble, 1989; Gargett, 1989*a*; Noble & Davidson, 1989). However, before 1989 there had been no strenuous criticism, and no one suggested that, taken together, the evidence for purposeful MP burial was equivocal.

In 1989 I examined published claims for purposeful burial at La Chapelle-aux-Saints (Bouyssonie *et al.*, 1908, 1913; Boule, 1909), Le Moustier (Peyrony, 1930), La Ferrassie (Capitan & Peyrony, 1909, 1910, 1911, 1912*a*,*b*, 1921; Peyrony, 1934; Heim, 1968), Teshik-Tash (Okladnikov, 1949; Movius, 1953), La Grotte du Régourdou (Bonifay, 1962, 1964; Bonifay & Vandermeersch, 1962), and Shanidar (Solecki, 1955, 1960, 1961, 1963, 1971; Solecki & Leroi-Gourhan, 1961; Leroi-Gourhan, 1975). I argued that their preservation was equally well explained by natural deposition (Gargett, 1989*a*,*b*). Furthermore, I suggested that similar doubt could be cast on claims for purposeful burial at Roc de Marsal (Bordes & Lafille, 1962), Kiik-Koba (Bonch-Osmolovskij, 1940; Klein, 1966), La Quina (Martin, 1923), Amud (Suzuki & Takai, 1970) and Tabun (Garrod & Bate, 1937). To judge by the content of university textbooks, most scholarly works, and the popular press in the last 10 years, my conclusions have been widely ignored. Seven principle criticisms of my earlier paper bear reviewing here, because they are the basis on which the work has been judged. The present paper is in part aimed at addressing some of these perceived shortcomings.

First, Gargett (1989*a*) dealt only with putative burials recovered in the early part of this century, which were not well excavated or recorded. Some complained that this was unscientific (e.g., Frayer & Montet-White, 1989; Trinkaus, 1989). Yet, if shortcomings are evident in the most often cited examples, constructive criticism and plausible alternative explanations ought to be considered worthy of publication.

Second, I chose to critique only claims for Neandertal burial, and not those of skeletally modern MP hominids. I now address that omission, by examining a number of more recent Neandertal discoveries, and by broadening the scope of my examination to include the discoveries from Qafzeh.

Third, some scholars question my authority, and argue that the excavators and their conclusions are above reproach (Bricker, 1989; Hayden, 1993). It may be true that *some* archaeologists *are* above reproach. Nevertheless, archaeological inferences should be able to stand on their own, and not depend purely on reputation.

Fourth, a number of commentators disagreed with the alternative explanations I proposed, or asserted that I had misinterpreted the literature. My replies are a matter of record (Gargett, 1989*a*:184–188,*b*:326–329).

Fifth, I did not explain the absence of articulated remains before about 100 ka ago

(Gilman, 1989). As I discuss later, this may simply imply that, in earlier times, hominids spent little time in caves and rockshelters, and were concomitantly less likely to have been preserved (cf. Binford & Ho, 1985).

Sixth, many noted that I ignored Upper Palaeolithic and later burials, many of which would not pass my stringent criteria (e.g., Belfer-Cohen & Hovers, 1992). If, in the MP, one is dealing with the earliest evidence for purposeful burial, even a cursory glance at the Upper Palaeolithic evidence reveals differences that obviate the need for a comparison between the two. In the Upper Palaeolithic, for example, one often sees something more than might be expected to occur naturally (cf. Stringer & Gamble, 1993:160; Noble & Davidson, 1996:208–209). Moreover, with the exception of the recent claims from Taramsa Hill, Egypt (Vermeersch *et al.*, 1998) only fully modern, Upper Palaeolithic humans have been found articulated in open-air sites—e.g., Lake Mungo, Sunghir, Dolní Vestonice (Stringer & Gamble, 1993:160), or with unequivocal evidence for mortuary treatment, in the form of extreme flexion or complete extension, or cremated, or with copious, unmistakable grave goods, and so on.[1]

Seventh, and most important, more credence is given to claims of MP burial made in the last quarter-century (e.g., Farizy & Masset, 1989; Gamble, 1989; Mellars, 1989; Trinkaus, 1989; Bar-Yosef & Meignen, 1992; Garrard, 1992; Roe, 1992; Rosenberg, 1992; Schepartz, 1992; Smith, 1992). Indeed, there is a widespread conviction that the recently excavated MP hominids from Qafzeh (Vandermeersch, 1981), Kebara (Arensburg *et al.*, 1985; Bar-Yosef *et al.*, 1986, 1988, 1992), Saint-Césaire (Lévêque *et al.*, 1993; Lévêque & Vandermeersch, 1980), Dederiyeh (Akazawa *et al.*, 1993; Akazawa *et al.*, 1995*a*,*b*), and Amud (Rak *et al.*, 1994; Hovers *et al.*, 1995) are indisputable evidence for purposeful burial. This belief has perpetuated acceptance of any and all claims for MP burial, and nurtured claims for purposeful disposal of the dead even earlier, in the Middle Pleistocene. For example, recent spectacular discoveries of early archaic *Homo* from the Sima de los Huesos in Atapuerca, northern Spain, have bred speculation that the disarticulated remains were purposefully disposed of (see e.g., Bahn, 1996; Gore, 1996). However, the presence of nonhominid remains in the same natural trap undermines any appeal to arcane mortuary ritual as an explanation of the hominid remains. That is, unless one were to argue that the animals, too, were placed in the cave by the archaic hominids. Clearly the widespread acceptance of claims for purposeful MP burial is encouraging such fanciful behavioural inferences.

Because of the faith placed in the more recent discoveries as irrefutable evidence of purposeful MP burial, there is an urgent need to examine them for what their depositional circumstances can reveal. I hope to show that in spite of the superior care with which they were recovered, the more recent claims still suffer from the same inferential shortcomings as those from La Chapelle-aux-Saints, Le Moustier, La Ferrassie, Teshik-Tash, Régourdou, and Shanidar (see Gargett, 1989*a*,*b*). Ironically, if my inferences about the recent discoveries are

[1]Vermeersch *et al.* (1998) describe an articulated hominid in the open air, in what is argued to be an MP open-pit chert mine. However its depositional circumstances are just what I would expect if natural sedimentary processes were to have been responsible for preserving a hominid intact in an open-air site. The remains are buried in what is argued to be an undisturbed MP "extraction dump," the undisturbed nature of which is inferred on the basis of the presumed stratigraphic integrity of what the authors claim are mid and mid- to late-MP stone artefacts. A 6000- to 9500-year-old aridsol has developed on the surface at the site, which the excavators use to infer a Pleistocene age for the remains. I leave it up to the reader to scrutinize Vermeersch *et al.*'s arguments in light of the criteria I bring to bear in this paper.

more robust, it will be because of the quality of the data that resulted from the meticulous excavations.

The taphonomy of hominid burial

The primary critical stance I assume in this work is that natural processes must be ruled out before invoking human or hominid behaviour to explain archaeological occurrences. If purposeful burial were indeed the only means by which articulated hominid skeletal remains could be preserved, there would be no need to argue that it had occurred in the MP, and there would be no point in questioning the inference. But, as the epigraph from Brain (1981) reminds us, purposeful burial is not the only way that articulated skeletal remains can be preserved. Indeed, processes that have nothing to do with hominid behaviour have always been at work creating a fossil record that includes articulated skeletons. Special depositional circumstances are all that is needed—i.e., natural processes that combine to preserve the skeletal elements in their anatomical relationships, and (some would say) to mimic purposeful burial. Thus, because natural processes are capable of preserving articulated skeletons, natural processes need to be ruled out before human or hominid agency is inferred. To accomplish this, archaeologists need adequate methodological tools. In this case they need knowledge of the range and variability of site-forming processes to enable them to distinguish between what is likely to be natural and what could only be produced by hominid behaviour.

Explaining the archaeological occurrence of articulated hominid remains should be no different from that of interpreting similarly preserved animal bones. Zooarchaeologists have given considerable thought to the epistemology of interpreting animal bones from archaeological sites (see e.g., Binford, 1981; Gifford, 1981; Gifford-Gonzalez, 1989, 1991; Haynes, 1990). The consensus seems to be that stronger inferences result when multiple, convergent lines of evidence are employed, and when present-day processes are the source for strong analogies. Strong—i.e., relational—analogies enable more accurate modelling of past processes (cf. Wylie, 1989; Gifford-Gonzalez, 1991). Relational analogies are those which depend on recognizing relevant causal relationships between observed formal attributes and the processes that created them. Therefore, in constructing robust inferences from the evidence of animal bones, archaeologists need to take into account the presently observable range, and the variability inherent in processes that can affect animal skeletons, both at the time of death, and after—i.e., the biostratinomic and diagenetic processes (Gifford, 1981).

This part of the paper presents an overview of the site-formation processes that can play a part in preserving hominid skeletal remains. I propose that claims for purposeful MP burial rest ultimately on the presence of articulated skeletal remains, which is assumed to preclude natural burial. This is unwarranted. Five questions and their implications form the core of my argument.

(1) What constitutes evidence of purposeful protection of the corpse?
(2) What is the probability of natural burial in caves and rockshelters?
(3) What is the prior probability of preservation under any circumstances?
(4) What is the importance of articulation?
(5) What is the variability in decomposition rates, disarticulation sequences and likelihood of disturbance?

Before turning to these five issues, I wish to dispense with two lines of evidence that are often employed by proponents of MP burial, but which cannot support claims for purposeful burial: position of the corpse and so-called grave goods or offerings.

Position of the corpse. As one of many categories of mortuary ''style,'' diachronic changes in body position have been useful in making inferences of *modern* human cultural change. Position of the corpse also figures prominently in the arguments for Neandertal burial. Bouyssonie *et al.* (1913:630), for example, proposed it as one of five criteria for inferring purposeful burial of the La Chapelle-aux-Saints hominid, saying that the individual was flexed, ''as if in sleep'' (my translation). Since that early twentieth-century discovery, a number of excavators have employed the position of the corpse as primary evidence for burial. Amud 1 is another good example of this (Suzuki & Takai, 1970). Archaeologists have used body position as a means of inferring MP ''culture'' change and geographic ''cultural'' variation, in studies modelled on modern human mortuary analyses (but see also Belfer-Cohen & Hovers, 1992; and most notably Smirnov, 1989; Defleur, 1993). In these cases the *a priori* assumption is that purposeful burial had occurred. Analyses of MP corpse position, therefore, depend on the presumption that purposeful burial has occurred, and thus that the position of the skeleton is the result of conscious choices on the part of MP hominids. On the model of tightly bound human corpses readied for burial in very small places, position means something. Present-day humans make conscious choices about how they are going to ''lay out'' a corpse. However, if one is indeed interested in evidence useful for determining *if* purposeful burial has occurred, it makes little sense to employ categories of evidence that assume *that* it has occurred. There are several reasons why the position of the corpse is an unhelpful criterion for recognizing purposeful MP burial.

First, its use implies that mortuary treatment has occurred, even though it is being used to argue that purposeful treatment has occurred. This is a circular argument.

Second, use of body position has lacked descriptive precision. MP skeletons' positions are always described using some variant of ''flexed,'' with no attention paid to the imprecision the term carries with it. When one looks at the body positions of claimed MP burials one is struck by the variety encapsulated by the term ''flexed,'' from the almost extended Qafzeh 9 (Vandermeersch, 1981) to the nearly ''foetal'' position of Amud 1 (Suzuki & Takai, 1970). Thus, as support for an argument in favour of purposeful MP burial, the criterion of body position is virtually meaningless, because any position a hominid corpse could assume on its own could be described as ''flexed.'' Only in purposeful burials of modern humans does one see skeletons ''fully extended'' (in the archaeological sense of limb elements parallel to the long axis of the body) and ''fully flexed'' skeletons (i.e., with the heels a few centimetres from ischium, knees nearly touching ribs, and carpals within a few centimetres of proximal humerus). Such positions have never been described in MP contexts. The term ''flexed'' thus masks a great deal of variability, variability that is important to answering the question of whether or not MP hominids buried their dead.

Third, using body position in arguments for MP burial presumes that a flexed corpse could not occur naturally. Many workers have claimed that the degree of flexion of some of the putative MP burials precludes natural death and entombment (e.g., Villa, 1989:325), or that rigor mortis and post-mortem bloating would in all likelihood have caused even a very flexed, unburied corpse to extend. However, there is nothing unnatural about the positions of MP hominids with very flexed lower limbs. Newell (1984), for example, describes the excavation of a pre-European-contact Inuit house whose occupants were asleep when pack ice over-rode the beach berm behind which their house stood, killing and

entombing them. These individuals had obviously not been prepared for burial, but were nevertheless very flexed—every bit as flexed as Amud 1 (Suzuki & Takai, 1970). To preserve in the death position only requires the right environmental conditions.

Grave offerings. Archaeological materials "associated" with claimed MP burials are often called grave offerings or grave furniture (cf. Binford, 1968; Chase & Dibble, 1987; Noble & Davidson, 1989). Often these are scraps of animal bone, or stone tools, or bedrock clasts. The Law of Association (Worsaae, 1843), which developed out of mortuary archaeology, refers only to objects that are indisputably buried with the corpse at the time of interment. In no claimed MP burials has there been any demonstration of the existence of such association. Close proximity is not, in any sense, association. For example, the inference of flowers buried with the Shanidar 4 individual (Solecki & Leroi-Gourhan, 1961; Leroi-Gourhan, 1975) suffers from this methodological shortcoming. Sediment samples were taken, almost as an afterthought, "*from about the same level on which the skeleton lay*" (Solecki, 1971:247) (my emphasis), without any effort to demonstrate that the samples were part of a "burial" context. Most MP cave and rockshelter sites are places where there are plenty of stone artefacts and animal bones. Thus, one has to argue nimbly, and ultimately distort the intent of the Law of Association, to propose that the proximity of hominid skeletons to other archaeological sediments stands as evidence of anything other than their presumptive contemporaneity (and there is no guarantee that this would be the case). Until such time as MP burial is demonstrated, and not argued, an object in proximity to a hominid skeleton in the absence of stratigraphic evidence for a grave cannot stand as evidence of purposeful burial. As long as there are no clearly defined MP burial strata (a point to which I turn in a moment), there can technically and practically be no such thing as "associated" grave goods.

I now return to the five questions posed earlier, with the aim of developing some criteria that *can* be useful when examining the depositional circumstances of MP hominid remains. The first of these is protection of the corpse.

What constitutes evidence of purposeful protection of the corpse?

Purposeful protection of the corpse is always inferred where putative MP burials are concerned, but this category of evidence has yet to be observed in an MP context. In a strict stratigraphic sense, the most secure evidence for purposeful burial is the artificial stratum containing the remains, created at the time of interment (Drucker, 1972:5; Harris, 1979:95). To be distinguished from naturally accumulating sediments, and thus to stand as evidence for burial, the new stratum must be distinct from those upon which or within which it occurs, and from those accumulating above it and the original surface. It is not enough, for example, to recognize a depression or a low spot within which the remains occur, and which might be interpreted as a "burial pit." Unless a new stratum can be distinguished, there is no logical way to argue that the remains were purposefully protected. The reason for this is simple: if the overlying sediments are part of a more extensive deposit that includes the "fill" of the "pit," this greatly weakens the argument that the overlying sediments were the result of purposeful burial. It goes without saying that the new stratum must not be an artefact of natural erosion that has simply removed the upper portion of a more extensive, continuous stratum containing the remains.

A new stratum is the key to discerning *unequivocally* that purposeful burial has occurred. In the absence of unequivocal support, other lines of evidence must be employed, which need to be grounded in an

understanding of the range of processes that can affect preservation.

Where the question of MP burial is concerned, failure to distinguish a new stratum—and thus to demonstrate unequivocally that purposeful burial has occurred—leaves the inference open to challenge, and to the need for alternatives to explain the deposition of hominid remains.

For example, at La Chapelle-aux-Saints the excavators identified a depression containing Neandertal remains. Yet the published profile does not distinguish between the sediments that accumulated in the depression from those that accumulated above it (Bouyssonie *et al.*, 1908:516). Thus, one is left to conclude that the same sedimentary process covered the corpse and filled the entire cave to a depth of 0·5 m. One cannot rule out the possibility that the Neandertal was placed in an oversized pit and covered by such an extensive new stratum. However, it does seem rather unlikely. In any case, one cannot rule out the possibility that the skeleton was naturally buried, without relying on a number of auxiliary hypotheses, as I now explain.

In arguing that the La Chapelle-aux-Saints Neandertal was buried, the excavators relied heavily on the inference that the depression was purposefully created, and on the presence of an articulated skeleton. Otherwise, the argument goes, it could not have preserved in the way it did. Later I examine the assumption that disturbance would inevitably have occurred, and question the warrant for the assumption that an articulated skeleton is evidence of purposeful burial. For now I simply suggest that the presence of a pit is not evidence of purposeful burial. Whether the depression was purposefully created or not, there is no evidence that it was filled at the time the Neandertal remains were deposited. Thus, the inference of purposeful burial at La Chapelle-aux-Saints relies on creaky archaeological inference based on weakly warranted assumptions.

Having suggested the stringent requirement of recognizing a new stratum to infer burial unequivocally, I would hasten to add that, archaeological reality being what it is, discoveries of skeletal remains will not always be in sediments that lend themselves easily to distinguishing a new stratum. Indeed, even in what are clearly modern human cemeteries, burial strata as I have defined them are not always evident (a point made by many commentators on my 1989*a* paper). However, the need to observe a new stratum when arguing that purposeful burial has occurred cannot be overemphasized. Without it, to support a claim for MP burial (or to be critical of one) archaeologists must rely on models and probabilistic inferences based on their understanding of the processes that condition preservation. Accurately inferring the taphonomic history of a hominid skeleton will depend on the quality of the models that are brought to bear. In the case of MP burial, making robust inferences depends on specifying as broad a range as possible of the processes capable of producing the archaeologically recovered materials, while avoiding reliance on simplistic models of site formation.

Developing a nuanced understanding of natural formation processes will involve considering multiple, independent lines of evidence, which can produce a mutually constraining and mutually supportive evidentiary basis for inferences (see e.g., Wylie, 1989; Gifford-Gonzalez, 1991). With the object of building up a battery of models of site formation and taphonomy, the next section begins with a brief overview of the depositional environment in which MP hominid remains are most commonly found—i.e., calcareous caves and rockshelters. The depositional environment in caves and rockshelters determines the probability that a hominid corpse will preserve naturally. This is such a crucial issue that I presented the relevant aspects in my earlier examination of the evidence for Neandertal

burial (Gargett, 1989*a*). More comprehensive treatments of karst geomorphology and cave sedimentology may be found in Ford (1976); Jennings (1985); Dreybrodt (1988) and White (1988) (see also Courty *et al.*, 1989).

What is the probability of natural burial in caves and rockshelters?

Archaeological deposits in caves and rockshelters contain more kinds and sizes of sediment than any other depositional environment (Jennings, 1985:163). When they develop in calcareous bedrock, caves are also (usually) places where bone preserves better than elsewhere, for a variety of reasons, including sedimentation rate, mode of deposition, pH, and microclimate. All things being *un*equal, therefore, bones in caves and rockshelters enjoy a greater chance of survival than those lying out in the open. This is why caves and rockshelters are the pre-eminent European Palaeolithic archaeological sites.

Investigations of MP burial must acknowledge that each cave's and rockshelter's depositional history is complex and unique. Even the idea that one could develop a set of criteria by which to evaluate the inference of purposeful burial is rendered suspect by the complexity of interpreting such sites. For this reason alone it is difficult to be critical of the inferences that emerge. To prime the reader for the criticism I make later, I briefly introduce the major characteristics of sedimentation in caves and rockshelters (for further elaboration refer to Gargett, 1989*a*:158–161).

Autochthonous sediments. The bedrock within which caves and rockshelters develop is often a prime source of sediments. In calcareous bedrock, dissolution of carbonates can result in gradual accumulation of whatever insoluble material is left behind, usually sediments in the clay size range. Freeze-thaw and wet-dry cycles near the open air cause angular and subangular blocks of all sizes to break away from the bedrock on the walls and ceiling. In addition, episodic, sudden bedrock breakdown contributes sediments that can range from dust- to house-sized, which are likely to be poorly sorted to unsorted, and may or may not be clast supported. Many caves and rockshelters that contained putative burials were more susceptible to sudden bedrock breakdown because they occurred in tectonically active areas (e.g., Shanidar, Qafzeh). One could imagine that a rockfall responsible for killing and preserving a hominid need not be voluminous, nor include very large fragments. Therefore, before other processes are invoked, sudden bedrock breakdown must be ruled out as an explanation for the presence of some of the claimed MP burials. Unfortunately, distinguishing the sediments of a catastrophic bedrock collapse from those of more gradual processes, such as exfoliation, has proven exceedingly difficult, because of the variability inherent in breakdown products (Farrand, 1985:28).

Solecki (1960:613), for example, makes much of what he observed as "a cluster" of "smaller stones" "superimposed upon a layer" of "larger stones" lying immediately superior to the Shanidar I remains. He infers that

> "survivors of the rockfall returned . . . and, seeing what had happened, heaped some loose stones, the closest at hand, over the unfortunate's remains."

Farrand (1985:26, Table 1) suggests a way in which previously deposited sediments might be altered by catastrophic collapse and thereby act as witness to such an event: "Crushed Debris (of all kinds)". Thus the interpretation of bedrock collapse rests almost completely on interpretations of what constitutes crushed debris. Following from Farrand's suggestion, it would seem that crushed hominid skeletal material would be one potential indicator of rockfall, as would

broken stone artefacts. As it happens, both categories of evidence occur at Saint-Césaire, about which I comment later in this paper.

Allochthonous sediments. In addition to the potential for a great variety of autochthonous sediments, caves and rockshelters invite occupation by many kinds of animals, some of which (including hominids) can introduce all manner of allochthonous sediments, among them bones. Fuel for fires or for bedding, and faeces are also common constituents of such sites, as are stone artefacts in hominid habitations. A number of southwestern Asian sites contain large quantities of ash.

Depositional environment. In contrast with most depositional environments, for long periods caves and rockshelters can experience little erosion of their deposits, thus increasing the net rate of deposition. However, even though protected from some kinds of erosion, reactivation of karstic subterranean stream activity can cause flushing out. Moreover, sinkholes can form in previously stable sediments creating, effectively, a drain through which material passes to lower parts of the cave system. Thus, although the rate of deposition in caves and rockshelters can be on average more rapid than in most subaerial contexts, making them, effectively, ''sediment traps,'' the net rate of deposition is unpredictable. And, since the deposition rate is almost never a constant, there is no theoretical warrant for estimating annual rates based on overall accumulation, even when there is a chronometric estimate of the length of time a deposit took to form. For example, a 1-m-deep deposit that takes 10 ka to accumulate built up at a theoretical average rate of 1 mm every 10 years. However, it might be the case that 90% of the deposit accumulated in the first ten years—i.e., a real rate of 90 mm a year. In this case the theoretical rate is at variance with the actual rate. There is always the possibility that within an apparently slow-to-accumulate deposit, relatively rapid sedimentation will occur, regardless of whether the main source of sediments is autochthonous or allochthonous.

Deposition in caves and rockshelters also varies according to many characteristics of the bedrock and local hydrology. In particular, the timing and periodicity of bedrock breakdown events would vary according to bedding thickness and dip. For example, caves developed in thinly bedded, steeply dipping sedimentary rock will tend to break down at a much higher rate, and in much smaller individual clasts, than those in massive, horizontally bedded, sedimentary rock. Thus the rate of deposition can be faster or slower, depending on the unique conditions operating in the site, and can change in response to alterations in those conditions resulting from the site's morphological life history, or from climatic or other environmental change. As an example of the huge variability in rates of cave deposition, and the impossibility of predicting such characteristics, two roughly contemporary caves in different parts of the world, La Chapelle-aux-Saints and Shanidar, accumulated sediments at different rates: just over a metre has built up at La Chapelle since the Neandertal was deposited, while approximately 15 m has accumulated in what is assumed to be more or less the same period at Shanidar Cave. The difference is due entirely to differences in the bedrock and geomorphic environment, resulting in vastly different depositional histories. At Shanidar Cave, for example, bedrock from the ceiling has collapsed repeatedly over the millennia, probably encouraged by active tectonism, creating an enormous vault above the excavated area from which all of the hominid material was recovered.

Microdepositional variability. Added to the inherent variety of sediments and depositional rates in caves and rockshelters is the strong likelihood that different microdepositional environments will exist within a

given site, creating locations with different kinds and rates of deposition and different bone preservation potential. The archaeologist faced with interpreting the likelihood of hominid skeletons preserving in such circumstances needs to be aware of the possibilities.

One example of a microdepositional environment with an above-average potential to preserve skeletal material is that of the low spot (including closed depressions). These come in two types: (1) erosional unconformities (after Harris, 1979), where sediments are deleted in a confined space by a variety of processes (including, but not restricted to, purposeful excavation—see below), and (2) topographic low spots that are simply the fortuitous product of depositional circumstances. Crucial to this discussion of MP burial is the well-known sedimentological phenomenon that it takes more energy to transport a sediment out of a depression or a low spot than it took to get it there. However they are formed, low spots are ''sediment traps''—they will accumulate sediments more rapidly than surrounding surfaces. In addition, any vertebrate carcass that came to rest in a depression or a low spot in a cave or rockshelter would stand a greater chance of preservation, because it would be more rapidly buried than similar material in a more easily eroded environment, and thus would be more rapidly protected from trampling and other destructive processes.

In light of the depositional characteristics of low spots, and the likelihood that closed depressions containing hominid remains will be interpreted as burial pits, it is important to understand that closed depressions and other low spots can form naturally in a variety of ways. In calcareous sediments, for example, solution cavities can form in bedrock, which I have suggested as an explanation for the ''graves'' at Kiik-Koba, and for the two depressions reported at La Chapelle-aux-Saints, only one of which contained hominid remains (Bouyssonie, 1954:108) (in addition to inferring that the large depression at La Chapelle-aux-Saints was deliberately excavated to bury a hominid, the contents of a much smaller depression near the entrance to the cave, presumably formed in the same way, was interpreted as a ritual feature). In a limestone cave, water dripping from the ceiling can form metre-sized circular depressions in unconsolidated floor sediments (personal observation). Inside caves and rockshelters, developing talus cones can create low spots where they adjoin walls, which is apparent at Régourdou (in a similar vein, I have suggested that La Ferrassie 1 and 2 may have been rapidly buried because they came to rest on a near-wall surface that was sloping downward towards the wall). When water communicates between the upper and lower portions of a cave that has been vertically bisected by talus, it can produce hourglass-like erosional cavities in the unconsolidated sediments lying against bedrock walls, which can be closed off by accumulating sediments and begin to act as sediment traps (also apparent at Régourdou). Resting animals can produce hollows in unconsolidated sediments where they habitually lie (e.g., kangaroos and dogs), and some animals are known to excavate such places intentionally (e.g., cave bears). Most importantly, modern human foragers are known to prepare shallow basins in unconsolidated sediments, when they wish to be comfortable, or to keep warm when sleeping on the ground (e.g., Gould, 1977:41; Hayden, 1979:173). Regardless of how they formed, closed depressions might easily be interpreted as burial features if they were to contain hominid remains. A small number of MP hominid remains have been recovered either at the contact with, or in sediments immediately superior to, closed depressions. These are usually inferred to represent burial or ritual contexts. However, none of these rare ''pits'' has been found filled with a new

stratum, thus precluding unequivocal interpretation of such features as burial pits.

In general, the location of skeletal remains in caves and rockshelters can be assumed to have a major determining role in bone preservation, although the data to support this contention have been rather unsystematically collected, and are still, unfortunately, sparse. Many cavers, cave archaeologists, and palaeontologists have alluded to the ways in which depositional circumstances and ethology can combine to contribute to preservation (e.g., Koby, 1941, 1953; Ford, 1976; Kurtén, 1976; Sutcliffe *et al.*, 1976; Courty *et al.*, 1989; Kerbis-Peterhans, 1990; Lam, 1992; Theunissen *et al.*, 1998). My own analysis of behaviourally meaningful spatial patterning in a cave bear fauna from Pod Hradem Cave, Czech Republic (Gargett, 1996), is the first systematic study of spatial patterning in the traces left by organisms other than modern humans. From such accounts, the following expectations can be derived. Against the wall, or among boulders, bones will tend to collect, because whether they are consciously or unconsciously moved around, they are less likely to be moved subsequent to their coming to rest in out-of-the-way places. In addition, once against the wall or in a natural niche, they are protected from trampling and comminution. Thus, delicate bones, as well as articulations between bones, will tend to survive better if they are protected from disturbance by fortuitous location in out-of-the-way places, or if they are buried by rockfall. Although at present there are no data to support the proposition, the inherent complexity and microdepositional variability in caves and rockshelters might lead to differential preservation of different bones of an individual skeleton, should the carcass span two areas with different depositional rates and thus different preservation potential—e.g., the boundary between a talus slope and the floor; the boundary between the floor and a depression in the floor; a discontinuous or uneven roof collapse, which would leave parts of a skeleton nearer the new surface, and thus more susceptible to trampling or other disturbance. Moreover, subsequent erosion of the sediments that encase previously buried skeletal material will most likely lead to differential degradation of the exposed portions. All of these hypotheses are empirically investigable. This is a neglected area of research and is in need of much attention. In addition to the mechanical determinants of preservation, one could add the differential effects of sediment chemistry and diagenesis, which also act variably to degrade or preserve bone (Courty *et al.*, 1989; Weiner *et al.*, 1993, 1995; Schiegl *et al.*, 1996).

In sum, caves and rockshelters are inherently variable, inherently complex depositional environments, which obviate the use of simplistic models of site formation and bone preservation.

What is the prior probability of preservation under any circumstances?

In the knowledge that caves and rockshelters are capable of preserving bone better than in the open air, and that the microdepositional variability in caves could lead to differential preservation of bone, one can begin to see how articulated skeletal remains might at times preserve naturally. But how frequently do articulated remains preserve? How likely is it? Complete, articulated hominid skeletons are extremely rare. Most of the several hundred documented MP hominid individuals are known only from fragments of skeletal elements. Often these are the more durable parts of the skeleton, such as the cranium, mandible and dentition. Thus, the overwhelming majority of the hominids that have contributed parts of their skeletons to the MP fossil record were obviously not spared the ignominy of destruction of large portions of their skeleton. Some, like the Teshik-Tash boy, were gnawed by carnivores. Moreover, most of the relatively few

MP hominids claimed to have been buried are incomplete. In fact, most of the putative burials scrutinized later in this paper are incomplete! The fragmentary nature of the MP hominid fossil record has led most workers to conclude that articulated hominid remains are anomalous, and in need of special explanation. The question arises as to whether the anomaly is real or imagined, and whether or not purposeful burial is the only possible explanation.

The fossil record demonstrates that MP hominid skeletons had a low probability of being preserved in such a way that burial would be suspected. However, it is simply unwarranted to assume that disturbance processes would always have resulted in disarticulated and fragmentary hominid remains. There is, in truth, no good way of assessing the prior probability of disturbance in the case of a hypothetical MP hominid. At best, one can get an idea of the posterior probability of preservation from the record itself, and then only on a site-specific basis. For example, suppose that the 23 Neandertal specimens from Kebara Cave (Bar-Yosef *et al.*, 1992) (a) were not purposefully buried, that (b) each represents the remains of a single individual, and (c) that they represent every Neandertal that ever died in the cave. On that evidence, the 23 hominids apparently had about a one in ten chance of reasonably intact preservation. On the other hand, if one assumes (a) that purposeful burial was occurring at Kebara, and (b) that all ages and individuals stood an equal chance of being buried upon their death, then purposeful burial did nothing to improve the likelihood of preservation.

Either way one looks at the MP fossil record, the more or less complete and articulated hominid remains claimed as burials are rare occurrences. Yet, to argue on that basis alone that their preservation must be the result of purposeful burial is to ignore the almost continuous range of completeness that exists in the fossil record, from the predominant isolated teeth and cranial fragments, to whole elements and articulated body segments, to disarticulated partial skeletons, and to complete or nearly complete articulated or nearly articulated skeletons. The most complete individuals are therefore only slightly more ''anomalous'' than the next-best preserved remains, and so on. Where does one draw the line and say that such-and-such a portion must have been buried and that another less well-preserved portion was not? This is not mere quibbling; such perceptions are crucial to the question of MP burial (cf. Binford, 1968; Harrold, 1980). As I point out in the next section, the presence of articulated portions of hominid skeletons is ultimately what leads archaeologists to infer purposeful burial.

Yet while purposeful burial is a sufficient explanation for articulated hominid remains, it is not a necessary explanation. Often, the inference of purposeful burial is not enough to adequately explain the condition of the finds. More often than not, auxiliary hypotheses are required. At times, some very tenuous auxiliary hypotheses have been needed to prop up the inference of purposeful burial for partial skeletons—e.g., that the remains are those of a secondary burial, or they result from post-interment ritual—usually without any supporting evidence beyond argument from want of evident alternatives.

On this point, it is worth reiterating that only a few of the relatively small number of MP hominids claimed to have been buried are technically complete. Most are partial skeletons, and some are quite incomplete (e.g., Kebara 2 is missing the right lower limb, most of the left lower limb, and the cranium (Bar-Yosef *et al.*, 1992). It is reasonable to suggest that equal weight be given to alternative explanations that account for the presence of articulated skeletal elements, and that did not require fanciful auxiliary hypotheses to explain

the differential preservation of skeletal parts.

Finally, if MP hominid mortality was like that of most species, including modern humans before the advent of modern medicine, one would expect high numbers of very young in most natural death assemblages. Despite the high probability that infant remains would succumb to destruction at a higher rate than adult skeletons, infants do have teeth and petrous portions of their temporal bones, both of which are extremely dense, and might be expected to preserve at least as well as some parts of adults. This should mean that, all things being equal, parts of juveniles should still preserve in high numbers in localities where they, along with adults, were dying. The fossil record bears this out. For example, at Kebara Cave there are more immature specimens than adult: eight under 1 year; five between 1 and 10 years; one between 10 and 20; eight adults (Bar-Yosef *et al*., 1992). Thus, it is clear that juveniles, at Kebara at least, are being preserved in some form as often as adults. Similarly high numbers of juveniles occur at Qafzeh (Vandermeersch, 1981).

The question remains, however, ''How are the more fragile parts of immature hominids being preserved, and how does one explain the occasionally well-preserved infant?'' The simple answer is that the depositional circumstances are as important to the preservation of infant remains as they are for adult skeletons. While infant remains are overall more susceptible to destruction, the same processes that can preserve adult remains have an almost equal capacity to preserve the fragile remains of infants. Thus, there is no need to view preserved immature remains as anomalous. Their preservation depends on special depositional circumstances, no less than that of adult remains.

In sum, given the reality of deposition and preservation in caves and rockshelters as I have outlined it, it should come as no surprise that all of the Neandertal specimens whose depositional circumstances I previously examined (Gargett, 1989*a*) were found in circumstances that would be expected to produce better than average preservation. For example La Chapelle-aux-Saints, several individuals at La Ferrassie, Kiik-Koba 1 and 2, and Roc de Marsal 1 were discovered in depressions filled with surrounding sediments. La Ferrassie 1 and 2 were found on inward sloping sediments near walls, where they would be less likely to succumb to trampling, and where they would have been buried relatively rapidly. At Teshik-Tash the remains were found in a basin where water-borne sediments preserved and obscured them. At Shanidar all nine individuals were discovered under collapsed bedrock or in natural niches formed by cave breakdown, which were subsequently buried by collapsing sediments.

I have argued, therefore, that something other than purposeful burial was preserving all of those remains. Clearly the depositional environment has a powerful influence on the prior probability of hominid remains preserving. Add to this that the depositional circumstances are variable within individual caves and rockshelters, and vary a great deal from site to site. Thus, it is virtually impossible to say what the prior probability of preservation would have been for a single site, much less for the entire MP. Certainly there is no warrant for assuming that deposition would always have been too slow to naturally bury a hominid corpse. There is therefore no point in arguing solely on the basis of the fragmentary condition of most hominid fossils, that the rare, articulated specimens must therefore have been purposefully protected. The presence of all the claimed burials in depositional circumstances that lend themselves to protecting and preserving skeletal material should alert palaeoanthropologists to the possibility that all of the so called burials are the result of special natural depositional circumstances,

and not, therefore, the result of MP mortuary practices.

What is the importance of articulation?

If a vertebrate decomposes fully without being buried, natural disarticulation takes place—with the soft tissue gone, the skeletal elements become separate, and can be acted on by gravity and other disturbance processes. Logically, if burial did not occur prior to decomposition and disarticulation, and no other disturbance occurred, such a skeleton would eventually be found with all of the elements present, and more or less in relation to their anatomical neighbours, but not articulated. Thus, for skeletal elements to preserve in articulation, burial of some kind must occur prior to soft tissue decomposition. There can be no doubt that for those rare hominids discovered with articulated portions, the remains must have been buried prior to soft tissue decomposition. The question is whether or not that burial was purposeful.

For the majority of palaeoanthropologists the inference of purposeful burial best explains articulated hominid remains. Indeed, the mere discovery of articulated remains is viewed by many as *prima facie* evidence of purposeful burial. For example, in their treatment of Natufian and MP burial, Belfer Cohen & Hovers (1992:464) state: "... skeletal articulation remains the single unchallenged criterion for intentional burial." Their assertion, too, has gone unchallenged, which leads one to suspect that this argument has many adherents (cf. Rak *et al.*, 1994). However, implicit in Belfer-Cohen and Hovers's position is the unwarranted assumption that in all cases involving MP hominids, natural burial would be too slow to bury a carcass before it decomposed and disarticulated naturally, or was disturbed in some other way.

To examine this assumption, one needs to look at the fossil record of other animals, to see if articulated preservation occurs, and under what circumstances. Natural burial occurs in the fossil record, and occasionally an articulated skeleton comes to light. All that is needed is special depositional circumstances (cf. Brain, 1981:11). Often one finds the articulated skeletal material of mired animals, or those that have been buried in catastrophic floods. Articulated MP hominid remains are always found in special depositional circumstances, even when, as in the case of the Taramsa Hill hominid (Vermeersch *et al.*, 1998), they may be found in open-air contexts. With that one possible exception, the entire corpus of putative MP burials comes from caves and rockshelters. And, as I outlined above, caves and rockshelters are above average in their capacity to produce the kind of special depositional circumstances that can lead to natural burial. For example, in the Friesenhahn Cave, two adult and one juvenile sabertoothed cat (*Homotherium* sp.) skeletons were preserved, articulated, in Pleistocene basin deposits (originally described in Evans, 1961; Marean & Ehrhardt, 1995). Friesenhahn Cave was an animal den, and not simply a natural deadfall trap, where one might expect to find abundant evidence of complete (but not necessarily articulated) animal remains. The *Homotherium* specimens died where they had lived, a claim which is attested to by the presence of a large quantity of juvenile mammoth bone inferred to have been the remains of their meals (Marean & Ehrhardt, 1995). (Students of MP burial will remember that a similar depositional environment most likely led to preservation of the, albeit disarticulated remains of the Teshik-Tash juvenile Neandertal.)

Without a complete review of the palaeontological literature, it would be impossible to say how many such examples of articulated vertebrate remains have been recovered, and how those would relate numerically to the fragmentary ones, and whether or not that ratio differed

significantly from the MP hominid fossil record. I do not intend to undertake such a review, or to produce such evidence in this paper, because little would be achieved by it, even though many commentators have suggested its necessity. I decline to do so because it would be theoretically incapable of achieving any useful end. One cannot, after all, determine the prior probability of occurrence of articulated vertebrate skeletons, given the uniqueness of every cave and rockshelter's depositional and occupational history, and the uniqueness of every species' life history and behaviour. Let us suppose, for example, that hominids spent 80% of their time in caves, as against 50% for cave bears, and less for denning carnivores. Those behavioural dissimilarities would be likely to result in a different prior probability of preservation for each species—the more time spent in such a place, the higher the probability that death will occur there.

In any given depositional environment, all things being equal, the species dying in greater numbers would naturally preserve in greater numbers. The probability of substantial interspecific behavioural differences renders impotent any comparisons I could make on the basis of a review of the vertebrate fossil record. As mentioned earlier, I strongly suspect that interspecific behavioural differences might explain the dearth of skeletal preservation similar to that of MP hominids among the hominids of earlier times, such as *Homo erectus*, whose remains are sometimes found in caves. Rather than implying real cultural differences, which would be the position held by most proponents of MP burial, it may signal nothing more than that *H. erectus* spent little time in caves (cf. Binford & Ho, 1985), or that prior to the MP such spaces were predominantly the domain of denning carnivores that later became scarce through competition with more successful predators, such as the Neandertals (Gamble, 1993). Thus, *H. erectus* remains were more often than not subjected to subaerial conditions, leading to a much lower likelihood of survival. Commentators on my 1989*a* paper who pointed out that the MP hominid record was unique in the number of articulated specimens may simply have failed to appreciate the complexity of the issue, including the importance to bone's survival of the interplay of site type, depositional regime, and behaviour.

Thus, because of the complexities of site formation and taphonomy, one could never know how often hominids might have been buried naturally in cave contexts, no matter how much is known about the rest of the fossil record. Notwithstanding our inability to assess the prior probability of burial, one can still know something about other processes which would have a bearing on whether or not a hominid would be preserved in articulation by natural sedimentation. From knowledge of such processes one can develop expectations for what would happen to a vertebrate after death if it were allowed to decompose naturally in a cave or rockshelter. Such expectations, based on knowledge of processes acting in the present, go a long way towards explaining the preservation of articulated MP hominid remains.

What is the variability in decomposition rates, disarticulation sequences, and the likelihood of disturbance?

If vertebrates naturally preserve with elements articulated, one has the beginnings of an empirical framework to assess the claim that "skeletal articulation remains the single unchallenged criterion for intentional burial" (Belfer-Cohen & Hovers, 1992:464). To take the framework further, however, one must look in more detail at three processes that condition the probability that a skeleton, or portion thereof, would remain intact while it was naturally buried—i.e., decomposition, disarticulation,

and likelihood of disturbance. Implicit in Belfer-Cohen and Hovers's statement is the assumption that natural burial of articulated skeletons would be highly unlikely, if not impossible. To examine that assumption I begin by specifying the range of variability in disarticulation rates.

Decomposition. Disarticulation occurs as part of the process of decomposition. To better understand the likelihood of a hominid skeleton preserving with its elements articulated, one must have an appreciation of the variables affecting decomposition, and thus the variation in the time it takes an animal carcass to become disarticulated. When soft tissue connecting two skeletal elements decomposes, the elements can become disarticulated—i.e., they will become displaced from their anatomical relationship. However, if the organism does not decompose, or only decomposes partly, in the absence of disturbance it cannot become completely disarticulated. The rate at which decomposition occurs, as well as the way that it proceeds, are influenced by moisture and temperature (e.g., Micozzi, 1986; Galloway, 1989).

As Micozzi (1997) points out,

> "postmortem change is essentially a competition between decay and desiccation, and . . . temperature and humidity largely determine the outcome."

The rate at which a dead organism dries out will therefore have a bearing on whether or not, and the degree to which disarticulation will occur. Rapid desiccation will occur in arid environments, regardless of the temperature. Under circumstances of relatively high temperature and humidity, decomposition will prevail over desiccation. However, as the temperature drops, decomposition slows, and desiccation progresses to the detriment of decomposition. The lower the ambient temperature, the longer the carcass will take to decompose and the lower will be the degree of desiccation required to halt decomposition and thus preclude disarticulation. For example, between 15° and 37°C desiccation must be rapid to halt decomposition; below 5°C bacterially induced putrefaction will cease, and only a minimal degree of desiccation is required to preserve soft tissue (Micozzi, 1997). Finally, freezing will preserve a carcass indefinitely. When and if thawing occurs the effects of anaerobic bacteria are minimized (Micozzi, 1986)—and thus bloating in decomposing carcasses, and the concomitant straightening of limbs, are less likely to occur. If a carcass remains dry, skeletal elements can stay articulated for a considerable time. Just how long is difficult to estimate, although in the arid environment of the American southwest, mummified organic materials can survive for hundreds of years (Galloway, 1989). At the other end of the moisture spectrum, as the *Homotherium* remains from Friesenhahn Cave (mentioned above) demonstrate, deposition in wet sediments can also prolong decomposition and ensure preservation of articulated skeletons.

Although temperature and humidity are in general determined by climate, climatic conditions are not the only source of variability in ambient temperature or moisture in, especially, caves. Temperature in caves and rockshelters varies according to aspect—e.g., south-facing caves in the northern hemisphere could be expected to remain warmer longer than those facing north. And even with today's equable world climate, north-facing shelters in the northern hemisphere tend to stay cold even when the ambient temperature is relatively warm. Humidity, too, is subject to variation. Even caves developed in karst can become dry when the wet karstic conditions that created the cave cease. For example, I have observed desiccated, articulated, large mammalian remains in a karstic cave in Israel, where, clearly, the wet conditions that created the cave had given over to a much drier regime. Thus, the chance that temperature and

humidity combined to preserve the few articulated hominid remains may have been vanishingly small, yet it still could have produced the specimens claimed to have been purposefully buried.

In spite of being aware of variability in decomposition rates, in practice one cannot say for certain if a given hominid was likely to have undergone a protracted decomposition. This is because no one can say with any certainty what conditions prevailed at the time the hominid died, nor how much this may have contributed to its preservation as an articulated skeleton. One could contend that such events were rare in the MP. However, in the fossil record one is already dealing with the results of rare events. And one can only guess at how rare the known fossil hominids are in relation to all those that died without leaving a trace.

Even if one cannot say for certain that a given specimen was preserved because of environmental factors, it is safe to say that some of the southwestern Asian specimens were likely to have been subjected to more arid conditions than the Neandertals of western Europe, whose corpses were in turn likely to have been subjected to extremely cold, often periglacial conditions. Ambient temperatures sufficient to freeze a hominid corpse would be expectable in rockshelters and cave entrances under periglacial conditions or, for that matter, during most mid- to high-latitude winters during interglacials. Moreover, even in more or less humid, present-day coastal localities, Pleistocene air and sea temperatures would have waxed and waned in combination with marine regression and transgression cycles creating favourable preservation conditions at some times and not at others. As I pointed out above, retarding decomposition to the point where disarticulation was precluded would require some combination of ambient temperature below 5°C and only relatively low humidity. At 4°C bacterial growth is extremely slow, and at 0° no desiccation would be required for preservation to occur (Micozzi, 1997). Any carcass deposited in a cave or rockshelter under the right conditions could have been naturally buried before it became partially or completely disarticulated. In sum, one cannot simply assume that purposeful burial is required to preserve an articulated skeleton.

From a taphonomic perspective, the foregoing discussion offers archaeologists a new line of evidence for inferring depositional histories: the degree of articulation can provide evidence for the degree to which a carcass decomposed prior to being encased in surrounding sediments. All things being equal, a hominid buried in an instant—whether by purposeful burial or in a rockfall—should be preserved with more elements articulated than one that has undergone some pre-burial decomposition. Therefore, as I explain below, it should be possible to assess the likelihood that a carcass has lain exposed for a time before burial, as well as the relative time it lay exposed, by reference to its degree of articulation, and the species-specific disarticulation sequence.

Disarticulation. Vertebrate skeletons do not disarticulate willy-nilly. A sequence of disarticulation that is more or less uniform across a species allows predictions to be made about which elements can be expected to disarticulate in what order (Toots, 1965; Hill, 1979; Hill & Behrensmeyer, 1984; Weigelt, 1989). In a long-term study of vertebrate decomposition and natural carcass disarticulation, involving the East African bovid *Damaliscus korrigum*, Hill (1979) found that there is an anatomically logical, more or less regular sequence of disarticulation and decomposition. Hill & Behrensmeyer (1984) found a high correlation in the order of disarticulation across four species of ruminant artiodactyls and one equid species. Micozzi (1986) was able to find a similar sequence in laboratory mice. The sequence of disarticulation has

thus been well documented for some mammalian groups. It appears to be equally true of humans, although detailed studies similar to those documented for animals have yet to be carried out on human subjects. The data on the human sequence of disarticulation are thus coarse-grained (see e.g., Haglund, 1997; McKeown & Bennett, 1995, on estimating time since death on the basis of tooth loss; Micozzi, 1986 for an attempt to use mice as analogues for humans).

Although the disarticulation sequence of other mammalian taxa might not be perfect models for hominid decomposition, a number of anatomical similarities resulting from common evolutionary descent make it possible to use them as analogues to model the order in which hominid skeletal elements would come apart, if allowed to decompose without being encased in sediments. The mammalian disarticulation sequences comes into play, when the Kebara 2 discovery is examined below.

Disturbance. Decomposition is just one of the ways a hominid skeleton might become disarticulated. Scavenging carnivores and subsequent cave occupants could also have had a significant impact on unburied or partly naturally buried hominid corpses. The Teshik-Tash Neandertal remains, for example, were subjected to carnivore modification (Movius, 1953), and were thus incomplete and disarticulated. While there is good reason to suppose that carnivore disturbance may have occurred in some places and at some times throughout the MP, there is no warrant for the assumption that it would always have threatened hominid remains lying exposed.

One might readily infer that the majority of MP hominid corpses did succumb to carnivore and other kinds of disturbance; given that so much of the record consists of fragments. The corollary of this is that those few articulated skeletons that survived did so because they sustained no carnivore or other disturbance, for reasons that are the subject of this paper. However, there is great variability inherent in the desirability of hominid remains to scavengers, as well as the potential for great variability in the distribution of predators and scavengers. Desiccation will render a carcass undesirable to scavenging carnivores (Gifford, 1981), and Haynes (1982:268) reports that wolves "prefer fresh meat ... to feeding very long on frozen carrion." Therefore, at times hominid remains might not have been sought by such animals. In fact, absence of carnivore disturbance might mean nothing more than that they were absent from the area at the time the carcass was in an otherwise desirable state. Gamble (1993:166), for example, argues that carnivores were being outcompeted by hominids, thus explaining the apparent absence of carnivores from European sites during periods of hominid occupation. In a situation where, for example, carnivores had been successfully out-competed by MP hominids in a local area, the prior probability of carnivore disturbance would have been reduced to zero. Straus (1982) argues that, usually, hominid and carnivore occupations are alternating, rather than contemporaneous, suggesting that the two kinds of animal may have avoided one another's habitations (cf. Stiner, 1994). The length of time between alternating occupations might have had an impact on the likelihood of a hominid skeleton preserving intact, but it is equally likely that corpses in special depositional circumstances would in any case escape disturbance, whether or not temperature or humidity or both had rendered the corpse undesirable—rockfall, for example, would instantly have protected hominid remains from subsequent disturbance, including by carnivores, thereby reducing the prior probability of disturbance to near zero (although it would always be possible to argue that scavenging carnivores were capable of digging up such naturally buried hominids).

Disturbance by subsequent occupants would have been another potential threat to the unburied corpse of a hominid. However, many of the hominid discoveries I examined for the 1989*a* paper, and several of those I critique in the present work, would likely have escaped such subsequent disturbance quite easily, by having been buried, naturally, in bedrock breakdown events (e.g., those in Shanidar Cave). Others ended up near walls, or in natural niches, where trampling would have been less likely, and thus would have had a higher prior probability of being preserved. So, as with carnivore disturbance, one need not presume that continued occupation or re-occupation of a cave or rockshelter subsequent to the death of a hominid would have disturbed the remains. Again, it must be assumed that the vast majority of MP hominid remains succumbed to some form of physical disturbance, since there are so few complete skeletons. But postmortem disturbance, of whatever kind, need not, and I would argue did not happen in every case.

Summary

The vast majority of MP hominids that died in caves and rockshelters must have had a high prior probability of being dispersed and fragmented prior to natural burial, or subsequently, due to postdepositional disturbance. With all that can happen to a vertebrate after death, survival of an articulated skeleton thus acquires the appearance of being an event of low probability. On the evidence, survival of even fragments of MP hominids must have been a highly improbable event. However, in reality one has no way of assessing, *a priori*, what that probability was. All that can be known is that, *a posteriori*, it appears low.

In spite of the low probability of preservaton, hominid skeletal remains occasionally preserve in a manner that suggests they were purposefully buried. It was the presence of articulated hominid remains that led to the first inferences of burial, and it continues to fuel claims for purposeful MP burial. Yet, as I have argued, purposeful burial is by no means the only way that hominid remains can preserve intact and articulated. Thus, because hominid remains can be preserved in articulation by more than one means, the primary interpretive task for one who suspects purposeful burial should be to specify the range of natural processes that could have been responsible. When, and if, it becomes clear that natural processes alone could not account for the archaeological discoveries, then human or hominid agency might reasonably be inferred.

Unfortunately, there exist no straightforward means of assessing the credibility of claims for MP burial. Each case is unique. Thus there is no simple recipe for interpretation—the taphonomic assessment of hominid burial is by nature qualitative, not quantitative; inductive, not deductive; interpretive, not prescriptive. Under the circumstances one would like to turn to empirically-based research for help in assessing claims of MP burial. However, to date there has been no explicit research into, or modelling of, the processes involved in natural burial of articulated vertebrate skeletal material, and certainly none that addresses the issue of whether or not MP hominids buried their dead.

One thing is certain, the wide range of completeness and degree of articulation represented in the MP fossil record demands explanation. Given the variability inherent in cave and rockshelter site formation processes it is tenuous at best to accept the unwarranted assumption that hominid skeletal remains could only have preserved in anatomical connection due to purposeful burial, especially given that claimed burials represent an inestimably small fraction of the MP hominids that lived and died. In the case studies that follow, I present evidence that claims for MP burial are greatly weakened when viewed in light of expectable

natural processes and the variability inherent in them.

I end this section where I began it, by suggesting that to adequately assess claims for purposeful MP burial, taphonomic histories of the hominid skeletons need to be inferred. For each specimen, such a history would necessarily include, but not be restricted to, the following observations.

- Is there evidence of a new stratum containing the remains created at the time the remains were buried, and distinct from those upon which the new stratum was deposited, and from those accumulating above?
- Is the skeleton complete? Missing or displaced elements could mean that they became disarticulated during a process of natural burial, or that they simply never preserved, due to particular circumstances of deposition. Missing elements may also be due to postdepositional erosion, chemical decomposition (i.e., diagenesis) or other disturbance, such as burrowing.
- Is the skeleton articulated? If so, are all elements articulated? If not, what explains the disarticulated portions? Gradual burial of a slowly decomposing corpse could be indicated.
- Are the bones of the skeleton preserved equally? Unequal preservation could be the result of microdepositional variation, identification of which could also help to explain preservation of the remaining portions.
- Is the skeleton fragmented? Are the breaks peri- or postmortem? Perimortem breaks may be the result of catastrophic rockfall, while postmortem breaks may only signal sediment compaction. Postmortem breaks could equally well, however, imply exposure to destructive postdepositional sedimentation.
- What is the position of the skeleton? Could a similar pose have been adopted during sleep or because of a traumatic injury, or *in extremis*, or could it only have occurred due to mortuary treatment?
- Is there evidence of disturbance due to trampling? Is there any evidence of portions that could have been broken or displaced by trampling during a process of natural burial?
- What are the characteristics of the bedrock? Is it likely to have broken down catastrophically, or gradually, or both?
- Does the cave or shelter occur in a tectonically active area? If so, it may be that episodic catastrophic breakdown has occurred.
- What are the characteristics of the depositional contexts in which the remains are found? Are the remains in a low spot that would have accumulated sediments more or less rapidly, or in some other microdepositional environment that would naturally bury or otherwise protect a corpse, such as near a wall, or in a natural niche?
- Do the sediments themselves tell a story? Are there rodent burrows, erosional channels, crushed skeletal material, broken stone tools, or any other evidence to suggest disturbance of one kind or another?

The foregoing is by no means an exhaustive list of what needs to be considered when examining claims for purposeful burial in the MP. Numerous natural processes and possible combinations of natural processes are capable of preserving articulated hominid remains in caves and rockshelters. Thus, it is incumbent upon the archaeologist to look beyond the unwarranted assumption that articulated remains presuppose purposeful burial, and to consider all the evidence that might have a bearing on whether or not the remains could have been naturally deposited.

In the following sections of the paper, I examine published accounts of the findings from Qafzeh Cave, Saint-Césaire, Kebara

Cave, Amud Cave, and Dederiyeh Cave. I look critically at the arguments for purposeful burial. In each case I approach the observations and the claims with a view towards ruling out the natural processes that could have preserved articulated hominid remains. My conclusions should be regarded as alternative models constructed to explain the archaeological occurrence of well-preserved hominid remains, and are themselves subject to revision upon presentation of new evidence. I begin by looking at the discoveries from the Mousterian levels of Qafzeh Cave, where a number of skeletally modern fossils were recovered in the 1970s.

Qafzeh Cave

In the 1970s a joint Israeli and French expedition recovered the skeletal remains of as many as 18 MP hominids during several episodes of excavation at Qafzeh Cave, near Nazareth, Israel (Vandermeersch, 1966, 1969, 1970, 1981). Of the 18, most were fragmentary, three were articulated partial skeletons and two were articulated, nearly complete skeletons. The presence of so many hominid fossils was already enough to make Qafzeh an important palaeoanthropological locality. However, it grew in significance with the publication of thermoluminescence dates of 90 to 100 ka BP for burned Mousterian flint artefacts inferred to be contemporaneous with the fossil remains (Valladas *et al.*, 1988). The Qafzeh fossil hominids, deemed to be skeletally modern, were thus contemporary with the plesiomorphic Neandertals. Discovery of morphologically modern *Homo* contemporary with Neandertals in the Near East and Europe brings into sharp relief the question of when hominids became human, especially given the ongoing debate about what Mousterian stone tools imply about the cognitive abilities of their makers. Thus, whether or not any of the Qafzeh specimens were purposefully buried has a direct bearing on questions of modern human origins.

At the time of their discovery it was believed that the Neandertals had buried their dead. There was thus no need to question whether or not these remains were purposefully protected, because of the expectation, common at the time, that morphologically modern hominids would have been even more like modern humans than the Neandertals. Nevertheless, there is sufficient evidence to suggest that the Qafzeh hominids could have been naturally buried.

The catalogue of hominids from recent excavations in Qafzeh Cave includes:

- Qafzeh 8, a partial adult skeleton recovered from Couche XVII, including a portion of the tooth-bearing lower face with some teeth, a fragment of the right os coxa, and fragments of the right upper limb and lower right and left limbs;
- Qafzeh 9, an almost complete adult recovered from Couche XVII;
- Qafzeh 10, a child's skeleton recovered from Couche XVII, near the distal limbs of Qafzeh 9;
- Qafzeh 11, the upper portion of an infant, was discovered in Couche XXII;
- Qafzeh 12, a child's cranium recovered from Couche XVII;
- Qafzeh 13, an incomplete foetal cranium, found in Couche XVa;
- Qafzeh 14, a fragmentary child's cranium recovered from Couche XVII;
- Qafzeh 15, the upper portion of a child's skeleton recovered from Couche XVII.

Of the eight individuals, six were recovered from Couche XVII, a spatially limited sedimentary unit mostly comprising limestone rubble infilled with fines (Vandermeersch, 1981:27). Qafzeh 11 was earlier in time; Qafzeh 13 was later. Whether judged by reference to the remaining sediments at Qafzeh, or by comparison with most other MP fossil localities, the contents of Couche XVII would be an astonishing collection of

fossil hominids—six individuals in the space of approximately 3 m^3 of sediment. No wonder they are unquestioningly deemed to have been purposeful burials—the density of skeletal material in some ways resembles that of present-day cemeteries!

Protection of the corpse

The first place to look for evidence of purposeful burial is the immediate stratigraphic context of the skeleton. As with all other MP hominids, none of the Qafzeh specimens was found in a new stratum created at the time of its deposition. Stratigraphic evidence, therefore, cannot be used to say that the hominids were purposefully protected at the time of their death.

Despite the absence of unequivocal stratigraphic evidence, one specimen was recovered in depositional circumstances that tantalized the excavators, and which appear to be, at least in part, artificial. Qafzeh 11 was discovered in one end of a 20–25-cm-deep depression in the deepest deposits of the cave's vestibule. Vandermeersch (1970:299) describes the niche as ''altered'' bedrock, composed of calcareous rubble enveloped in calcareous sand. The report goes on to suggest that two bedrock boulders, one atop the lower limb of the 10-year-old, were employed to shore the putative grave's sides, which were so unconsolidated that they collapsed easily. Although the presence of a depression is indisputable, the inference that it functioned as a grave is less secure.

As I mentioned previously, all kinds of animals, as well as people, are capable of creating such hollows as comfortable resting places, and not just as places to inter the dead. As with the other specimens at Qafzeh, the absence of a distinct new stratum created at the time Qafzeh 11 was buried makes the burial hypothesis less robust. Not even the presence of an antler in the individual's possession necessarily implies that it was a grave offering. Presumably such faunal remains occur in Mousterian contexts from time to time. Presumably they were being transported there by hominids. And if Qafzeh 11 had been in possession of the antler at the time of its demise, and it met with no subsequent disturbance, presumably it would have been preserved along with the skeleton.

Condition of the skeletal remains

All of the Qafzeh skeletal material is uniformly described as highly fragmented. Only two specimens are completely preserved, or nearly so—Qafzeh 9 and 10. Qafzeh 8, although it is clearly an articulated skeleton, has been affected by postdepositional processes that destroyed the left (upper) side of the skeleton. Even so, Qafzeh 8's surviving elements are for the most part crushed and often incomplete. The remaining hominid specimens are also less than perfectly preserved and incomplete. Thus, there is evidence of considerable peri- or postmortem destruction. If purposeful burial was occurring, it did a poor job of protecting these individuals from destructive processes. Unless one is to imagine that they were purposefully buried in an incomplete state, one must explain how they came to be that way. Natural burial by expectable depositional processes provides a parsimonious explanation for the Qafzeh remains.

Whether purposefully buried or naturally encased in sediments, one must always expect that in caves and rockshelters erosion can occur. Whenever it rains in caves like Qafzeh, run-off from the surface above is transmitted through a chimney to the talus slope below, and then out through the horizontal opening. At such times surface erosion is unavoidable, and quite capable of exposing portions of buried skeletons, which could lead to their eventual destruction. Erosion could easily account for the absence of Qafzeh 8's cranium, or the missing lower portions of Qafzeh 11 and 15. However, from an excavator's standpoint, evidence for such erosion might be elusive.

If any of the Qafzeh hominids had been caught in a shallow rockfall of variable depth, the missing parts of individuals may simply not have been covered by enough sediments to ensure preservation. The fragmentary state of several of the Qafzeh hominids might therefore stand as proxy evidence that Couche XVII accumulated rapidly, perhaps in an instant. Given the possibility of rockfall, the presence of so many remains in the same location becomes easier to explain—the brow of the cave is the best-lit portion, with a vantage of the wadi outside. The cave mouth is also where most breakdown due to freeze–thaw and wet–dry cycles would be expected. Hominids (perhaps) habitually inhabiting an area of inherently unstable ceiling bedrock, coupled with the cave's location in a tectonically active area, meant that the ''vestibule'' would have been a prime candidate for repeated catastrophic preservation of hominid remains.

While erosion or incomplete burial could explain the absence of parts of some skeletons, erosion cannot explain the crushing and deletion of portions of the elements that did survive. Qafzeh 8, for example, preserved some of the right carpals complete, while others are crushed; some of the phalanges survived complete, while others are crushed, and some are absent. Moreover there are other similar examples of differential preservation from this specimen. The uppermost portions of Qafzeh 8 are missing and were very likely affected by the process that resulted in brecciation. However this process cannot account for all of the missing portions. Diagenesis would probably have affected articulating elements, such as the carpals, equally, and would not, therefore, have resulted in differential preservation of some of the wrist bones of the right hand. Thus some other explanation must be sought. The evidence suggests rockfall. Those parts that survived intact may have been just those that escaped direct impacts by falling rubble. Qafzeh 9 presents perhaps the clearest evidence for such an event.

Qafzeh 9 is virtually complete. However, Vandermeersch (1981:51) describes its condition in this way:

> In the grave, it lay buried on the left side and was crushed by the weight of the sediments, to the point where the right and left ribs were in contact with one another. The almost complete absence of sediments in the space between permits one to infer that the crushing must have occurred a short time after the inhumation. This crushing has broken the cranium into numerous fragments [my translation]

Besides the crushed elements, the crucial evidence given here is that there are no sediments between the left and right ribs, with the implication that damage to the ribcage occurred before the soft tissue decomposed. Otherwise, as the soft tissue decomposed, sediment would have leaked into the chest cavity and been present on the lowermost bones of the ribcage when the upper (left side) ribs collapsed. Furthermore, there is the inference that Qafzeh 9's ribcage was crushed by the weight of sediments accumulating above it after purposeful burial. Does the absence of sediment between the ribs necessarily imply that crushing occurred ''a short time'' after death, or can it imply that crushing occurred perimortem? One way to clear up the matter would be to examine the break margins for evidence of peri- or postmortem damage. Columnar fractures and right angle break margins would imply that the damage occurred well after the individual's death, while spiral fractures and break margins with acute angles would more than likely occur perimortem. However, even if the bones are equivocal on the matter, the ribs supply evidence that the crushing occurred close to the time of Qafzeh 9's death.

Qafzeh 9 occurs in a stratum that may be no more than 50 cm thick (see below for a

discussion of the cave's stratification). It would be difficult to specify, but considerable pressure must be required to collapse a hominid ribcage when the bone is fresh. Therefore, I question whether 50 cm of sediments, placed carefully on the corpse in a purposeful burial, would have had sufficient energy to collapse the ribcage prior to soft tissue decomposition. And, if greater than 50 cm of sediments was required to crush the ribcage, by the time enough sediment had accumulated above the buried corpse it seems highly likely that the corpse would have decomposed to the point where sediments were entering the chest cavity. Even if Qafzeh 9 had become desiccated after being purposefully buried, it seems improbable that no sediment would have intruded between the left and right sides before or during the collapse of its ribcage (although that possibility cannot be ruled out).

Thus, a more parsimonious explanation for Qafzeh 9's condition would be that the crushing weight of falling sediments occurred at the moment of her death due to sudden bedrock breakdown. On the evidence, Qafzeh 10, the infant, succumbed to similar forces, which would be expected if it had been in the care of Qafzeh 9 when they were both killed by rockfall. Qafzeh 8, likewise, appears to have been crushed.

Finally, crushing is not restricted to the hominids in Couche XVII. The entire underside of Qafzeh 11 is described as being damaged almost beyond recognition, and the pelvis is completely crushed. The ribs, too, were ''crushed against the rock'' (Vandermeersch, 1970:299). Moreover, the individual was very probably hit sharply on the right forehead (Vandermeersch, 1970:299), which left a depressed fracture and a hole in the cranium. It is described as follows:

> On the right side of the frontal, about 3 cm behind the frontal boss, there is a deep depression, 2 cm across, which ends in a hole 8 mm by 5 mm. On the back, the bone displays a regular bevel [*biseau*]

A break margin described as beveled, rather than at 90° to the surface, suggests perimortem, rather than postmortem damage. Thus, despite the presence of a shallow depression in which the remains were discovered, contained in the description of Qafzeh 11's discovery is evidence that this individual may have been killed on the spot by falling rubble. Altogether, the evidence from Qafzeh Cave strongly suggests natural burial in a destructive depositional environment.

Position of the corpse

All of the Qafzeh specimens are in poses that could have occurred naturally. However, the proximity and relative position of Qafzeh 9 and 10 are used to postulate that the two comprise the first multiple burial in the archaeological record (Vandermeersch, 1970:32). Qafzeh 9 is lying on her right side, with her right arm slightly adducted and slightly flexed at the elbow, and her right hand resting under her right femur; her left upper arm is abducted, and slightly flexed at the elbow. Her femora are flexed about halfway from the anatomical position, her knees are also flexed at about right angles to the femora; her left foot is extremely inverted and slightly plantarflexed; her right foot is slightly inverted, and in extreme plantarflexion. Qafzeh 10, the infant, was discovered near the feet of Qafzeh 9. The infant's right arm is adducted posteriorly and flexed slightly at the elbow, the left is difficult to make out in photographs. The infant's lower limbs are both slightly adducted, with slight flexion of the knees apparent (Vandermeersch, 1990).

As I said before, basing an hypothesis of burial on the position of skeletons is fraught with problems. Nothing about the position of these individuals implies intentional preparation, or compels acceptance of the burial hypothesis. One can easily postulate what

would have happened to a female carrying an infant if a small earthquake had loosened several cubic metres of sediments from the ceiling of this cave. If caught in such a rockfall an upright adult female with an infant in her arms could easily have dropped the vulnerable subadult at her feet as both perished. Multiple burial, as postulated by Vandermeersch, seems on the evidence to be only one possibility among many, and an unlikely one, at that.

Articulation

Most of the Qafzeh specimens were articulated. This should come as no surprise, because whether encased in a rockfall, gradually buried by aggrading sediments in the cave during prolonged decomposition, or purposefully buried, one would expect a skeleton to remain articulated.

Characteristics of the bedrock

Vandermeersch (1981) describes Couche XVII, in the cave's mouth, as being composed predominantly of calcareous rubble filled with fine sediments. These deposits occur at the distal end of an immense talus cone, and are evidence of a long history of bedrock breakdown. On a visit to Qafzeh in 1989 I observed the bedrock within which the cave developed. It is steeply dipping and finely bedded calcareous rock that breaks down into pebble- and cobble-sized clasts. Such parent material is intrinsically more susceptible to breakdown than more massively and horizontally bedded material would be (Jennings, 1985:164). Moreover, relatively constant breakdown of the friable sediments would have occurred throughout its depositional history, especially near the mouth of the cave, where diurnal temperature gradients and wet/dry cycles would have increased the rate at which the bedrock degraded (Farrand, 1985). The witness profile left by the archaeological excavations near the mouth of the cave also testifies to Qafzeh's history of more or less continuous breakdown during deposition of Couche XVII. Finally, Qafzeh occurs in one of the more tectonically active areas of the world (i.e., at the northern end of the East African Rift). Such inherently unstable bedrock would probably have produced a hailstorm of potentially lethal particles and dust during an earthquake.

Characteristics of the sediments

The hominids in Couche XVII are buried in a homogeneous layer of larger clasts infilled with fine sediments. As described by its excavators, Couche XVII varies from about 10 to about 50 cm deep (Figure 1), averages about 25 cm, and covers an area about 3 m by 4 m (Figure 2). It occurs near the bottom of a suite of distinctly stratified sediments defined on the basis of granulometry and colour: Couches XV to XVIII. However, although XVII is given a separate descriptive taxon in the stratigraphic column, there is some ambiguity in Vandermeersch (1981) regarding its distinctiveness. Immediately above and contiguous with it is a massive accumulation of brecciated sediments, named Couche XVI, described as part of the larger group comprising XV to XVIII, and differing from the rest only in that it is brecciated. Thus, Couche XVII might simply be the unaltered lower portion of a much thicker stratum that built up as a result of a uniform depositional process. However, Vandermeersch (1981:27), states that the brecciation masks the contact between XVI and XVII, which implies that the excavators did in fact recognize a stratigraphic break between XVII and the overlying XVI. In addition, the published profile shown in Figure 1 depicts a dotted line, which is presumably an inferred continuation of the upper limit of Couche XVII—i.e., a clear indication that the excavators had decided Couche XVII was a discrete depositional unit. In spite of the ambiguity introduced in its description, there seems to be some warrant to

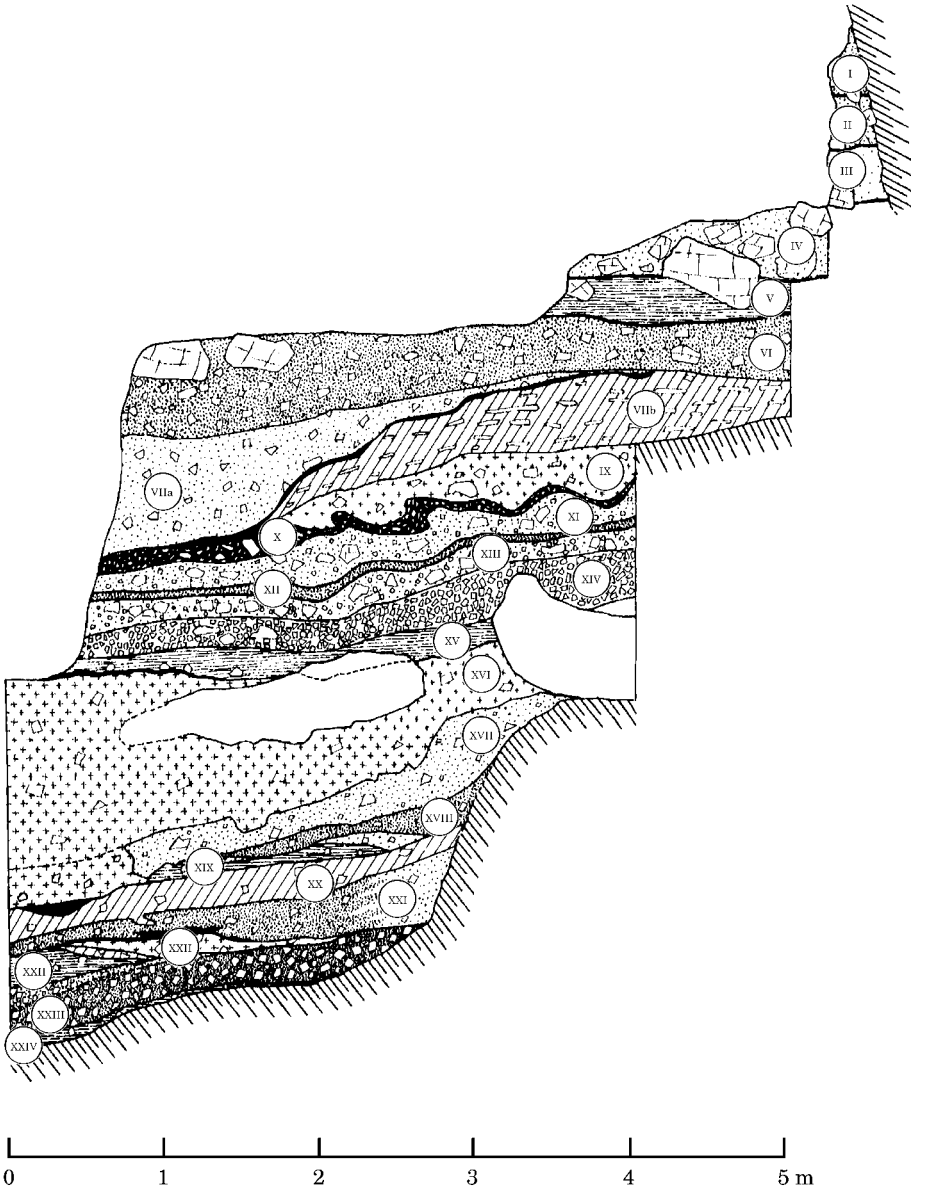


Figure 1. Qafzeh Cave. North-south stratigraphic profile, at western excavation limit. Most of the claimed burials come from stratum XVII (after Vandermeersch, 1981:28, Figure 6). Reproduced with permission from *Les Hommes Fossiles de Qafzeh* (1981) Paris, C.N.R.S. Copyright retained by C.N.R.S., Paris.

identifying Couche XVII as a separate depositional context.

Further evidence for Couche XVII's distinctiveness comes from the description of its constituents. Couche XVII is unique in this suite of deposits in being described as containing ''nombreuses traces de foyers'' (Vandermeersch, 1981:27)—i.e., numerous traces of hearths (my translation). This description distinguishes XVII from those

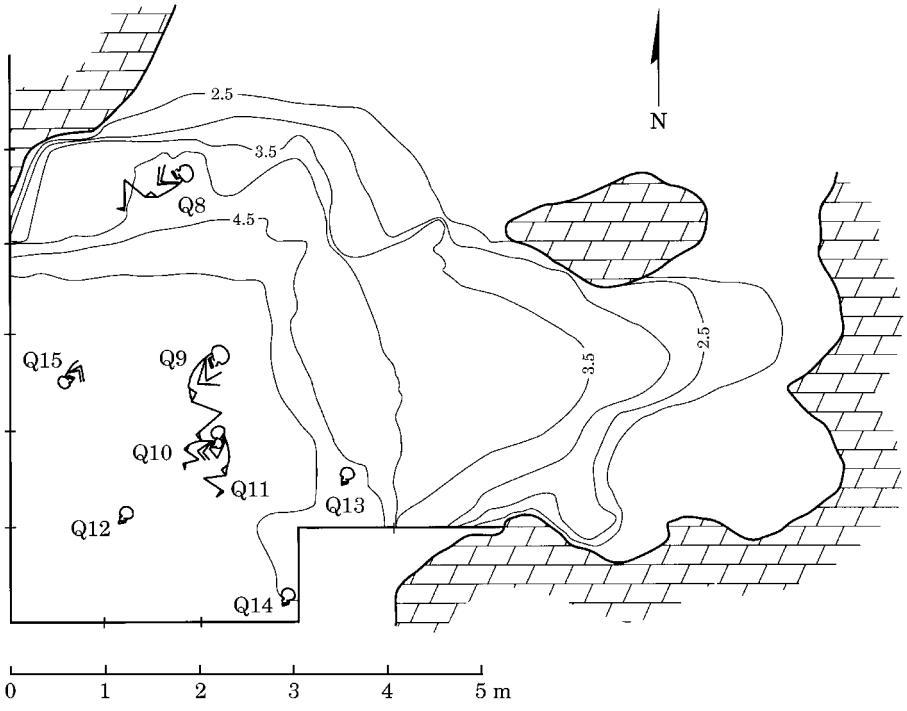


Figure 2. Qafzeh Cave. Schematic representation of locations of claimed burials in plan (after Vandermeersch, 1981:33, Figure 8). Note that not all individuals are complete, nor are the poses of the skeletons uniform. Reproduced with permission from *Les Hommes Fossiles de Qafzeh* (1981) Paris, C.N.R.S. Copyright retained by C.N.R.S., Paris.

above and below it. It also implies that the evidence for hearths is not in the form of hearths, *per se*, but something else that belies the onetime presence of hearths. One can infer this from the description of the earlier Couche XXI, which is stated to have contained "numerous hearths." There is thus some question as to the nature of the evidence for hearths in XVII. It could, for example, be in the form of dispersed charcoal, in which case it may have filtered downward into an otherwise heterogeneous jumble of bedrock collapse material. Given that the evidence in XVII and XXI is described differently, one is left to wonder whether the "traces" in XVII are true hearths. Moreover, given the effort to describe the sediments of XVII as distinct from the rest, including XXI, it is reasonable to conclude, at least tentatively, that XVII is a distinct depositional unit, and that the six hominid specimens within it were deposited in a horizontally and vertically restricted space. The absence of true hearth features would lend support to the suggestion that Couche XVII accumulated rapidly, and in the process buried a group of MP hominids. On the other hand, if complete hearths are present in Couche XVII, it might only imply that its deposition was not instantaneous, but rather, episodic. Such a scenario would not preclude natural burial of the Qafzeh hominids in Couche XVII.

A geomorphologist would have a difficult time determining macroscopically if any of the Qafzeh sediments were the result of a rockfall—i.e., whether they had accumulated rapidly enough to kill and bury the hominids found there. However, the crushing evident in all of the skeletal material is

strong support for the occurrence of rockfall (Ferrand, 1985).

Summary

Dealing with what they thought were modern humans, the excavators assumed that the Qafzeh hominids had been buried. There is thus little in the way of explicit argument in the published account towards which one can address critcism. In spite of this, it is possible to assess whether or not natural processes could have been responsible for the fossil remains. The cave is developed in friable, thinly bedded and steeply dipping calcareous rock. There is ample evidence that bedrock in the cave's vestibule has been breaking down more or less continuously throughout its history. Villa (1989:325) views as anomalous a similar situation at Shanidar, in which several individuals died in the same part of the cave. Rather, I have argued (Gargett, 1989*a*) that those individuals were entombed by a time-transgressive phenomenon—i.e., localized, episodic bedrock breakdown beneath a developing ceiling vault. A similar fate may have befallen the Qafzeh hominids. In any event, given the sedimentary context, the position, completeness and state of preservation of most of the specimens from Couche XVII and XXII, natural processes cannot be ruled out as an explanation for the hominid fossils at Qafzeh.

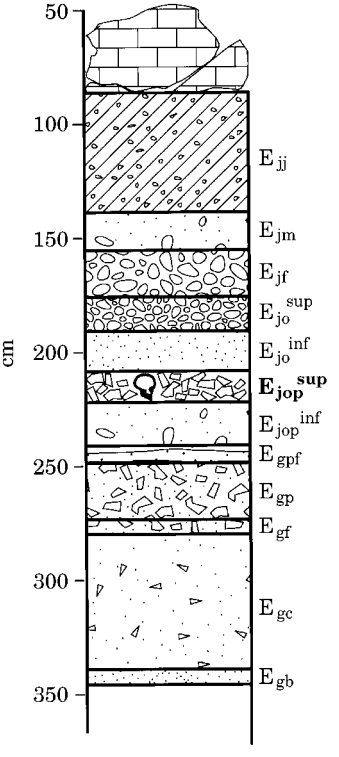


Figure 3. Saint-Césaire. Schematic stratigraphic profile illustrating granulometry. Hominid remains found at base of stratum $E_{JOP}^{superior}$ (after Miskovsky & Lévêque, 1993:10, Figure 2.1). Reproduced with permission from *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptation at Saint-Césaire, Charente-Maritime, France* (1993) Madison, WI: Prehistory Press. Copyright retained by F. Lévêque.

Saint-Césaire (La Roche à Pierrot)

The disarticulated and highly fragmented Saint-Césaire Neandertal specimen was discovered in 1979, in La Roche à Pierrot, a small rockshelter near Saint-Césaire (Charente-Maritime), France (Lévêque & Vandermeersch, 1980). It is a most important find because burned flint artefacts from the same sedimentary context have yielded a mean thermoluminescence date of about 36,300 ± 2700 BP (Mercier *et al.*, 1991), placing it in Europe several thousand years after the earliest dates for stone tools and other traces thought to be contemporaneous with behaviourally modern hominids (e.g., ApSimon, 1980; Melars, 1989). The crushed, partial and fragmentary adult skeleton (>500 pieces) was encased in the upper portion of level E_{JOP} (Miskovsky & Lévêque, 1993) (Figure 3), a sedimentary unit containing stone and other artefacts ascribed to the Castelperronien industry. Such assemblages are thought by many to represent a "hybrid" of Middle and Upper Paleolithic industries, and are thus crucial to arguments about the cognitive capacities of

the last Neandertals in Europe. Miskovsky & Lévêque (1993:10) define $E_{JOP}^{superior}$ by the presence of "numerous angular pieces of limestone"in the upper ca. 10 cm of E_{JOP}, which is an otherwise uniform matrix of fines that are the result of bedrock dissolution filling in an earlier rockfall (Backer, 1993:105).

The unusually numerous limestone pebbles and cobbles overlying the hominid skeleton are visible in the published photographs (e.g., Miskovsky & Lévêque, 1993:Figure 2.2), and are indeed suggestive of a different sedimentary regime, and (at a minimum) a destructive depositional environment. The 70-cm-diameter concentration of skeletal remains that comprise the presumptive Neandertal burial occurs about 1 m away from the wall of the shelter (Figure 4, top left) (Backer, 1993:106, Figure 9.1; Vandermeersch, 1993:130), at the base of what the excavators refer to as "Rockfall B." Judged too friable to be excavated in the field, the remains were removed *en bloc*, to enable careful study in the laboratory. There, the remains were found to be vertically compressed into a "few" centimetres, and all but the feet were represented by at least some identifiable fragments (Vandermeersch, 1993:129).

In spite of what would appear to be good evidence for natural deposition—in the form of sediments described as "rockfall"—in the following excerpt, Vandermeersch (1993:130) argues explicitly that the Saint-Césaire specimen was a purposeful burial:

> 1. We observed no differences between the skeletal deposition area and the other parts of the layer. There was no apparent pit.
> 2. The archaeological layer contained many limestone blocks, but these blocks were absent from the skeletal area. They were very close to the skeleton, but not between the human bones.
> 3. There was also a very low frequency of lithic artifacts directly associated with the skeletal block.
> 4. All the human bones were found within a small area, almost circular, measuring about 70 cm in diameter.
> 5. All the bones were at the same level and the human bone deposit was only a few centimetres thick.
> 6. Some elements, but not all, were articulated. For instance, the maxillary and the mandible were almost in occlusion and articulated. Some fragments of the tibia and fibula diaphyses were side by side. Many of the hand bones were only slightly disturbed from their relative anatomical position. Unfortunately, we have not been able to fully reconstitute the skeleton in place; too many bones are fragmented and the fragments displaced.
> 7. By comparison we must remark that no articulated animal skeleton or even any part of any animal skeleton in anatomical position has been found in this layer.
> 8. Finally, no cut marks have been observed so far on the preserved human bones.
>
> If we consider all these arguments it seems to me that they support the burial hypothesis. If it was not a burial it would be the first time, to my knowledge that fragments of almost all parts of a skeleton would have been found together in a Paleolithic site, outside of a burial context. But if we accept the burial hypothesis, another question arises: it is indeed really difficult to understand how to fit a complete body in so small a space. Therefore if we accept this hypothesis we should be led to consider another one: the possibility of a secondary burial.

These arguments for purposeful burial deserve careful unpacking, because although the points must be taken as containing factual statements about the disposition of the remains, they nevertheless involve less than parsimonious inferences.

Protection of the corpse

There was no discernible new stratum supporting the inference of purposeful protection of a corpse—i.e., there was no grave. The absence of unequivocal evidence for purposeful burial forces one to look further into what can be inferred from other aspects of the Saint-Césaire specimen's condition and the depositional context.

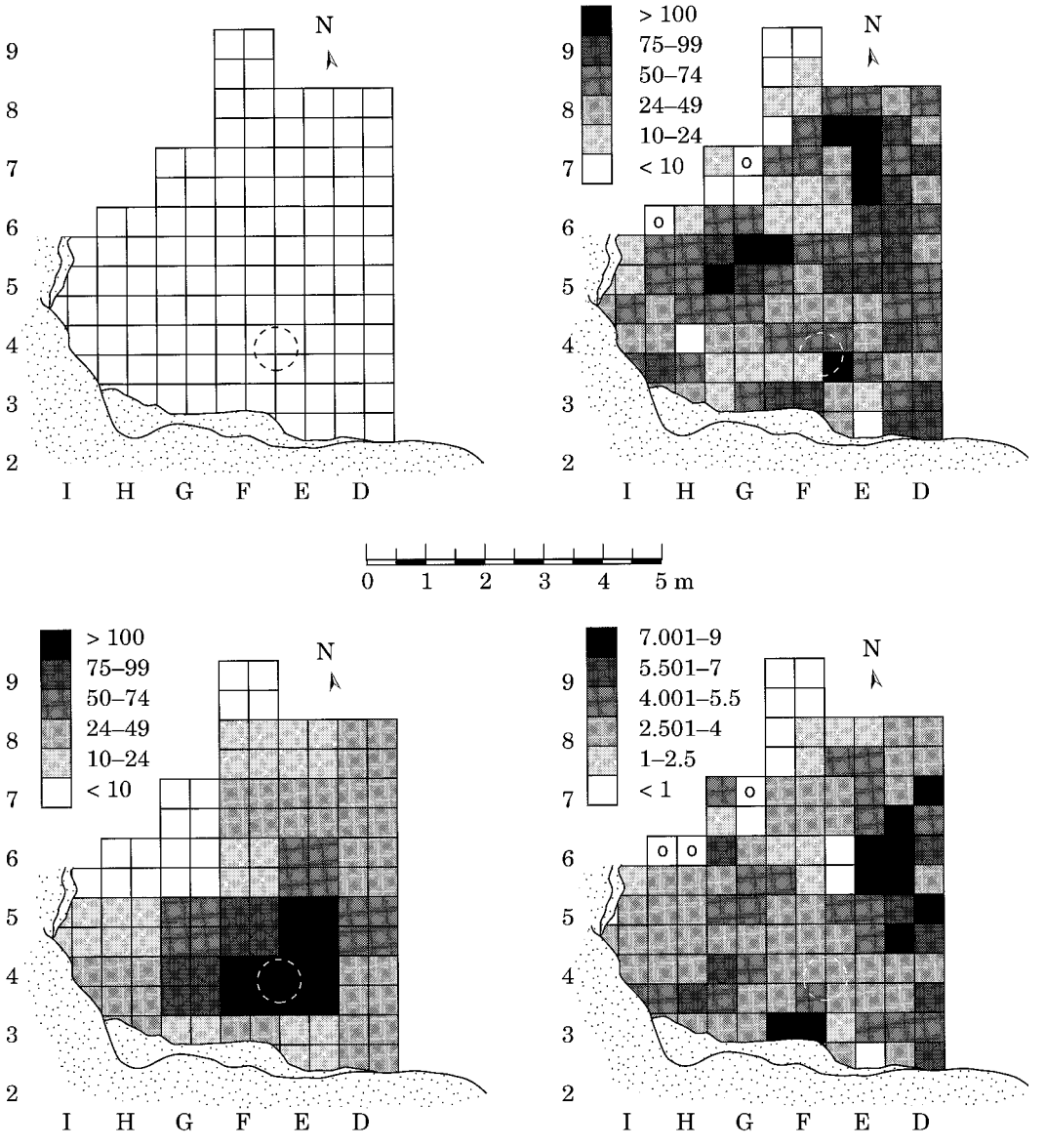


Figure 4. Saint-Césaire. Plan of excavation. Top left: hominid remains were recovered from squares E4–F4 (after Backer, 1993:106, Figure 9.1). Top right: distribution and density of unretouched flakes $\leq$2 cm (after Backer, 1993:109, Figure 9.3). Bottom left: distribution of naturally modified pieces (after Backer, 1993:117, Figure 9.6). Bottom right: small flake surplus (after Backer, 1993:119, Figure 9.8). Reproduced with permission from *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptation at Saint-Césaire, Charente-Maritime, France* (1993) Madison, WI: Prehistory Press. Copyright retained by F. Lévêque.

Condition of the skeleton

The Saint-Césaire skeleton is incomplete (missing all the bones of the feet), highly fragmented, and only some portions of the skeleton were found articulated. Moreover it was found to be vertically compressed into a

few centimetres of the deposit. This offers little support for the contention that the remains represent a primary interment, and there is good reason to doubt that it is evidence for secondary burial.

If purposefully buried while the soft tissue still held the joints in connection, one would expect that an individual would be preserved with most of the same joints in anatomical position once the soft tissue had decomposed, no matter what insult befell the deposits postburial. This, after all, is the major supposition of the advocates of MP burial. If the Saint-Césaire individual had been purposefully buried as an intact corpse, and postdepositional disturbance had not removed the foot bones, it seems unlikely that any amount of postdepositional sediment compaction would have disarticulated the skeleton to such a degree that only a few parts were more or less where they would have been in a living individual. Moreover, if the individual had been caught in a single rockfall event it would probably have been protected from disarticulation as long as it stayed buried. Saint-Césaire 1, however, is a disarticulated skeleton. This argues equally against burial in a single, catastrophic rockfall, and purposeful primary interment.

However, while primary interment seems unlikely, the hypothesis of secondary burial is only very weakly supported by the evidence. Secondary interments most often occur once the soft tissue has decomposed, and would thus preclude preservation of articulated body segments. However, one cannot rule out secondary interment of articulated portions of a corpse not fully skeletonized. Such a scenario could explain the absence of foot bones, and the presence of only a few articulated elements. The hypothesis of secondary burial might explain the presence or absence of certain parts, and the differential articulation in evidence. Nevertheless the secondary burial of originally intact skeletal elements might have resulted in better preserved, intact elements, and might not, therefore, best explain the degree of fragmentation or vertical compression in evidence at Saint-Césaire. For secondary burial to explain the disarticulated, fragmented, and vertically compressed state of the Saint-Césaire skeleton it must have involved secondary burial of already fragmented skeletal elements. This seems improbable.

Even if one were to accept the possibility of secondary burial of an already fragmented and incomplete skeleton it would still mean ignoring all of the evidence for a destructive depositional environment at La Roche à Pierrot. By being asked to accept the hypothesis of secondary burial, one is being asked, ultimately, to accept that the skeletal fragmentation and the high-energy depositional environment are unrelated—i.e., merely coincidental—phenomena. Such a request stretches the limits of credulity, because gradual burial in the destructive environment of Saint-Césaire could account for the fragmentation and vertical compression of the remains. Gradual, natural burial of a skeletonizing corpse might tend to compress the corpse initially, and subsequent or repeated insult would more than likely lead to further vertical compression and fragmentation of the skeletal elements, while maintaining, to some degree, the anatomical locations of individual elements. Prolonged exposure could also explain the absence of body parts, such as the feet and half of the cranium, either through scavenging, or trampling.

The likelihood of disturbance

Other animal remains were not recovered in similar circumstances at Saint-Césaire. I would expect that, if this was a place that Neandertals habitually used to shelter, other animals may simply have avoided it, or have been absent from the area (Straus, 1982; Gamble, 1993:166). Moreover, given the vicissitudes of decomposition, and the

impossibility of knowing if an exposed corpse would have been attractive to scavengers, the necessity of disturbance by carnivores or other occupants is obviated. Under the circumstances, the absence of evidence for other animals in the deposits is at best weak support for an argument for purposeful burial.

Position of the skeleton

The position of the corpse is the next evidence proposed to support the inference of purposeful burial. Vandermeersch asserts that the Saint-Césaire specimen could not have been contained within a 70-cm circle under circumstances of natural burial. Yet there is some empirical evidence to suggest that a 70-cm circle is sufficient to accommodate a hominid body. Newell's (1984) observation of the protohistoric Inuit habitation catastrophically destroyed by pack ice clearly shows that a human being, surprised in sleep, could be encompassed in an area of 70 cm. In the case of the Saint-Césaire specimen, whose feet are missing, 70 cm would have been commodious. Thus, the horizontal extent of the space within which the Saint-Césaire remains were found is at best weak evidence for purposeful burial.

Characteristics of the sediments

The sedimentary context of the Saint-Césaire specimen offers very little support to arguments for its purposeful burial—especially given the excavators' habit of referring to the sediments as "rockfall." $E_{JOP}^{superior}$ contains many limestone cobbles, any one of which could have caused the demise of a sleeping Neandertal. There were bedrock blocks "very close" to the skeleton, but none "between the human bones" (Vandermeersch, 1993:130). This is to be expected, for two reasons. First, the skeleton is described as lying at the lower extreme of $E_{JOP}^{superior}$—in other words at the bottom of the layer of "rockfall." Most of the rockfall derives from the wall of the shelter, and was deposited during an inferred cold phase (Miskovsky & Lévêque, 1993:14). Because the remains were lying at the base of a layer of large rocks, one would naturally expect to find no great amount of rubble beneath them. Second, given the variability inherent in the spatial distribution and particle size associated with even small bedrock collapse events, it is quite expectable that the limestone blocks of interest to Vandermeersch might have been "very close to the skeleton, but not between the human bones" (Vandermeersch, 1993: 130). A plan of the site (Backer, 1993:106, Figure 9.1) clearly illustrates a non-uniform distribution of limestone clasts. In sum, the absence of large rubble in the 70-cm circle containing the skeletal remains cannot stand as evidence for burial.

Nor do the allochthonous sediments provide much support for the hypothesis of purposeful burial. The few vertical centimetres containing the skeletal remains yielded "a very low frequency of lithic artifacts" (Vandermeersch, 1993:130). Lower frequencies of sharp stones in the vicinity of the remains is just what one would expect if the individual had died in its sleep and was later buried in the shelter's destructive depositional environment. Any stone tools that accumulated above the remains would have been removed in the process of excavation prior to the skeleton's discovery, and would not therefore have been present in the block containing the remains that was removed to the laboratory. That the individual may have been resting on low frequencies of sharp pieces of stone also stands to reason, if one supposes that the individual had been sleeping when the shelter wall or brow collapsed—you would expect it to have cleared a comfortable area for rest, which would presumably have included removing sharp pieces of stone. Such behaviour does not require a modern human mind, or a culturally prescribed

notion of cleanliness—finding and maintaining a comfortable resting place is a common enough behaviour in the animal world. Therefore, the absence of lithics beneath the Saint-Césaire Neandertal might instead be construed as evidence supporting the suggestion that the individual had been resting in that place when it died, and was subsequently buried by collapsing sediments.

Considerable additional support for the existence of a destructive (and potentially lethal) depositional environment in the area of the skeleton comes from Backer's (1993) examination of site structure at Saint-Césaire. In the vicinity of the Neandertal remains (Figure 4, top left) one finds the highest frequencies of so-called naturally modified lithic debris—i.e., more than 400 pieces in the 1 × 1 m square containing the skeleton (Backer, 1993:117, reproduced here as Figure 4, bottom left). Among other things, this observation contrasts with Vandermeersch's account of a low frequency of lithic artefacts within the block containing the skeletal remains (Vandermeersch, 1993:130). Backer (1993:121) also reports that the debitage that would have resulted from natural breakage, i.e., the "small surplus flakes," do not co-occur with the "naturally" modified lithics. This "lends credence to the possibility that the Saint-Césaire Neandertal was purposefully buried" (Backer, 1993:121). Yet this analysis is not supported by the data. These small flakes are "expected to result from stone modification activities, because tiny retouch flakes and debris are likely to remain embedded in the substrate once they fall to the ground" (Backer, 1993:116). Again, it must be assumed that this distribution would have included the unretouched flakes that resulted from "natural modification." The "small-flake surplus" distribution is shown in Figure 4, bottom right (Backer, 1993:119, Figure 9.8). It clearly shows that the densest concentration occurs in a square adjacent to the one in which the hominid remains lay. In addition, far from being "absent" from the square containing the remains, small-flake surplus occurs in relatively high numbers.

In addition, one can suppose that the category of "unretouched flakes less than 2 cm" (Backer, 1993:109, Figure 9.3, reproduced here as Figure 4, top right), included at least some amount of the debris of natural modification. A glance at the distribution of "unretouched flakes less than 2 cm" reveals one of the densest concentrations in square E4. Thus, in just that place where one finds the crushed and fragmented hominid skeleton, one also finds the highest concentrations of "naturally modified" lithics, a high concentration of small, unmodified flakes that could have resulted from natural modification, and a relatively high density of what is acknowledged to be the debitage from natural modification.

Thus, rather than being an important indicator of purposeful disposal of the dead, the distribution of lithic debris gives additional support to the thesis that destructive deposition was occurring in the vicinity of the skeleton—enough, that is, to have produced four and five times as many "naturally modified pieces" in the square containing the Neandertal remains as in 22 of the 31 squares for which such data were reported. Finally, in accord with the pattern of destructive deposition in the vicinity of the remains, the highest concentrations of "whole" (i.e., undamaged) flakes occur several metres away.

Summary

The excavators and analysts of La Roche à Pierrot explicitly argue that purposeful burial preserved the hominid specimen. However, there are perfectly plausible natural explanations for its preservation. First, there are numerous limestone cobbles in $E_{JOP}{}^{superior}$. This accumulation of bedrock pieces is repeatedly termed a rockfall by the

multidisciplinary team that excavated it (Backer, 1993; Lévêque & Vandermeersch, 1980). By any measure, it was a destructive depositional environment, with crushed and broken skeletal material and broken stone artefacts in abundance. No burial pit was recognized, and no new stratum observed. Tenuous arguments are offered to account for the state of preservation, the near-total absence of articulation, the vertical compression and the relatively confined horizontal space in which the specimen was found. Added to this, interpretation of the lithics inferred to be contemporaneous with the skeleton introduces some confusion, and ultimately undermines much of the burial argument. In short, purposeful burial seems the least likely explanation for the Saint-Césaire skeleton's preservation. The Neandertal individual lay in an area of destructive bedrock breakdown, which not only produced the highest concentrations of "naturally modified lithics," "unmodified flakes less than 2 cm," and "small-flake surplus," but also the highest concentrations of naturally modified Neandertal bones in the site. With so much clear evidence for what Ferrand (1985:26) termed "crushed debris," there seems little support for the suggestion that Saint-Césaire 1 was purposefully buried. The individual could have died naturally, and been buried in the destructive depositional environment under circumstances of delayed decomposition. Taken together, the disarticulated, incomplete, fragmentary condition of the remains, coupled with the destructive depositional environment in the shelter lead to the conclusion that natural deposition cannot be ruled out as the explanation for Saint-Césaire 1's preservation.

Kebara Cave

The Kebara 2 Neandertal specimen was discovered in 1983 (Arensburg *et al.*, 1985; Bar-Yosef *et al.*, 1986, 1988, 1992), during the extensive modern excavation of the cave near Mount Carmel, in Israel. Kebara 2 is a partially disarticulated, partial skeleton. It was recovered in the deepest trench of the excavation, 7·85 m below datum, in unit XII (Figure 5). Its archaeological context has been dated by thermoluminescence to 59,500 ± 3500 years BP (Valladas *et al.*, 1987, 1989). In all, the remains of 23 subadult and adult hominids have been recovered from Kebara Cave's MP contexts. Only two of these, a partial adult, Kebara 2, and a partial infant, Kebara 1, are claimed as purposeful burials. Kebara 1's excavation took place earlier this century (Schick & Stekelis, 1977), and although it, too, is claimed to have been buried (Smith & Arensburg, 1977), I do not deal with it here because of inadequate documentation. Suffice it to say that there is nothing in the description of its discovery to warrant the belief that it was purposefully buried. The adult, on the other hand, was excavated under technically masterful conditions, and with the utmost care in recording and description. For this reason alone the Kebara 2 specimen has led the majority of palaeoanthropologists to accept claims that this Neandertal was purposefully buried, and on that basis to perpetuate the belief that such behaviour was common in the MP and earlier. Close reading, however, reveals a number of unwarranted assumptions which weaken the arguments.

The remains are described as follows (Figure 6):

> The skeleton was lying on its back . . . The right hand lay on the thoracic cavity at the level of the left scapula. The left hand lay a little lower at the level of the lumbar vertebrae. The cranium was missing, with the exception of the right, third upper molar. The cervical vertebrae were in anatomical sequence, with the atlas positioned between the branches of the mandible. The latter was tilted toward the vertebral column, indicating that the head of the skeleton originally

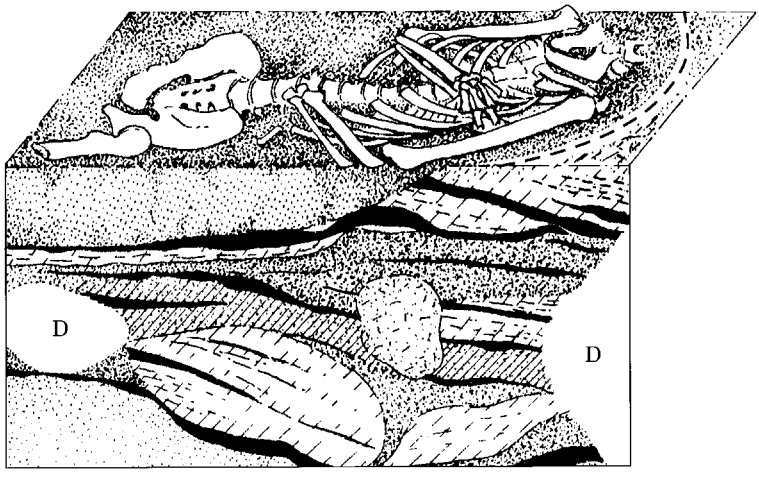


Figure 5. Kebara Cave. Stratigraphic profile showing position of Kebara Hominid 2 (Bar-Yosef *et al.*, 1988:23, Figure 1). Note that the skeleton does not appear to lie on the unconformity that the excavators describe as a burial pit. Note also the presence of an earlier, similar feature, near the bottom. Reproduced with permission from *L'Homme de Néandertal: Actes du Colloque International de Liège (4–7 Décembre 1986), 5 La Pensée* (1988) Liège: Études et Recherches Archéologique de l'Univérsité de Liège. Copyright retained by the University of Liège.

> leaned forward. The head lay at a slightly higher level than the rest of the body against the steep northeastern side of the burial pit. In its primary position the head was probably facing westward.
>
> The right humerus was turned inward with its lateral side facing up. The right innominate was in place, and the typical sideward collapse after the decay of the flesh had not occurred. These observations mean that the right side of the body was leaning against the northern wall of the burial pit, limiting the amount of bone movement which normally occurs with the decomposition of the soft tissue. The exact position of the bones therefore furnishes the needed information concerning the existence of the northern and northwestern edges of the pit. The western side of the pit remains unknown, as the right lower limb is missing. The left side of the skeleton has been affected by diagenetic processes which caused the alteration of the elbow, the pelvis, and the proximal part of the left femur.
> (Bar-Yosef *et al.*, 1992:527–528)

The excavators thus spend considerable effort describing the disposition of the skeletal remains, as part of their argument that this was a burial. However, their interpretation is not the only plausible one, and a parsimonious natural explanation appears to be in evidence.

Protection of the corpse

The partial skeleton was lying stratigraphically superior to an erosional unconformity—a basin-shaped depression—that truncates previous deposits. The depression itself is stratigraphically superior to other similar features, which suggest that it is merely the latest product of a time-transgressive phenomenon (most likely a karstic process). The depression is 20–25 cm deep, and is clearly distinguishable in the underlying profile (Figure 5). The remains are repeatedly described as having rested in a "burial" pit. There are two reasons to doubt that the "pit" was a burial feature. First, to securely infer that a pit was created for the purposes of burying anything, it must be possible to discern a new stratum created at the time of burial distinct from those into which the grave is dug and from those accumulating above it.

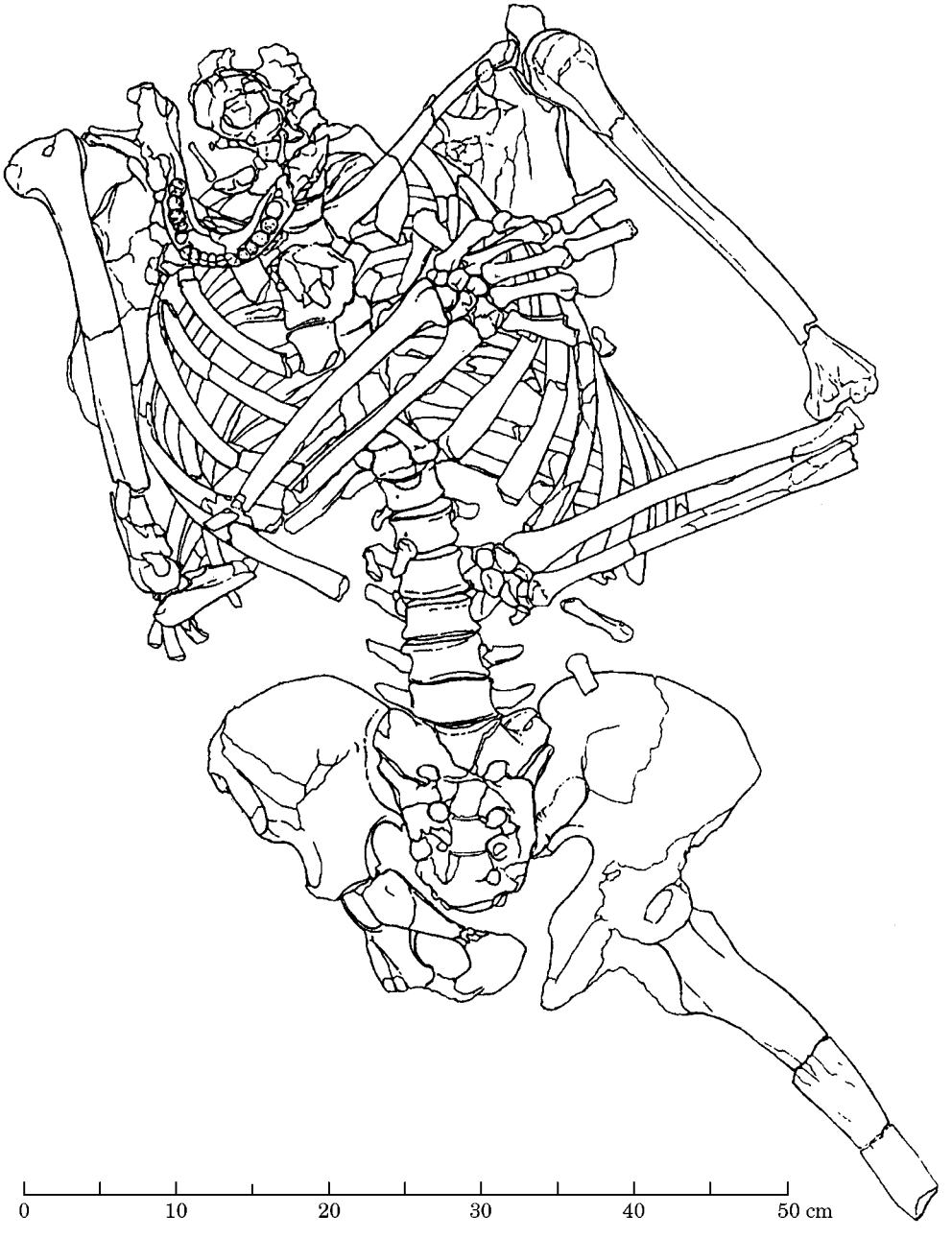


Figure 6. Kebara Cave. Plan of Kebara Hominid 2 (after Arensburg *et al.*, 1985:229). Note the following: absence of cranium; disarticulation of the right humerus, scapula, and clavicle; fragmented and disarticulated right elbow; disarticulated left hand; absence of the right lower limb. Reproduced with permission from *Comptes Rendus des seances de l'Academie des Sciences, Paris (1985) Series 2*, **300,** 227–230. Copyright retained by l'Academie des Sciences.

In the case of Kebara 2, the sediments surrounding it were indistiguishable from those occurring immediately above (Bar-Yosef *et al.*, 1988:19).

Second, if the unconformity were the result of a grave, one would expect the skeleton to be lying on the contact with the lower sediments. However, it is not clear from the profile, or from the excavators' description, if the skeleton was lying at the base of the depression, or was deposited sometime after the depression began to fill in. Such ambiguity renders the claim for purposeful burial less robust.

Further evidence that the unconformity may not have been a prepared grave comes from the uncertainty regarding its extent. Bar-Yosef *et al.* (1992) were unable to locate its limit on the right side of the skeleton. Finding no clear stratigraphic evidence for the extent of the erosional unconformity, the excavators argue that the right innominate's position indicates the confines of the ''pit.'' The right innominate was more or less in anatomical position, suggesting to the excavators that it had remained this way due to the inferred presence of the (unrecognizable) boundary of the depression. In contrast, the left innominate was disarticulated, and more or less horizontal. Explaining the differential articulation of right and left innominate is a relatively simple matter of modelling allochthonous deposition in the cave. The right innominate was on the side nearest the cave's entrance. Thus, it was nearer the source of wind-blown and colluvial sediments that form the majority of these deposits. During gradual burial of a skeletonizing corpse, sediments would have accumulated against the right innominate on the side opposite the articulation with the sacrum—in other words it would have formed a ''sediment dam'' behind which sediments accumulated to hold it in place. The left innominate was furthest away from the source of sediments, and the rate of sedimentation on the side opposite the articulation with the sacrum would have been less. Thus, there would have been nothing to stop the left element from becoming disarticulated. Here, then, is a plausible alternative to the excavators' claim that the right innominate was held in place by the inferred pit boundary. The position of the right innominate is at best equivocal evidence for the ''northern and northwestern edges'' (Bar-Yosef *et al.*, 1992:528) of the presumed burial pit.

The lack of clear stratigraphic evidence for the contemporaneity of the erosional unconformity and the skeleton require further examination and explanation. If an erosional unconformity of indeterminate extent was being filled naturally before the individual was deposited, one would expect that the horizontal extent of the original feature might be some distance from the remains, and might therefore have eluded excavators. A feature such as the erosional unconformity in evidence beneath Kebara 2 is the sort of place where sediments naturally accumulate at a more rapid rate than elsewhere in the cave. This would help explain how a skeletonizing corpse could have been preserved with portions intact.

Finally, there is evidence in the published profile that several similar sized depressions inferior to the skeleton had developed in the same place in the cave, and been filled in. This raises the possibility that the more recent depression, the one containing the hominid remains, was created naturally. Thus, while it is reasonable to entertain the possibility that the depression was purposefully created as a burial pit, it is not the only inference that one can draw from the observations, and the possibility that it was created naturally, and filled in gradually, cannot be ruled out.

Condition of the remains

Kebara 2 is an incomplete skeleton, missing all of the cranium except the right upper

third molar, most of the left lower limb, and all of the right lower limb. If only some part of a vertebrate skeleton is preserved, and purposeful burial is inferred, explanation must be provided as to why the remainder perished. The excavators suggest the auxiliary hypothesis that the cranium's absence was the result of a deliberate act of post-interment ritual. The left lower limb's absence inferior to mid-femur is argued to have been dissolved by diagenesis (Weiner & Goldberg, 1990; Bar-Yosef *et al.*, 1992; Weiner *et al.*, 1993, 1995). That same process is cited to explain the left olecranon and left innominate's poor preservation. This process is well documented, and adequately accounts for the degradation and absence of parts of the skeleton's left side. However, diagenesis cannot adequately explain the right lower limb's absence, nor that of the cranium. The excavators do mention the missing right lower limb, yet offer no explanation for its absence. Nor do they make a case for why they think it could have no bearing on the question of purposeful burial. Diagenesis cannot explain the right lower limb's absence, unless the process affected everything up to, but not including the acetabulum of the right innominate, a fairly unlikely possibility. Some actor or process must have displaced both the cranium and the right lower limb after the soft tissue decomposed. It is possible to use knowledge of decomposition and disarticulation to construct a parsimonious natural explanation for the condition of the remains, one that supports an inference that the skeleton underwent a process of gradual burial.

Decomposition and disarticulation

Bar-Yosef *et al.* (1992) argue that the skeleton's articulated state stands as the best evidence for purposeful burial.

> Most of the anatomical connections were still intact; for example, the extremely mobile hyoid bone remained in place between branches of the mandible. There was no evidence for the collapse of the thoracic cavity after decomposition of the soft tissue. The position of the components of the scapular girdle and the obliquity of the left clavicle indicate that the shoulders were contracted slightly upwards. These observations suggest that the body decomposed in a filled grave and that the burial pit was somewhat deeper at the level of the thorax. Despite the abundance of evidence for hyena-gnawed bones in the cave, no carnivore marks were noticed on these bones. The position of the upper limbs, especially the right hand reaching the left shoulder, supports the hypothesis of immediate inhumation, perhaps preceding rigor mortis. The positions of the mandible, the hyoid bone, and the right upper third molar, which fell from its socket next to the right lower third molar, exclude the hypothesis that the skull was removed by an animal. Furthermore, no cranial fragments were found. These observations suggest that the skull was removed by humans following the complete decay of the atlanto-occipital ligaments. This is, in our view, the first clear-cut case recorded in a Mousterian context for later human intervention in a primary burial. The absence of the skull precludes any further interpretations in terms of mortuary practices.
> (Bar-Yosef *et al.*, 1992:528–529)

In the preceding excerpt, the links between observation and conclusion are not always explicit. However, one is able to infer their lines of reasoning from the way in which the evidence is presented and the conclusions they reach. Their arguments hinge on expectations of what should happen when a hominid skeleton decomposes. By describing the remains in this way the excavators are clearly implying that, if left unburied (1) the hyoid should have been mobilized, (2) the ribs should have come apart from the backbone prior to the skeleton's thorax collapsing, (3) the scapula and clavicle should have been in anatomical position, (4) the bones should have been gnawed by hyenas, (5) the right hand could

not have been where it was, (6) the mandible, hyoid and upper third molar could not have been preserved where they were if an animal had removed the cranium. Since the authors depend on expectations of what should have happened, one would have expected some reference to actualistic studies underpinning their arguments. Studies of natural decomposition, and disarticulation, though rare, do provide background knowledge that renders most of their expectations open to question. It is possible to evaluate the excavator's assertions with reference to eight aspects of natural disarticulation.

First, quadruped forelimbs are the first body portion to become disarticulated as decomposition proceeds (Hill, 1979; Haglund, 1997), because there is no ligamentous attachment between the scapula and the rest of the skeleton. In hominids, however, the clavicle would make the process of forelimb disarticulation more complex. Thus, in a gradually decomposing skeleton, the articulation between the acromion and clavicle can plausibly explain the position of the scapular girdle and clavicle, which was taken to indicate that "the shoulders were contracted slightly upwards" (Bar-Yosef *et al.*, 1992:528). As the scapula comes free of the ribcage, it would form a continuous skeletal element "chain" with the clavicle and humerus, which, being anchored at the sternum, would mean that the whole structure would have "slid" dorsally and cephalically off the ribcage. Thus, rather than acting as evidence for immediate burial, the position of the left upper limb and scapular girdle can plausibly stand as evidence for this individual's having incompletely decomposed while being naturally buried.

Second, Bar-Yosef *et al.* (1992) make much of the preserved hyoid and the absent cranium, asserting that the cranium had been carefully removed in a postinterment ritual. However, they are somewhat vague when it comes to their reasons for concluding that animal disturbance cannot be involved to explain the absent cranium, and that "human" intervention was responsible. They base their conclusion on the position of the mandible, hyoid and upper third molar. Presumably the authors are suggesting that an animal bent on removing the cranium would not have been able to avoid disturbing the mandible, hyoid and upper third molar, with the clear implication that a Neandertal would have been able to. That seems unlikely. Whether it was a hominid with the intention of removing the cranium, an animal intent on scavenging the head, or a less intentional act such as stubbing a toe, the mandible, hyoid, and tooth would have been left behind unintentionally, because the soft tissue connecting them to the cranium had previously decomposed. The mandible is freed of its association with the cranium early in the sequence of disarticulation (Hill, 1979). The hyoid develops in soft tissue inferior to the mandible. It should come as no surprise that the mandible and the anatomically associated hyoid remained, while the cranium was displaced, without demonstrably affecting the position of either the mandible or the hyoid. For the hyoid to have been discovered between the "branches" of the mandible, the mandible must have first dropped forward on to the thorax. This is to be expected, given that the individual was lying on its back.

Third, the atlas is also described as being between the branches of the mandible, and it was in fact displaced slightly anteriorly (Tillier *et al.*, 1991:92). The atlas would have come free of the rest of the vertebral column prior to separation from the cranium (Hill, 1979). Thus, the true anatomical location of the atlas no more explains its final physical relation to the other elements of the preserved Kebara 2 skeleton than does that of the hyoid—neither are articulated with the mandible, but both are where one might expect them to be after a gradual

process of natural disarticulation followed by displacement of the cranium. The cranium must have been removed once the atlanto-occipital ligament was decomposed, because the atlas did not go with it. Thus, the most parsimonious explanation for the hyoid's position is that it was bound up in the soft tissue associated with one of the first elements to become disarticulated, in a natural sequence of decomposition in the open air. In a depression that was collecting sediments, one would expect that the mandible and hyoid, once having dropped on to the thorax, would have been buried somewhat earlier than the rather more prominent Neandertal cranium. The cranium would thus have remained exposed for much longer.

Fourth, the Kebara 2 right humerus is described as having been "turned inward with its lateral side facing up." This is to be expected if natural disarticulation had occurred prior to natural burial, because the humerus also becomes free early in the sequence of disarticulation (Haglund, 1997; Hill, 1979). Although the excavators mention that the right humerus was turned medially, they do not mention that it was also displaced at least 5 cm from the glenoid fossa of the scapula. This can be seen clearly in the plan of the hominid remains *in situ* (Figure 6). As with the missing lower right limb, Kebara 2's excavators offer no explanation for the disarticulated right humerus, nor do they explain why they think it is unimportant. However, it is, once again, potential evidence that parts of this skeleton decomposed and disarticulated prior to burial. Displacement of the right humerus occurred only once decomposition had advanced to the point where it became free of the scapula. Such displacement, I would argue, was unlikely to have occurred after purposeful burial. Whereas smaller elements, such as phalanges, can be removed by bioturbation, displacement of a major long bone is much less likely once it has been buried under any quantity of sediments—it would probably have required substantial disturbance to have moved it several centimetres sideways. Any disturbance process capable of such effects would probably have disturbed neighbouring elements. Displacement of the right humerus does appear to have been associated with other disturbance, notably that which fragmented the individual's right elbow region. Judging from the nature of that breakage it could only have occurred once the bones were dry, and it seems improbable that such damage could have been inflicted after purposeful burial. However, if a heavy visitor trod on this place while the specimen was in the process of being naturally buried, such damage might be expectable. There is still a slight chance, however, that such damage occurred after purposeful burial, but only if the individual had been buried in an extremely shallow grave.

Fifth, some of Kebara 2's condition is perfectly expectable, whether it had been purposefully buried or not. The right hand bones are more or less articulated, while those of the left are scattered about. The right hand bones were supported on the left ribs, while the left hand decomposed over the fleshy abdomen, resulting in the left hand bones scattering as the soft tissue decomposed.

Sixth, although some of Kebara 2's disarticulation would have been possible had it been purposefully buried, the cranium could have been displaced in only one of two ways. Either it was purposefully buried and then exhumed, as the excavators contend, or it was naturally displaced in the course of decomposition and natural burial. It is highly unlikely that the cranium's absence is due to scavenging. By the time the atlanto-occipital connection is severed, decomposition is well advanced, and it is unlikely that the remains would have been attractive. Once the soft tissue decomposed, and the connection between atlas and occipital were

severed, the cranium was free to roll or be kicked away. Crania are among the most mobile of hominid skeletal elements, especially those of the more recent, encephalized species (see e.g., Voorhies, 1969). Exposure during decomposition would parsimoniously explain the presence of the third upper molar with the Kebara 2 remains, even though the cranium is absent. For this tooth to have come free of the cranium, considerable time must have elapsed before the cranium was displaced—a minimum of a year in a dry environment, and probably longer if it did in fact mummify (McKeown & Bennett, 1995). While purposeful disinterment of the cranium cannot be ruled out, discoveries of isolated crania in many other MP contexts suggest that, at least at times, crania do get away from the rest of their body-mates. Finally, unless one is prepared to view the lower right limb's absence as evidence of a similar ritual, nothing should persuade us to think that the cranium's absence was anything other than an expectable taphonomic process. The damage to Kebara 2's right elbow region, disarticulation of the right humerus, and ''removal'' of the cranium could easily have occurred in a single disturbance episode, during natural burial, and need not be the result of postinterment ritual.

Seventh, last in Hill's sequence of disarticulation are the ribs and vertebrae (cf. Haglund, 1997). The joints of the spine and ribs are the last to decompose, because they are tightly bound together with a dense fabric of ligamentous soft tissue. Bar-Yosef *et al.* (1992) say this of the ribcage: ''There was no evidence for the collapse of the thoracic cavity after decomposition of the soft tissue.'' I take this to mean that the ribcage must have collapsed prior to decomposition of the soft tissue binding it to the spine. It is by no means clear why this stands as evidence for purposeful burial, and not gradual natural burial. Because the individual was lying on its back, the backbone and rib articulations would have lasted intrinsically longest and been buried earliest, with natural burial prolonging soft tissue decomposition (cf. Toots, 1965), leaving the shaft of the ribs to collapse without the proximal portions being displaced from their anatomical positions. By the time the soft connections were broken down, the ribs had already succumbed to breakage. That soft tissue connections can survive buried for a long time is exemplified by the natural mummies of the American Southwest. In extremely arid conditions mummified remains can survive with soft tissue adhering for thousands of years. Preserved skin and hair of the Spirit Cave mummy from Nevada, for example, are approximately 9415 radiocarbon years old (Tuohy & Dansie, 1996; Kirner *et al.*, 1997). And, while Kebara Cave was by no means as arid as the North American Great Basin when the hominid died, neither did the depositional circumstances require Kebara 2's soft tissue to preserve intact for 9000 years before it was naturally buried. Thus, to argue that the condition of the ribs is evidence for purposeful burial is to ignore good present-day models for how temperature and humidity can combine to retard decomposition and disarticulation.

Lastly, Bar-Yosef *et al.* (1992) use the position of the right hand to suggest that burial occurred prior to decomposition. Presumably they are arguing that bloating, which often accompanies decomposition, would have straightened the limb. But this ignores the variability inherent in the process of decomposition. Under cool conditions such bloating will not occur (Micozzi, 1997). In addition, cool conditions retard decomposition, allowing desiccation to prevail, which then ensures that the skeleton will stay intact for longer.

Characteristics of the sediments

The sediments that accumulated around the Kebara 2 specimen suggest that relatively

gradual sedimentation was occurring. During the Mousterian occupation of Kebara the predominant sediments are colluvial clay and aeolian sands and silts, with the addition of materials clearly of anthropogenic origin (i.e., lithic debris, faunal bone, and combusted plant fuel, Bar-Yosef *et al.*, 1992). Kebara's stratification presents a complex picture of allochthonous and autochthonous natural and anthropogenic sedimentation, postdepositional chemical alteration, karstic processes including sinkhole development and subsequent slumping, and significant bioturbation. Given the complexity of the cave's depositional history, and the erosional unconformity near which the remains were found, it is not possible to say with any certainty how rapidly the individual would have been covered. On the evidence of particle size and origin, relatively slow deposition was occurring in the cave at the time of Kebara 2's deposition. However, because the remains came to rest where deposition was relatively more rapid—i.e., in a localized sediment trap—they would have been more rapidly encased in sediments than if they had been exposed on a plane surface.

Summary

The excavators of Kebara 2 claim that a purposeful burial took place nearly 60,000 years ago in Kebara Cave (Bar-Yosef *et al.*, 1992). They argue for this based on the degree of articulation and the presence of a stratigraphically inferior erosional unconformity. They document a partially complete, partially articulated skeleton, the condition and stratigraphic context of which is amenable to explanation by other than purposeful burial. When first reporting the discovery, the excavators suggested that the corpse had been "protected" by wood, branches or skins until a process of skeletonization had been completed, at which time the cranium was removed (and presumably the right leg), and the remainder buried (Bar-Yosef *et al.*, 1988:20; cf. Villa, 1989:325, who also concludes that long exposure of Kebara 2 is indicated). It is not clear why Bar-Yosef *et al.* changed their minds four years later, and concluded that their "observations suggest that the body decomposed in a filled grave" (Bar-Yosef *et al.*, 1992:528), and that it was probably an "immediate inhumation" (Bar-Yosef *et al.*, 1992:529). One cannot, of course, rule out the possibility of Kebara having been a palaeo charnel-house, and that the remains were purposefully protected from some disturbance processes prior to purposeful burial. Neither can one rule out natural processes. The evidence is consistent with slow decomposition and natural burial.

Amud Cave

The original excavations of Amud Cave, Israel, recovered evidence for four Neandertal individuals. I previously argued (Gargett, 1989*a*) that Amud 1 (Suzuki & Takai, 1970) was recovered in unstratified sediments, near the wall of the cave. Therefore nothing about its discovery suggests that purposeful burial occurred, other than its degree of articulation, which I do not regard as evidence of anything other than special depositional circumstances. I will not therefore deal with the results of Suzuki and Takai's excavations again. Amud has now yielded three more hominids. One of these was Amud 7, a 10-month-old Neandertal (Rak *et al.*, 1994), discovered during the 1991–1992 field season. Amud 7 is a fragmentary, partial skeleton, with some elements still articulated. It is claimed to have been purposefully buried (Hovers *et al.*, 1995).

Amud 7 is described as follows:

> The specimen is an articulated skeleton of a 10-month-old infant, which was found lying on its right side directly on the bedrock in a small niche in the cave's north wall . . . The cranium is collapsed, and only the occipital, parietal, and temporal bones are present. . . .

> the face is badly damaged and cannot be reconstructed. Several upper teeth were retrieved when the sediment around the skeleton was sieved. The mandible, on the other hand, is relatively complete. Whereas the vertebral column and ribs are fairly well preserved, the long bones, the pelvis, the scapula, and the sternum are incomplete. The phalanges of the hands and feet were discovered in their proper anatomical position.
> (Rak *et al.*, 1994:314)

The authors argue that purposeful burial is indicated.

> In the highly dynamic environments of the Levantine caves during Mousterian times, hominid occupation commonly alternated with the activities of other animals, and the residues of both were often subjected to severe disturbance prior to further sediment deposition. Under such circumstances, the articulation of Middle Paleolithic hominid skeletons is the major criterion for their designation as intentional burials (Belfer-Cohen & Hovers, 1992). In the case of Amud 7, this claim is enhanced by the discovery of a red deer (*Cervus elephus*) maxilla leaning against the pelvis of the buried hominid.
> (Rak *et al.*, 1994:314)

The authors assume that the depositional environment at Amud would have meant disarticulation of an exposed carcass. Yet there is no good way of assessing the prior probability of disturbance, and it cannot simply be assumed. In spite of the excavators' assertions, the location and disposition of the Amud 7 skeleton provides clues as to why this individual was preserved better than some of the others recovered at the same site.

Protection of the corpse

The excavators found no burial pit or new stratum created when the corpse was deposited. There is thus no stratigraphic evidence of purposeful burial.

Grave offerings

Although the excavators assert that the deer maxilla resting on the pelvis of Amud 7 is a "burial gift" (Hovers *et al.*, 1995:52), there is no reason to accept the assertion. First, there is no clear evidence that this individual was intentionally buried. There is no evidence that such a discovery is unique or rare in the excavated sample. There is nothing to suggest that its preservation in an out-of-the-way place would be unexpected. Therefore, it is not logical to argue that the skeletal remains of one animal in proximity to those of a hominid are contemporaneous, much less a "burial gift" from a bereaved conspecific.

Completeness

A complete, articulated skeleton offers good evidence of a corpse protected from disturbance. However Amud 7 was not insulated from disturbance. It is incomplete. It lacks the frontal and facial bones. Moreover, the long bones, pelvis, scapula and sternum have portions missing. Given that the specimen is incomplete, one has to ask what became of the missing element and portions of elements. The excavators are not forthcoming with models to explain the missing parts, although they are quick to point out that carnivore disturbance is not indicated (Hovers *et al.*, 1995:52).

Decomposition and disarticulation

Hovers *et al.* (1995) and Rak *et al.* (1994) assert that articulation is good evidence for purposeful burial. However, parts of Amud 7 appear not to be articulated. The published stereo photograph (Rak *et al.*, 1994:316, Figure 2) clearly shows the state of the cranial elements *in situ*. First, the cranium is not, strictly speaking, articulated. Instead, it appears to be lying on the occipital condyles on the more or less horizontal bedrock. In other words, it has been rotated through 90° in the coronal plane. If indeed this individual had been placed on its right side and then buried, as the excavators

assert, its head should not be where it was found. That is, of course, unless the head was purposely twisted at right angles to the body while being prepared for burial. While it is impossible to rule out such an arcane burial scenario, based on the condition of the skeleton itself, the simpler explanation—that it was buried gradually in an out-of-the-way place—seems equally likely.

In addition to the evidence for extreme neck flexion, Amud 7's unfused cranial elements are not in any sense articulated. The occipital bone forms a bowl in which are deposited the left calotte elements. The left parietal and temporal, having been separated from the rest of the cranium, are resting almost vertically near the midline of the basicranium and occipital. The right temporal and parietal somehow escaped the lateral displacement experienced by the left, and instead, the fragments of the right temporal and parietal are lying near the right margin of the basicranial fragment, nested like fragments of a broken bowl. If this individual had been purposefully buried, one would have to postulate considerable microscale variability in the disturbance process, and differential distortion of the grave fill in the area of the cranium, to account for the different ways in which the left and right side calotte elements are positioned. Indeed, one would have to argue that two very different, dynamic subsurface disturbance processes had been at work within a scant few centimetres of one another to explain how the right cranial bones collapsed inside one another while the left ones remained more or less in their anatomical orientation, while being displaced several centimetres medially.

It is not necessary to postulate any highly unlikely permutations of postdepositional disturbance to explain the preservation and the location of this individual's skeletal elements—the cranial bones' orientation and fragmentation suggests simply that the breakage took place while the cranium was exposed. This is supported by the orientation of the cranium and mandible in relation to the rest of the skeleton. The unarticulated state of the cranium argues strongly for exposure prior to burial. It appears as if the head tipped on to its basicranium as the individual decomposed. There followed a gradual process of natural burial, which would have exposed the prominent cranium and other elements to damage.

Depositional circumstances

Amud 7's location in a natural niche in the cave wall would have given it a better than average chance at preservation—if only because trampling would have been virtually ruled out. In addition, the specimen's occurrence in a shallow cave, in a relatively arid area, means that its small body would have undergone rapid desiccation. Carnivores would then have been uninterested (Gifford, 1981). With respect to Amud 7's location in a natural niche, it would be impossible to rule out purposeful behaviour, regardless of whether or not it had been purposefully buried. On the other hand, it would be equally difficult to rule out the possibility that this was a chance combination of circumstances resulting in the specimen's excellent preservation.

Summary

Amud 7's excavators found no burial pit or new stratum created at the time of the skeleton's deposition. Taking into account the skeleton's location in a natural niche, the position of the various cranial bones, and the position of the skull and mandible, one cannot rule out the possibility that it was naturally buried.

Dederiyeh Cave

In 1993 a joint Syrian and Japanese expedition recovered the partially articulated, partial skeleton of a two-year-old Neandertal in

Dederiyeh Cave, about 400 km north of Damascus, northern Syria (Akazawa *et al.*, 1995*a*,*b*). The infant's remains were found near the back of the cave, about 1·5 m below the surface, "lying on its back with arms extended and legs flexed" (Akazawa *et al.*, 1995*b*:79) in what is reported as a burial pit. Infant skeletons are known to be extremely susceptible to destructive processes, and purposeful burial would be one possible explanation for the presence of well-preserved immature remains. At present there is very little published on the discovery, which makes critical appraisal of the depositional circumstances difficult. However, scholarly perception of the rarity of infant remains, and the care with which they were recovered would be enough to convince most palaeoanthropologists that they had been purposefully buried. However, in Akazawa *et al.*'s (1995*b*:79) account there are several observations on the depositional circumstances that suggest an alternative explanation.

Characteristics of the sediments

Examination of the cross-section of Dederiyeh Cave (Figure 7, top) reveals a 10 m by 15 m chimney at the back of the cave, open to the plateau above, which appears to be the apex of an enormous vault developing in the cave's ceiling. Beneath this chimney is an equally enormous talus cone that clearly resulted from ceiling breakdown, and must at times have included material falling or being flushed down from the plateau above. Beneath this chimney is where the infant's skeleton was found, in some sort of local low spot, depression, or pit. Whether one assumes purely autochthonous sedimentation prevailing at the time the infant was deposited, or some combination of allochthonous and autochthonous sedimentation, I would expect relatively rapid burial of anything coming to rest on the cone. Thus, relatively good preservation of even an infant's skeleton should be the expectation, rather than the exception.

Protection of the corpse

Akazawa *et al.* (1995*b*:79) refer to a burial pit, and observe that in "the mostly sterile fill of the burial pit, there was a sub-rectangular limestone slab above the head and a small triangular piece of flint where the infant's heart was located." However, Akazawa (1995) states that the pit does not conform to expectations for what a burial pit would look like, and is therefore unable to say whether or not it was dug for the purpose of burying the infant. As I suggested above, there are a number of ways that low spots can form in caves, and any low spot will tend to fill more or less rapidly. Thus, any vertebrate that found its way into such a depositional environment will have a better-than-average chance of survival.

There may be a clue to the depositional circumstances of the infant in Akazawa *et al.*'s (1995*b*:79) description of the pit fill as "mostly sterile." This implies either that the pit was dug into mostly sterile sediments, and that therefore its fill contained little evidence for hominid activity, or that the pit fill contrasts with the surrounding sediments in not containing traces of hominid behaviour. The latter seems more likely, given the often-noted difficulty of recognizing such features in cave sediments—if the fill contrasted with the sediments in which a low spot formed it would have made it easier to discern during excavation. And if the surrounding sediments included more evidence of hominid behaviour, this might suggest that the pit had been filled with mostly natural sediments in a process of natural burial. However, final interpretation must await publication of the individual's depositional context. At present, there is an incompletely warranted claim that the infant's remains were purposefully protected, and the remains themselves, which are more or less well-preserved.

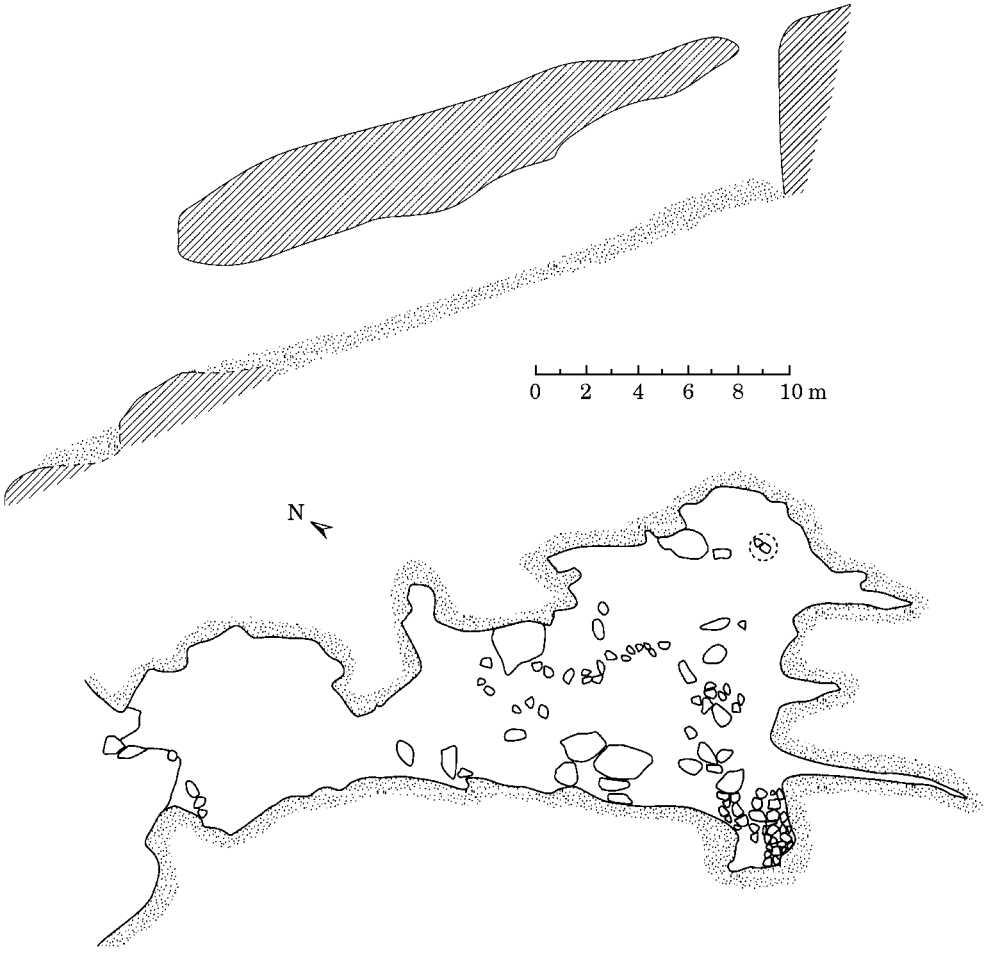
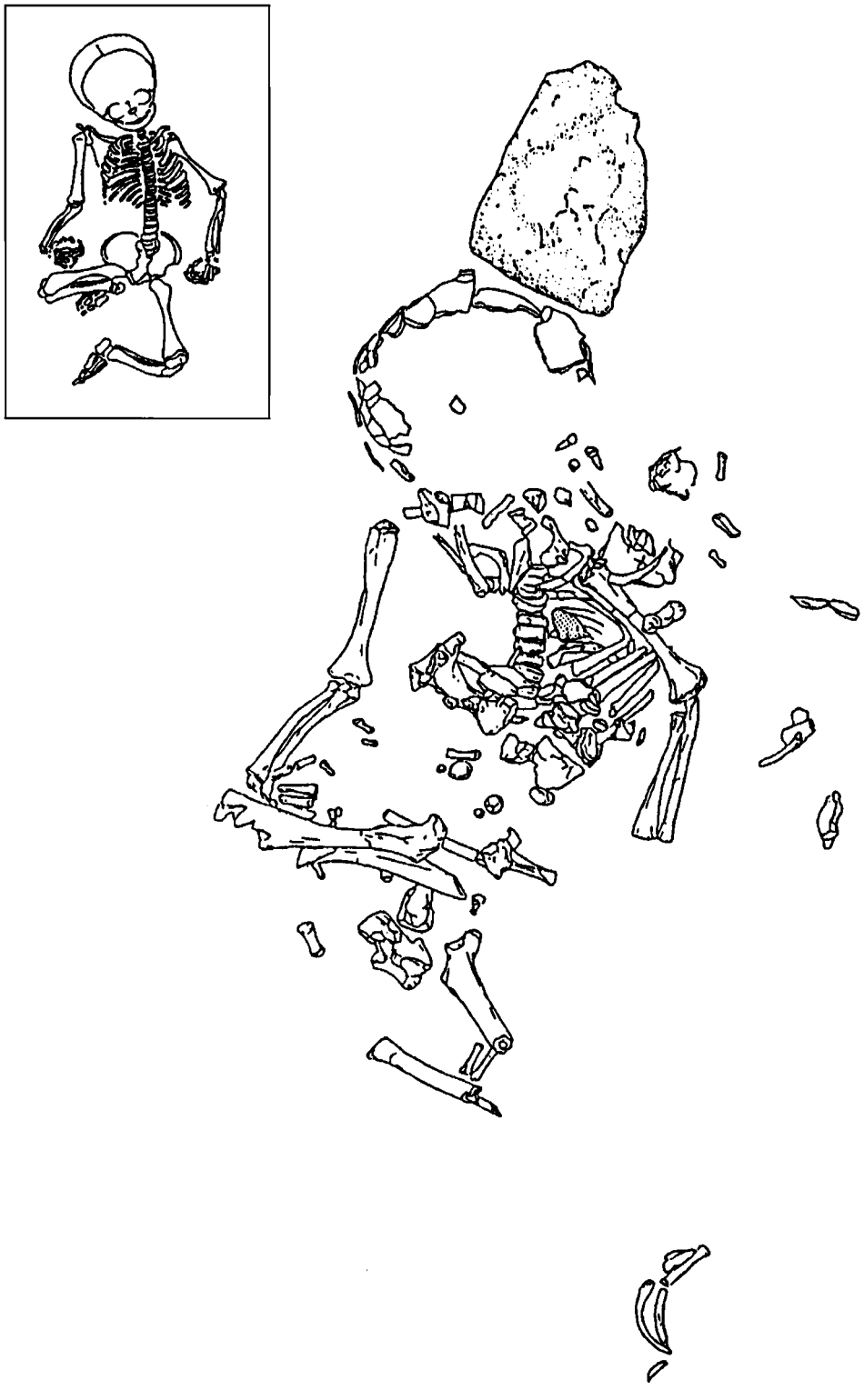


Figure 7. Dederiyeh Cave. Top: cross-section through cave and talus slope. Bottom: plan (after Akazawa *et al.*, 1995*b*:78–79, Figures 2 and 3). Hominid infant remains are shown on plan by a dashed circle. Note that the remains were recovered from the back of the cave, at the chimney's base, near the talus cone's apex. Reproduced with permission from *Paléorient* (1995) **21/2,** 77–86. Copyright retained by C.N.R.S., Paris.

Condition of preservation, decomposition and disarticulation

A plan drawing of the partially articulated, partial Dederiyeh infant *in situ* clearly demonstrates that a number of fragile elements were preserved, albeit fractured and fragmented (Figure 8). In general, immature vertebrate remains are quite fragile. If density-mediated destruction were the explanation for this skeleton's condition, one would expect the denser elements to have survived while the less dense, thinner, and smaller elements succumbed (Brain, 1967, 1969; Guthrie, 1967; Lyman, 1984). However, the catalogue of surviving elements reveals no clear relationship to density. For example, most of the spongy, fragile, innominate elements survived. Many of the facial bones did not. While not spongy, facial bones tend to be thin and therefore relatively fragile. They might be expected to be as susceptible to destruction


0
10
20
30
40
50 cm

as the innominate. The left clavicle, left ischium, the distal left femur, proximal and distal left fibula, and most of the small bones of the hands and feet did not survive, while their opposites did. The distal left tibia was damaged. Not so the right. Such differential preservation cannot be explained by differences in bone density—some very fragile bones survived, while some robust ones did not. Moreover, paired elements should be deleted simultaneously if affected by the same process. One must ask, for example, why all three right innominate elements were preserved, while only the left ilium and pubis survived. Indeed, none of the innominate parts should have survived given that a portion of the much denser left femur succumbed. The right clavicle survived. Why not the left? There does appear to have been some process differentially affecting the elements of the left side: i.e., the shoulder, hip, and lower limb. But what are the processes responsible?

Whether the Dederiyeh infant had been naturally or purposefully buried, it would be impossible to rule out bioturbation as an explanation for the skeletal part representation—these are relatively small skeletal elements, and most would be susceptible to displacement by burrowing rodents or root activity. Indeed, on the plan drawing it appears as if a number of elements have been separated from their anatomical neighbours, including several rib fragments that have been displaced by 40–50 cm. Alternatively, if rockfall was responsible for this individual's death, it is possible that burial was only partial, and that some of the individual's left side remained exposed, allowing differential decomposition. The exposed parts would have been more vulnerable to postdepositional destruction and displacement. On balance, it appears as if diagenesis of the sort in evidence at Kebara Cave can be ruled out, because some elements are absent from areas in which others have survived—the missing clavicle, for example. Thus, while the evidence of the skeleton's condition precludes density-mediated destruction and diagenesis, neither does it provide evidence for purposeful burial.

Position of the corpse

Although it is described as ''flexed'' the pose of this infant is anything but flexed in the way most would associate with flexed burial. In the excavators' interpretation of its original position (upper left of Figure 8) the right wrist is extremely flexed, while the right elbow is almost fully extended. The left wrist is extremely flexed, while the elbow is slightly flexed, about 45° (note that the plan drawing does not illustrate the left hand, while the excavators' interpretation does). The right femur appears to be abducted 90° to the spinal column, and the right tibia is parallel to the femur. The left femur is abducted about 45°, and the right knee is flexed about 120° (note that in the plan drawing, this angle is closer to 150°). Thus, in both the plan drawing and in the interpretation the skeleton's position looks more like that which one would expect if the infant had died in a fall, or had been caught in a rockfall, and not what one might expect to see in a purposeful burial. The flexion of the right wrist and leg more resembles the awkward positions of limbs that have been buckled as an individual collapsed, or were folded underneath by a fall. Given the position of its limbs at the time of burial, it is

Figure 8. Dederiyeh Cave. Infant remains *in situ*. Plan of excavated skeletal remains and interpretation of original position (inset) (after Akazawa *et al.*, 1995*b*:80, Figure 5). Note the contortion of the right wrist, and buckling of the right leg. Note also the displacement of rib fragments in lower portion of this view. Reproduced with permission from *Paléorient* (1995) **21/2,** 77–86. Copyright retained by C.N.R.S., Paris.

difficult to ignore this infant's location near the top of a cone of talus developing under a vault, with a chimney open to the plateau above. By itself, the skeleton's position is at best weak evidence for purposeful burial. On the other hand, it is better evidence of some sort of catastrophic event.

On the evidence of its location and its position, one can propose at least two alternative hypotheses to explain this infant's death and preservation: (1) rockfall, and (2) a fall down the chimney, followed by relatively rapid burial in falling sediments. A rockfall would not be out of the question, considering the way the cave has formed, and its location in a tectonically active region. One line of evidence in support of the rockfall scenario is reported by Akazawa *et al.* (1995*b*), when they state that mostly sterile sediments encased the infant. A dearth of artefactual material in the encasing sediments would be expected if the baby had died in a small rockfall. Moreover, whether the infant was killed instantly, by rockfall, or died after a fall down the chimney and was then buried by gradual, more or less rapid breakdown, some quantity of sediments without artefactual material should be expected.

Summary

On present evidence, the absence of a new stratum created at the time of burial, the infant's position, its location directly beneath an enormous vault and chimney, and the depositional regime that could be expected in a cave in a tectonically active area, all combine to make it impossible to rule out natural processes to explain this Neandertal's preservation.

Discussion

In this paper I have re-examined the context of a number of MP hominid specimens. Based on present knowledge of the range of natural processes known to form archaeological sites, I have offered alternative explanations for MP hominid traces claimed to have been purposefully buried. There is nothing unusual, or even especially creative in what I have done—subjecting hominid behavioural inferences to examination from a taphonomic perspective has become a commonplace in archaeological inquiry. There are a number of good examples: Brain's (1981) critique of Dart's inference of an australopithecine osteodontokeratic technology at Makapansgat (Dart, 1957*a*,*b*), Stiner's (1991) and White & Toth's (1991) alternative to inferences of ritual cannibalism at Grotta Guattari (Monte Circeo) (Blanc, 1958), Koby's (1941, 1953) and Kurtén's (1976) demystification of cave bear cults at the Drachenloch cave (Bächler, 1921). In all these cases, what were once widely accepted theories for the way pre-modern hominids behaved have been replaced by more parsimonious explanations that rely on an empirically derived specification of the range of processes capable of forming such archaeological traces.

In drawing their inferences, excavators of the claimed MP burials employed a similar kind of reasoning to the one I employ. The major difference in our approaches, and what underlies the differences in our explanations for the hominid remains, is the set of assumptions that underpin our interpretive models. Meticulous recovery techniques, exemplified by those of Kebara 2's excavators, and prompt publication of site descriptions have enabled me to undertake a taphonomic re-analysis, drawing on knowledge of a wider range of taphonomic processes than have heretofore been employed in interpreting these discoveries.

In assessing my claims, the reader should remember that the archaeological record contains inherent checks against unwarranted assumptions, whether mine or those of other workers. I have suggested that the archaeological record makes it difficult

to rule out natural burial of MP hominids. If, for example, my suggested alternatives were implausible, or just false, the excavators' observations could be used to counter my assertions. For example, if Kebara 2 was as fragmented and crushed as the Saint-Césaire specimen, I would be hard pressed to explain how it could have happened in a low-energy depositional environment, where any vertebrate would probably have been gradually buried in fine sediments. If, indeed, the Kebara skeleton were to have been more like that of Saint-Césaire's—i.e., crushed, fragmented, disarticulated, and vertically compressed—my suggestion of gradual, natural burial of Kebara 2 might legitimately be seen to stretch the limits of plausibility. Likewise, if Qafzeh 9 were partly disarticulated, and was missing portions of the skeleton, and did not bear evidence of having been crushed at or near the time of death, my suggestion that this individual was entombed in a rockfall would be seriously weakened. Thus, a nuanced appreciation of the processes contributing to preservation of vertebrate skeletons provides the basis for alternatives to the claims of purposeful burial. In sum, this re-examination allows me to draw two conclusions.

The evidence for MP burial

First, there is no direct evidence for purposeful burial in the MP. Neither the reports from La Chapelle-aux-Saints, La Ferrassie, Le Moustier, La Grotte du Régourdou, Shanidar, Teshik-Tash, Roc de Marsal, Kiik-Koba, La Quina, Amud (1), Tabun and Skhul (Gargett, 1989*a*,*b*), nor those I have examined in the present paper contain any direct evidence for purposeful burial. Direct evidence would take the form of an artificial stratum containing the remains, which was created at the time of interment, and which could be distinguished from naturally accumulating sediments by being distinct from those upon which or within which it occurs, and from those accumulating above it and the original surface (cf. Drucker, 1972:5; Harris, 1979:95). In the absence of direct evidence, purposeful burial has been inferred on the basis of weakly warranted assumptions. For example, the presence of hominid skeletal material in or near erosional unconformities has been used to argue that such depressions were created for the purpose of burying hominid corpses. However, I have argued that erosional unconformities can be created by many processes, most of which do not rely on a belief in an afterlife. In addition, proximity to erosional unconformities and low spots would help to preserve articulated hominid skeletal material.

Second, it is clear from pubished accounts of claimed MP burials that inferences of purposeful burial are based on assumptions about the way the archaeological record *must* have formed, often without recourse to the range of processes capable of forming sites. In particular, most of the arguments explicitly or implicitly hinge on the degree of articulation of skeletons and portions of skeletons. Archaeologists have assumed that skeletons would naturally decompose and become disarticulated, and on that basis they have felt justified in making claims of purposeful burial. However, there is no adequate warrant for the claim that articulated skeletons would not preserve naturally. Instead, with a more nuanced view of cave and rockshelter deposition, and the prior probability of preservation, it becomes clear that purposeful burial is not the only process capable of preserving articulated hominid remains in MP archaeological contexts. Thus, when examined from a taphonomic viewpoint, the archaeological contexts of all the claimed burials described in this paper and in Gargett (1989*a*) provide evidence of processes that are capable of naturally preserving articulated hominid skeletal material.

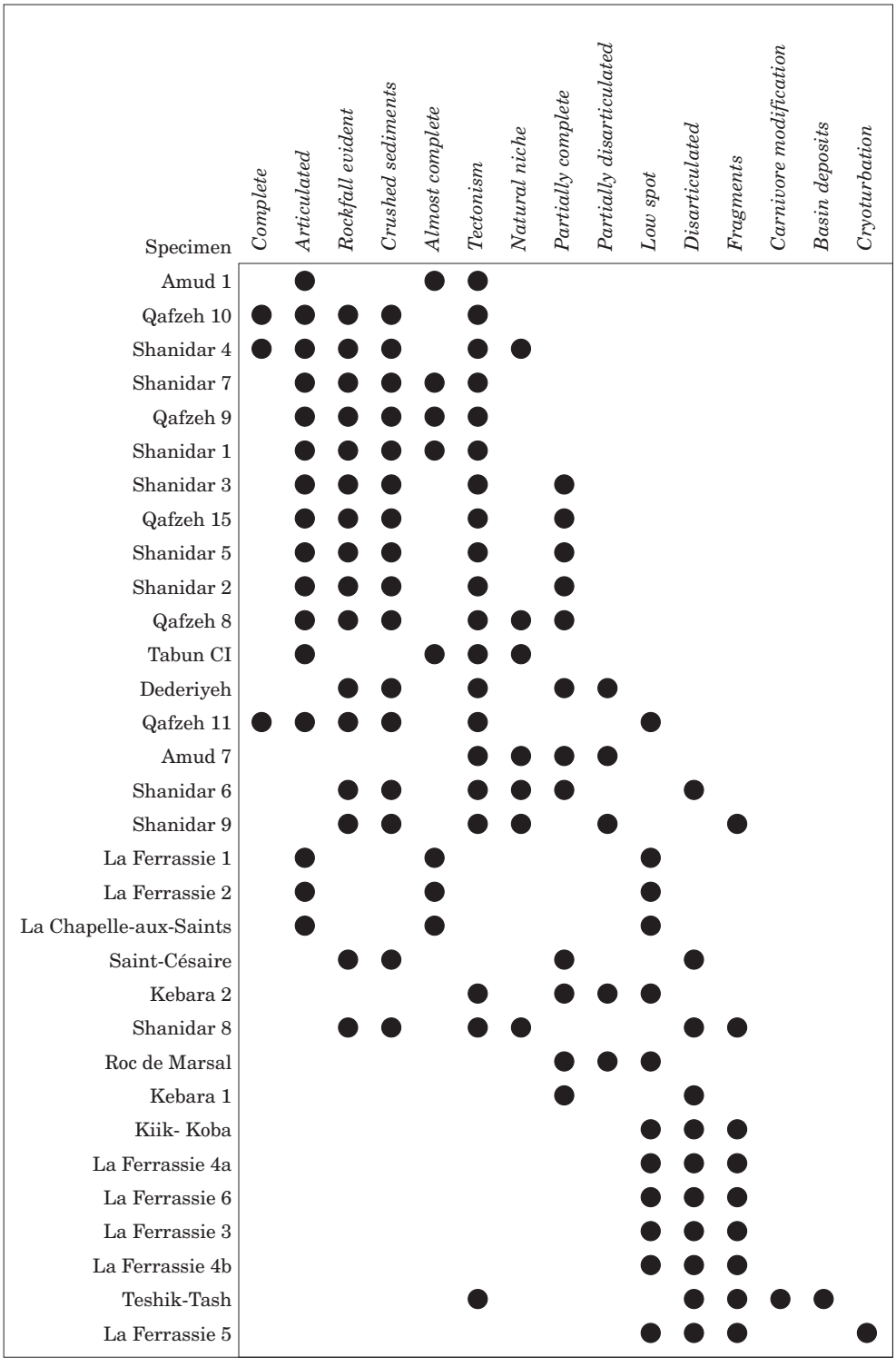


Figure 9. Seriation by correspondence analysis of depositional environment and state of preservation for 32 claimed MP burials. From left to right the data are ordered from complete to fragmentary, and from articulated to disarticulated. From top to bottom, the data are ordered from more rapid to more gradual depositional contexts.

What the evidence tells us

When the data on MP burial are looked at as a whole, one can see patterns that provide strong support for my proposed alternatives to purposeful burial. Figure 9 presents published data from 32 claimed burials. I have now dealt in detail with most of them (see also Gargett, 1989*a*). In general, I accept the observations of the excavators. However in some cases I have made inferences that are at variance with them, as follows. First, contrary to the excavators' descriptions, I observe that Amud 7 and Kebara 2 are only partially articulated. Second, I think that there is good evidence for the occurrence of rockfall at Qafzeh and Dederiyeh. Note that crushed sediments occur both where the excavators have observed rockfall (i.e., at Shanidar and Saint-Césaire), and at Qafzeh and Dederiyeh where there is no explicit recognition of it. Farrand (1985), remember, considers crushed sediments good proxy evidence for rockfall in the absence of other sedimentary clues. In that vein, at Qafzeh there are abundant crushed sediments, in the form of the several hominid remains, while at Dederiyeh, rockfall was inevitable beneath the chimney. The only other area in which I disagree with the observations of the excavators is in the category of erosional unconformities, which I have termed "low spots." Most are claimed to have been burial pits. La Ferrassie 1 and 2 were discovered in a low spot created by the wall of the shelter and the sloping surface on which they rested. Thus, with the few exceptions noted, the data presented in Figure 9 are consistent with the claims of the excavators.

Using *MV-Arch* (Wright, 1992), the data were subjected to a seriation by correspondence analysis, in which a parsimonious solution is achieved by grouping records with similar sets of attributes. A seriation by correspondence analysis provides a graphical representation of patterns in the data. It does not imply causal relationships, nor does it attach statistical significance to the outcome—it merely sorts like with like. Viewed along either axis of Figure 9, *MV-Arch* sorted the data along a continuum from complete to fragmentary, from articulated to disarticulated, and from (what I would consider) more rapid to more gradual deposition. The specimens fall roughly into two groups: (1) those that occur along with evidence for rockfall or tectonism, or both; (2) those that occur in low spots as I have defined them. Straddling this division are those specimens found in natural niches or similar protected locations. Half of those found in protected contexts occur in sites with evidence of rockfall; half where more gradual deposition was taking place.

It is immediately clear from Figure 9 that half of all the claimed burials are found in sedimentary contexts that, on the evidence, are consistent with rockfall (i.e., crushed sediments and skeletal material, as well as evidence of bedrock breakdown). The remainder are to be found in niches and low spots.

A striking correspondence exists between the better-preserved specimens and depositional environments that I and others have inferred to include rockfalls. From these come all three of the complete specimens, as well as a majority of almost complete (63%) and partial skeletons (58%). As one might expect, given knowledge that sudden bedrock breakdown will tend to preserve skeletal material intact, only 27% of the fragmentary specimens come from contexts with evidence of rockfall.

There is also correspondence between rockfall contexts and the degree of articulation. A majority of the articulated specimens (69%) are found in depositional environments bearing evidence of sudden bedrock breakdown, while 40% of the partly disarticulated and only 27% of the disarticulated specimens are to be found in such environments. Thus, in line with expectations, contexts containing evidence of

rapid deposition are more likely to be those where hominid skeletons are preserved more completely, and articulated.

The next clear pattern in these data is that the majority of the less well preserved specimens occur in natural niches or low spots. Natural niches can be expected to protect skeletal material somewhat from mechanical disturbance, and low spots act like sediment traps, which then experience a more rapid depositional rate than open areas. All of the natural niches in which MP hominids have been found occur in regions with active tectonism, and most co-occur with evidence for rockfall. Thus, the evidence for rapid deposition can explain the better preserved specimens. However some specimens in niches fared less well, most probably because they were more gradually buried (e.g., Amud 7).

What I have termed low spots are especially important to the discussion of purposeful burial, because at least some of these features are claimed to have been burial pits. However, one sees remarkably few well-preserved specimens in these contexts, a somewhat counterintuitive finding, if one assumes that purposeful burial should preserve hominid skeletons well. Figure 9 illustrates that in low spots one finds none of the complete specimens, and only a minority of almost complete (38%) and partially complete (17%) specimens. Looked at in another way, in low spots one finds the majority (67%) of fragmentary specimens and 75% of the less than fully articulated specimens. These data suggest that, in large measure, depositional rates are determining the state of preservation.

There are several clear inferences to be made from the data in Figure 9. The first of these I have said before—all of the so-called MP burials are found in special depositional circumstances that are capable of naturally preserving hominid skeletal material. Notwithstanding the problematic claims from Taramsa Hill, Egypt (Vermeersch *et al.*, 1998), there is not a single open-air context where purposeful burial is indicated, as there is from the early Upper Palaeolithic in Eastern Europe and from some of the earliest documented open-air sites in Australia.

The second inference to be drawn from Figure 9 is that there appears to be a negative correspondence between the length of time a corpse is exposed and the degree to which it is preserved complete and articulated. Rockfall, for example, is responsible for rapid deposition in caves and rockshelters. It is likely that even a small rockfall would be capable of killing and instantly burying a hominid, thus improving its chances of preserving as an articulated specimen. On the other hand, deposition in a natural niche, or in a low spot, would be more rapid than that occurring on more salient surfaces, but would nevertheless be slower than rockfall. Thus, low spots and natural niches would expose the remains to destructive processes for longer. Under those circumstances skeletal material in them would be less likely to preserve complete and articulated. Figure 9 bears witness that where more rapid deposition occurs, hominid skeletal material is much more likely to be complete and articulated, whereas in circumstances where natural burial would have been slower, the skeletal material tends to be more fragmentary and disarticulated.

The third major inference I draw from Figure 9 does not refer to the data presented there. Instead I call attention to the skeletal evidence for hundreds of MP hominids that are too fragmentary to be considered ''burials.'' I estimate that the number of fragmentary MP hominids exceeds that of claimed burials by at least 10 to 1. Furthermore, I estimate that the MP hominids that lived and died without leaving a trace would outnumber the so-called burials by several orders of magnitude more than 10 to 1. Thus, the vast number whose

remains did not survive were unlucky enough to die in places and at times when depositional circumstances did not contribute to their preservation, i.e., either in the areas of caves and rockshelters that were subjected to the greatest destructive processes, or out in the open, away from the protected environments of caves and rockshelters.

The role of meticulous excavation

This re-examination was motivated by the nearly universal belief that rigorous excavation techniques provide secure inferences of purposeful burial from Qafzeh, Kebara, La Roche à Pierrot, Amud and Dederiyeh. However, while rigorous excavation techniques are necessary to extract the maximum information from an archaeological site, they do not interpret the evidence, nor can they provide the models on which robust inferences depend. Rigorous excavation techniques can provide archaeologists with the sedimentary clues with which to construct a depositional history, but they cannot provide an assessment of the prior probability of preservation in a given depositional environment. Rigorous excavation techniques can recover plenty of penecontemporaneous evidence; however, they cannot provide excavators with knowledge of inherently variable processes with which to infer a taphonomic history. In the end, rigorous excavation techniques cannot rescue inferences of purposeful MP burial from unwarranted assumptions, nor save archaeologists from the consequences of choosing to ignore or downplay certain kinds of evidence, and seeing no value in others. I hope I have demonstrated that rigorous excavation techniques do nothing to help identify the kinds of evidence that can and do underpin satisfying alternative explanations. Finally, rigorous excavation techniques cannot adopt the practice of ruling out natural causes before invoking hominid behaviour to explain archaeological occurrences.

Fortunately, for the purposes of this re-examination, rigorous excavation techniques and their detailed publication do allow assessments of the kind presented here, illuminated by current understanding of site formation processes and taphonomy. The modern excavators have documented many more useful observations than was the case for La Chapelle-aux-Saints, La Ferrassie, Le Moustier, La Grotte du Régourdou, Shanidar and Teshik-Tash (Gargett, 1989*a*,*b*). The evidence recovered from Qafzeh, Kebara, La Roche à Pierrot, Amud and Dederiyeh is therefore much more useful than was the case for those earlier discoveries. However, it is still equivocal evidence for purposeful burial, and does not allow one to rule out natural processes.

Implications for the archaeology of modern human origins

After re-examining the evidence for purposeful burial at Qafzeh, Amud, Dederiyeh, Saint-Césaire and Kebara, I conclude that claims for purposeful burial in the MP rely too heavily on weakly warranted assumptions about how vertebrates are preserved in caves and rockshelters. My work fits in a larger framework of archaeological inquiry, fuelled by the suspicion that in the MP one may be dealing with hominids that were cognitively different from modern humans. In recent years, other claims for modern human behaviours among MP hominids have been called into question. Mousterian technology is not nearly so varied as was once thought (see e.g., Dibble, 1984; Barton, 1990; Rolland & Dibble, 1990). Levallois core and flake technology can no longer be assumed to provide evidence of a modern human mind (e.g., Noble & Davidson, 1996: Chapter 7). Notwithstanding strident claims to the contrary, so-called evidence for MP representation is rarely

unequivocal, and is often the result of natural processes that have simply been misinterpreted (see e.g., Chase & Dibble, 1987; Davidson, 1990; D'Errico & Villa, 1997; D'Errico *et al*., 1998). Neandertals hunted, but not in a way that modern humans do, until perhaps 55,000 years ago (Stiner, 1994), by which time there is some evidence that modern humans were already on the scene (Davidson & Noble, 1992; Brooks *et al*., 1995; Yellen, 1996). Spatial patterning of MP archaeological sites cannot be interpreted in the same way as that of modern human sites, because many animals, including cave bears, wolves, and hyenas are capable of creating behaviourally meaningful patterning. Thus, before one can argue that MP spatial patterning stands as evidence for culturally-mediated (and thus modern human) behaviour, archaeologists must first determine what kinds of spatial patterning are unequivocal evidence of modern human mental abilities (Gargett, 1996). The foregoing re-examination of claims for purposeful burial is therefore but a strand of a larger fabric of inquiry, one that calls into question a long-standing belief in the abilities of MP hominids.

I have not presented the foregoing arguments with the intention of "proving" that MP hominids were not burying their dead. Because even if one accepts my thesis that natural processes cannot be ruled out, there would still be no basis on which to argue that the Neandertals and their contemporaries were incapable of burying their dead. Nor would it be possible to say that they did not have thoughts similar to our own with respect to death. One cannot, after all, argue that absence of evidence is evidence of absence. MP hominids may have performed elaborate open-air rituals upon the death of a group member, and have normally left the corpse in a tree, or on a promontory. There is, for example, plenty of ethnographic evidence demonstrating that humans who leave a sparse and expedient archaeological record, like that inferred for the Middle Palaeolithic, nevertheless take part in a complex spiritual life, with artistic expression almost entirely restricted to body painting, and painting on other perishable media. Neandertals, on that model, may simply have chosen to make representational imagery on bark, skin, or in the sand, and not to paint or engrave rock outcrops or deep caves. However, archaeologists cannot be interested in what might have happened. What really matters in the debates about modern human origins is not a matter of speculation, it is a matter of dealing with the evidence as it exists. Thus, if one accepts the thesis that there is little unequivocal evidence for artistic representation or burial in the MP archaeological record, it provides the basis for scepticism that modern human behaviour began prior to about 40 to 60 ka ago. However it does not give one licence to infer that such behaviour did not exist prior to that time.

If, on the other hand, one chose to ignore the alternative explanations presented in this paper and continued to employ claims for burial and symbolic representation in arguments for an MP dawning of modern human behaviour, one would have to do so on shaky grounds. Moreover, one is left, under those circumstances, with a conundrum. In places and at times over the last 40 to 60 ka, humans have left traces that do not look so different from that of the MP. However, looked at globally, the archaeological record of the recent period looks different from that of the MP, and overall demonstrates great variability and flexibility. One can argue that paint wears off, and that caves painted 200 ka ago might today retain no traces of that activity. If that is the case, and evidence for MP engraving is so rare and contentious, one is left drawing conclusions about the cognitive abilities of MP hominid from other aspects of behaviour. Thus, with tenuous evidence for burial and symbolic representation in the MP, and with well-documented evidence for different MP procurement

strategies, and questions about the mental abilities required to produce MP stone tools, it remains an open question just why the archaeological record of the MP is so different in character from that of the Upper Palaeolithic and later, and why it stayed more or less static across vast distances, and through (according to conservative estimates) 200 ka.

Thus, one is left with purposeful burial as really the only behaviour that might demonstrate modern human thought processes (ignoring the leap required to get from purposeful burial to spirituality). In this paper I have argued that even the evidence for purposeful burial is equivocal. I would argue, therefore, that until archaeological understanding improves, and our observations of the depositional circumstances of hominid skeletal material is such that we can rule out natural processes, the existence of purposeful burial in the MP needs to be seen for what it is—an argument and not a fact. And until there is much better evidence that articulated hominid skeletal material could not preserve naturally in caves and rockshelters, MP burial will remain an argument based on insufficiently warranted assumptions.

Conclusion

Over the last 25 years, archaeologists have increasingly applied rigorous excavation techniques in early Upper Pleistocene sites containing evidence of human ancestry. This contrasts with a great many discoveries in the first half of the twentieth century. Recent publications include detailed sedimentological observations, adequate, if representative, illustrations of stratification, and more attention to the taphonomic history of these sites. This has resulted in a much richer set of data on the depositional circumstances of MP hominids. Given these improvements in our understanding of the MP archaeological record, one might have expected, *contra* Gargett (1989*a*), an avalanche of observations, construed as evidence, in arguments supporting claims of purposeful MP burial. Yet despite an increase in the quality and quantity of excavated material, arguments for purposeful MP burial have changed little since the earlier part of the century. For this reason they remain unsatisfactory, because they rely on the same premises as the earlier claims.

The arguments remain unconvincing for two reasons. First, they do not take into account current understanding of the range of processes that could naturally preserve articulated hominid remains. Second, even when archaeologists acknowledge the potential for natural processes to affect preservation, they do not acknowledge the variability inherent in those processes. Therefore, expectations of what went on in the past are limited to a narrow range of possibilities.

Good evidence may exist for purposeful MP burial. However, to date none has been recovered archaeologically. More often than not, claims rest on the unwarranted assumption that skeletal articulation would only occur if a corpse had been purposefully buried. Occasionally, these claims are supported by additional evidence, such as the presence of an inferred burial pit. But in this paper I have argued that even the observation of an erosional unconformity is insufficient to prop up the claim that purposeful burial had occurred.

I have proposed alternative explanations for the preservation of what are claimed to be purposeful MP burials. My alternatives are based on empirically grounded knowledge of inherently variable taphonomic and geomorphic processes that could easily have preserved hominid skeletal material. In the section on the taphonomy of hominid burial I described the special, natural depositional circumstances in which articulated skeletons might be expected to occur,

and provided evidence to support my contention that such depositional circumstances are in evidence in all cases of claimed MP burial.

In summary,

- The extraordinary occurrence of several individuals in the small space of Couche XVII at Qafzeh Cave can be explained without having to invoke hominid behaviour—the combination of friable bedrock and active tectonism would have led to episodic deposition of breakdown rubble in large and small quantities, and thus would have contributed to the hominid skeletons' preservation.
- The Saint-Césaire hominid's highly fragmented and fragmentary remains suggest prolonged exposure in a destructive depositional environment. Indeed, at La Roche à Pierrot there is abundant evidence of rockfall.
- Kebara 2's incompleteness and less than perfect articulation argues for natural incorporation in the sediments, despite claims that there was a "burial pit" to protect the corpse. Moreover, the "pit" may even have begun to fill in before the skeleton was deposited, which argues for gradual burial in a naturally filling depression.
- The natural niche in which the Amud infant came to rest would have meant a better than average chance of preservation, and its condition bears evidence that it had been buried gradually.
- The Dederiyeh infant was discovered in a depression of unknown origin, at the top of an enormous talus cone beneath a chimney. Such a depositional environment can easily explain both the tortured pose for the little skeleton, and preservation of the infant's delicate bones. On present evidence it is as difficult to argue in favour of burial as it is to argue against it.

Together with the results of a previous study (Gargett, 1989*a*) the present analysis brings the matter of MP burial up to date. However, together, these two papers cannot settle the question of whether or not MP hominids buried their dead. Rather, they underscore the need for archaeologists to acknowledge the ambiguity inherent in the traces they recover, and to refine their ability to distinguish between naturally and purposefully buried hominid remains.

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References

Akazawa, T. (1995). The Dederiyeh Neanderthal resuscitation project. In (T. Akazawa, Ed.) *Dederiyeh: Neanderthals and Modern Humans*, pp. 4–5. Tokyo: The University Museum, University of Tokyo.

Akazawa, T., Dodo, Y., Huhesen, S., Abdul-Salam, A., Abe, Y., Kondo, O. & Mizoguchi, Y. (1993). The Neanderthal remains from Dederiyeh Cave, Syria: interim report. *Anthrop. Sci.* **101,** 361–387.

Akazawa, T., Muhesen, S., Dodo, Y., Kondo, O. & Mizoguchi, U. (1995*a*). Neanderthal infant burial. *Nature* **377,** 585–586.

Akazawa, T., Muhesen, S., Dodo, Y., Kondo, O., Mizoguchi, Y., Abe, Y., Nishiaki, Y., Ohta, S., Oguchi, T. & Haydal, J. (1995*b*). Neanderthal infant burial from the Dederiyeh Cave in Syria. *Paléorient* **21/2,** 77–86.

ApSimon, A. M. (1980). The last Neanderthal in France? *Nature* **287,** 271–272.

Arensburg, B., Bar-Yosef, O., Chech, M., Goldberg, P., Laville, H., Meignen, L., Rak, Y., Tchernov, E., Tiller, A. M. & Vandermeersch, B. (1985). Une sépulture néandertalienne dans la grotte de Kébara (Israel). *C.r. Acad. Sci. Paris* **300,** 227–230.

Bächler, E. (1921). Das Drachenloch bei Vättis im Tamintal. *Jahr. St. Gallischen Naturwiss. Ges.* **57(1)**.

Backer, A. M. (1993). Spatial distributions at La Roche à Pierrot, Saint-Césaire: changing uses of a rockshelter. In (F. Lévêque, A. M. Backer & M. Guilbaud, Eds) *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptations at Saint-Césaire, Charente-Maritime, France*, pp. 105–127. Madison, WI: Prehistory Press.

Bahn, P. G. (1996). Treasure of the Sierra Atapuerca: a mountain range in northern Spain yields a cornucopia of human remains, including the world's oldest known burials. *Archaeology* **49,** 45.

Bar-Yosef, O. (1988). Evidence for Middle Palaeolithic symbolic behaviour: a cautionary note. In (M. Otte, Ed.) *L'Homme de Néandertal: Actes du Colloque International de Liège (4–7 Décembre 1986), 5 (La Pensée)*, pp. 11–16. Liège: Etudes et Recherches Archéologiques de l'Univérsité de Liège.

Bar-Yosef, O., Laville, H., Meignen, L., Tillier, A. M., Vandermeersch, B., Arensburg, B., Belfer-Cohen, A., Goldberg, P., Rak, Y. & Tchernov, E. (1988). La sépulture néanderthalienne de Kébara (unité XII). In (M. Otte, Ed.) *L'Homme de Néandertal: Actes du Colloque International de Liège (4–7 Décembre 1986), 5 (La Pensée)*, pp. 17–24. Liège: Etudes et Recherches Archéologiques de l'Univérsité de Liège.

Bar-Yosef, O. & Meignen, L. (1992). Insights into Levantine Middle Paleolithic cultural variability. In (H. Dibble & P. Mellars, Eds) *The Middle Paleolithic: Adaptation, Behavior, and Variability*, pp. 163–182. Philadelphia: University Museum, University of Pennsylvania.

Bar-Yosef, O., Vandermeersch, B., Arensburg, B., Belfer-Cohen, A., Goldberg, P., Laville, H., Meignen, L., Rak, Y., Speth, J. D., Tchernov, E., Tillier, A.-M. & Weiner, S. (1992). The excavations in Kebara Cave, Mt Carmel. *Curr. Anthrop.* **33,** 497–550.

Bar-Yosef, O., Vandermeersch, B., Arensburg, B., Goldberg, P., Laville, H., Meignen, L., Rak, Y., Tchernov, E. & Tillier, A.-M. (1986). New data on the origin of modern man in the Levant. *Curr. Anthrop.* **27,** 63–64.

Barton, C. M. (1990). Beyond style and function: a view from the Middle Paleolithic. *Am. Anthrop.* **92,** 57–72.

Belfer-Cohen, A. & Hovers, E. (1992). In the eye of the beholder: Mousterian and Natufian burials in the Levant. *Curr. Anthrop.* **33,** 463–471.

Bergounioux, F. M. (1958). Spiritualité de l'homme de Néandertal. In (G. H. R. von Koenigswald, Ed.) *Hundert Jahre Neanderthaler (Neanderthal Centenary)*, pp. 151–166. New York: Wenner-Gren Foundation.

Binford, L. R. (1981). *Bones: Ancient Men and Modern Myths*. New York: Academic Press.

Binford, L. R. (1985). Human ancestors: changing views of their behavior. *J. Anthrop. Archaeol.* **4,** 292–327.

Binford, L. R. & Ho, C. K. (1985). Taphonomy at a distance: Zhoukoudian, "the cave home of Beijing man"? *Curr. Anthrop.* **26,** 413–442.

Binford, S. R. (1968). A structural comparison of disposal of the dead in the Mousterian and Upper Paleolithic. *Southwest. J. Anthrop.* **24,** 139–151.

Blanc, A. C. (1958). Torre in Pietra, Saccopastore, Monte Circeo: on the position of the Mousterian in the Pleistocene sequence of the Rome area. In (G. H. R. von Koenigswald, Ed.) *Hundert Jahre Neanderthaler (Neanderthal Centenary)*, pp. 167–174. New York: Wenner-Gren Foundation.

Bonch-Osmolovskij, G. A. (1940). *Grot Kiik-Koba* (in Russian). Moscow: Paleolit Kryma.

Bonifay, E. (1962). Un ensemble rituel moustérien à la grotte de Régourdou (Montignac, Dordogne). In *Proceedings of the 6th International Congress of Prehistoric and Protohistoric Sciences*, pp. 136–140. Rome: ICPPS.

Bonifay, E. (1964). La grotte du Régourdou (Montignac, Dordogne): stratigraphie et industrie lithique moustérienne. *Anthropologie, Paris* **68,** 49–64.

Bonifay, E. & Vandermeersch, B. (1962). Dépôts rituels d'ossements d'ours dans le gisement Moustérien du Régourdou (Montignac, Dordogne). *C.r. Acad. Sci. Paris* **D:255,** 1635–1636.

Bordes, F. & Lafille, J. (1962). Découverte d'un squelette d'enfant moustérien dans le gisement du Roc de Marsal, commune de Campagne-du-Bugue (Dordogne). *C.r. Séanc. Acad. Sci. Paris* **D:254,** 714–715.

Boule, M. (1909). L'homme fossile de la Chapelle-aux-Saints (Corrèze). *Anthropologie, Paris* **20,** 257–271.

Bouyssonie, A., Bouyssonie, J. & Bardon, L. (1908). Découverte d'un squelette humain moustérien à la Bouffia de la Chapelle-aux-Saints (Corrèze). *Anthropologie, Paris* **19,** 513–518.

Bouyssonie, A., Bouyssonie, J. & Bardon, L. (1913). La station moustérienne de la "Bouffia" Bonneval, à la Chapelle-aux-Saints. *Anthropologie, Paris* **24,** 609–634.

Bouyssonie, J. (1954). Les sépultures moustériennes. *Quaternaria* **1,** 107–115.

Brain, C. K. (1967). Hottentot food remains and their bearing on the interpretation of fossil bone assemblages. *Scientific Papers of the Namib Desert Research Station* **32,** 1–7.

Brain, C. K. (1969). The contribution of Namib Desert Hottentots to an understanding of australopithecine bone accumulations. *Scientific Papers of the Namib Desert Research Station* **39,** 13–22.

Brain, C. K. (1981). *The Hunters or the Hunted? An Introduction to African Cave Taphonomy*. Chicago: University of Chicago Press.

Bricker, H. (1989). Comment on "Grave shortcomings: the evidence for Neandertal burial," by R. H. Gargett. *Curr. Anthrop.* **30,** 177–178.

Brooks, A., Helgren, D. M., Cramer, J. S., Franklin, A., Hornyak, W., Keating, J. M., Klein, R. G., Rink, W. J., Schwarcz, H., Smith, J. N. L., Stewart, K., Todd, N., Verniers, J. & Yellen, J. E. (1995). Dating and context of three middle Stone Age sites with bone points in the upper Semliki Valley, Zaire. *Science* **268,** 548–553.

Capitan, L. & Peyrony, D. (1909). Deux squelettes humains au milieu de foyers de l'époque moustérienne. *Revue de l'Ecole d'Anthropologie* **19,** 402–409.

Capitan, L. & Peyrony, D. (1910). Deux squelettes humains au milieu de foyers de l'epoque moustérienne. *Bull. Soc. Anthrop. Paris* **1,** 48–53.

Capitan, L. & Peyrony, D. (1911). Un nouveau squelette humain fossile. *Rev. Préhist.* **6,** 129–132.

Capitan, L. & Peyrony, D. (1912*a*). Station préhistorique de la Ferrassie. *Rev. Anthrop.* **22,** 29–50, 76–99.

Capitan, L. & Peyrony, D. (1912*b*). Trois nouveaux squelettes humains fossiles. *Rev. Anthrop.* **22,** 439–442.

Capitan, L. & Peyrony, D. (1921). Découverte d'un sixième squelette moustérien à La Ferrassie (Dordogne). *Rev. Anthrop.* **31,** 382–388.

Chase, P. G. & Dibble, H. (1987). Middle Paleolithic symbolism. *J. Anthrop. Archaeol.* **6,** 263–296.

Courty, M. A., Goldberg, P. & Macphail, R. (1989). *Soils and Micromorphology in Archaeology*. Sydney: Cambridge University Press.

Dart, R. (1957*a*). *The Makapansgat Australopithecine Osteodontokeratic Culture*. Livingston: Chatto & Windus.

Dart, R. (1957*b*. *The Osteodontokeratic Culture of* Australopithecus promethus. Transvaal Museum Memoirs, No. 10. Pretoria: Transvaal Museum.

Davidson, I. (1990). Bilzingsleben and early marking. *Rock Art Res.* **7,** 52–56.

Davidson, I. & Noble, W. (1989). The archaeology of perception: traces of depiction and language. *Curr. Anthrop.* **30,** 125–155.

Davidson, I. & Noble, W. (1992). Why the first colonisation of the Australian region is the earliest evidence of modern human behaviour. *Archaeol. Ocean.* **27,** 113–119.

Defleur, A. (1993). *Les Sépultures Moustériennes*. Paris: C.N.R.S.

D'Errico, F. & Villa, P. (1997). Holes and grooves: the contribution of microscopy and taphonomy to the problem of art origins. *J. hum. Evol.* **33,** 1–31.

D'Errico, F., Villa, P., Pintollona, A. C. & Idarraga, R. R. (1998). A Middle Palaeolithic origin of music—using cave-bear bone accumulations to assess the Divje Babe 1 bone flute (Neandertal). *Antiquity* **72,** 65–79.

Dettwyler, K. A. (1991). Can Paleopathology provide evidence for "compassion"? *Am. J. phys. Anthrop.* **84,** 375–384.

Dibble, H. L. (1984). Interpreting typological variation of Middle Paleolithic scrapers: function, style, or sequence of reduction? *J. field Archaeol.* **11,** 431–436.

Dreybrodt, W. (1988). *Processes in Karst Systems: Physics, Chemistry, and Geology*. New York: Springer-Verlag.

Drucker, P. (1972). *Stratigraphy in Archaeology: An Introduction*. New York: Addison-Wesley.

Duff, A. I., Clark, G. A. & Chadderdon, T. J. (1992). Symbolism in the Early Palaeolithic: a conceptual odyssey. *Cambridge Archaeological Journal* **2,** 211–229.

Evans, G. L. (1961). The Friesenhahn Cave. *Bull. Tex. Mem. Mus.* **2,** 1–22.

Farizy, C. & Masset, C. (1989). Comment on ''Grave shortcomings: the evidence for Neandertal burial'' by R. H. Gargett. *Curr. Anthrop.* **30,** 179–180.

Farrand, W. R. (1985). Rockshelter and cave sediments. In (J. K. Stein & W. R. Farrand, Eds) *Archaeological Sediments in Context*, pp. 21–39. Orono, ME: Center for the Study of Early Man.

Ford, T. D. (1976). The geology of caves. In (T. D. Ford & C. H. D. Cullingford, Eds) *The Science of Speleology*, pp. 11–60. New York: Academic Press.

Frayer, D. & Montet-White, A. (1989). Comment on ''Grave shortcomings: the evidence for Neandertal burial'' by R. H. Gargett. *Curr. Anthrop.* **30,** 180–181.

Galloway, A. (1989). Decay rates of human remains in an arid environment. *J. forens. Sci.* **34,** 607–616.

Gamble, C. (1989). Comment on ''Grave shortcomings: the evidence for Neandertal burial'' by R. H. Gargett. *Curr. Anthrop.* **30,** 181–182.

Gamble, C. (1993). *Timewalkers: Prehistory of Global Colonization*. Stroud: Alan Sutton.

Gargett, R. H. (1989*a*). Grave shortcomings: the evidence for Neandertal burial. *Curr. Anthrop.* **30,** 157–190.

Gargett, R. H. (1989*b*). Reply to comments on ''Grave shortcomings: the evidence for Neandertal burial''. *Curr. Anthrop.* **30,** 326–329.

Gargett, R. H. (1996). *Cave Bears and Modern Human Origins: The Spatial Taphonomy of Pod Hradem Cave, Czech Republic*. Lanham, MD: University Press of America.

Garrard, A. (1992). Comment on ''The excavations in Kebara Cave, Mt. Carmel,'' by O. Bar-Yosef *et al*. *Curr. Anthrop.* **33,** 535.

Garrod, D. A. E. & Bate, D. M. A. (1937). *The Stone Age of Mount Carmel, Vol. I: Excavations at the Wady El-Mughara*. Oxford: Clarendon Press.

Gifford, D. P. (1981). Taphonomy and paleoecology: a critical review of archaeology's sister disciplines. In (M. B. Schiffer, Ed.) *Advances in Archaeological Method and Theory, Volume 4*, pp. 365–438. New York: Academic Press.

Gifford-Gonzalez, D. (1991). Bones are not enough: analogues, knowledge, and interpretive strategies in zooarchaeology. *J. anthrop. Archaeol.* **10,** 215–254.

Gifford-Gonzalez, D. P. (1989). Modern analogues: developing an interpretive framework. In (R. Bonnichson & M. Sorg, Eds) *Bone Modification*, pp. 43–52. Orono, ME: University of Maine, Center for the Study of the First Americans.

Gilman, A. (1989). Comment on ''Grave shortcomings: the evidence for Neandertal burial,'' by R. H. Gargett. *Curr. Anthrop.* **30,** 182.

Gore, R. (1996). Neandertals. *Nat. Geog.* **189,** 2–35.

Gould, R. A. (1977). *Puntutjarpa Rockshelter and the Australian Desert Culture*. New York: American Museum of Natural History.

Guthrie, R. D. (1967). Differential preservation and recovery of Pleistocene large mammal remains in Alaska. *J. Paleont.* **41,** 243–246.

Haglund, W. D. (1997). Dogs and coyotes: Postmortem involvement with human remains. In (W. D. Haglund & M. H. Sorg, Eds) *Forensic Taphonomy: The Postmortem Fate of Human Remains*, pp. 367–381. Boca Raton, FL: CRC Press.

Harris, E. C. (1979). *Principles of Archaeological Stratigraphy*. London: Academic Press.

Harrold, F. B. (1980). A comparative analysis of Eurasian Paleolithic burials. *World Archaeol.* **12,** 195–211.

Hayden, B. (1979). *Palaeolithic Reflections: Lithic Technology and Ethnographic Excavation among Australian Aborigines*. Canberra: Australian Institute of Aboriginal Studies.

Hayden, B. (1993). The cultural capacities of Neandertals: a review and re-evaluation. *J. hum. Evol.* **24,** 113–146.

Haynes, G. (1982). Utilization and skeletal disturbances of North American prey carcasses. *Arctic* **35,** 266–281.

Haynes, G. (1990). Taphonomy: science and folklore. In (S. Solomon, I. Davidson & D. Watson, Eds) *Problem Solving in Taphonomy*, pp. 7–17. St Lucia: University of Queensland, Anthropology Museum.

Heim, J.-L. (1968). Les restes nèandertaliens de La Ferrassie: nouvelles donnèes sur la stratigraphie et inventaire des squelettes. *C.r. Acad. Sci. Paris* **D:266,** 576–578.

Hill, A. (1979). Butchery and natural disarticulation: an investigatory technique. *Am. Antiq.* **44,** 739–744.

Hill, A. & Behrensmeyer, A. K. (1984). Disarticulation patterns of some modern East African mammals. *Paleobiology* **10,** 366–376.

Hovers, E., Rak, Y., Lavi, R. & Kimbel, W. H. (1995). Hominid remains from Amud Cave in the context of the Levantine Middle Paleolithic. *Paléorient* **21/2,** 47–61.

Jennings, J. N. (1985). *Karst Geomorphology*. Oxford: Blackwell.

Kerbis-Peterhans, J. C. (1990). The roles of porcupines, leopards and hyenas in ungulate carcass dispersal: implications for paleoanthropology. Ph.D. Dissertation, University of Chicago.

Kirner, D. L., Burky, R. & Southon, J. R. (1997). Dating the Spirit Cave mummy: the value of reexamination. *Nevada Hist. Soc. Quart.* **40,** 54.

Klein, R. G. (1996). The Mousterian of European Russia. Ph.D. Dissertation, University of Chicago.

Klein, R. G. (1994). The problem of modern human origins. In (M. H. Nitecki & D. V. Netecki, Eds) *Origins of Anatomically Modern Humans*, pp. 3–17. New York: Plenum Press.

Koby, F. E. (1941). Le ''Charriage à sec'' des ossements dans les cavernes. *Ed. geol. Helv.* **34,** 319–320.

Koby, F. E. (1953). Les paléolithiques ont-ils chassé l'ours des cavernes? *Act. Soc. jurass. Émul.* **57,** 157–204.

Kurtén, B. (1976). *The Cave Bear Story*. New York: Columbia University Press.

Lam, Y. M. (1992). Variability in the behaviour of spotted hyaenas as taphonomic agents. *J. archaeol. Sci.* **19,** 389–406.

Leroi-Gourhan, A. (1975). The flowers found with Shanidar IV, a Neandertal burial in Iraq. *Science* **190,** 562–564.

Lévêque, F., Backer, A. M. & Guilbaud, M. (Eds) (1993). *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptations at Saint-Césaire, Charente-Maritime, France*. Madison, WI: Prehistory Press.

Lévêque, F. & Vandermeersch, B. (1980). Découverte de restes humains dans un niveau Castelperronien a Saint-Césaire, Charente-Maritime. *C.r. Acad. Sci. Paris* **D:291,** 187–189.

Lieberman, D. E. & Shea, J. J. (1994). Behavioral differences between Archaic and modern humans in the Levantine Mousterian. *Am. Anthrop.* **96,** 300–332.

Lindly, J. M. & Clark, G. A. (1990). Symbolism and modern human origins. *Curr. Anthrop.* **31,** 233–261.

Lyman, R. L. (1984). Bone density and differential survivorship of fossil classes. *J. anthrop. Archaeol.* **3,** 259–299.

Marean, C. W. & Ehrhardt, C. L. (1995). Paleoanthropological and paleoecological implications of the taphonomy of a sabertooth's den. *J. hum. Evol.* **29,** 515–547.

Marshack, A. (1989). Evolution of the human capacity: the symbolic evidence. *Yearb. phys. Anthrop.* **32,** 1–34.

Martin, H. (1923). *L'homme Fossile de La Quina*. Paris: Octave Doin.

McBrearty, S. (1990). The origin of modern humans. *Man (N.S.)* **25,** 129–143.

McKeown, A. M. & Bennett, J. L. (1995). A preliminary investigation of postmortem tooth loss. *J. forens. Sci.* **40,** 755–757.

Mellars, P. (1989). Major issues in the emergence of modern humans. *Curr. Anthrop.* **30,** 349–385.

Mellars, P. (1995). *The Neanderthal Legacy: An Archaeological Perspective from Western Europe*. Princeton, NJ: Princeton University Press.

Mercier, N., Valladas, H., Joron, J. L., Reyss, J. L., Leveque, F. & Vandermeersch, B. (1991). Thermoluminescence dating of the Late Neanderthal remains from Saint-Césaire. *Nature* **351,** 737–739.

Micozzi, M. S. (1986). Experimental study of postmortem change under field conditions: effects of freezing, thawing, and mechanical injury. *J. forens. Sci.* **31,** 953–961.

Micozzi, M. S. (1997). Frozen environments and soft tissue preservation. In (W. D. Haglund & M. H. Sorg, Eds) *Forensic Taphonomy: The Postmortem Fate of Human Remains*, pp. 171–180. Boca Raton, FL: CRC Press.

Miskovsky, J.-C. & Lévêque, F. (1993). The sediments and stratigraphy of Saint-Césaire: contributions to the paleoclimatology of the site. In (F. Lévêque, A. M. Backer & M. Guilbaud, Eds) *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptations at Saint-Césaire, Charente-Maritime, France*, pp. 9–14. Madison, WI: Prehistory Press.

Mithen, S. (1995). Palaeolithic archaeology and the evolution of mind. *J. archaeol. Res.* **3,** 305–332.

Mithen, S. (1996). *The Prehistory of the Mind: A Search for the Origins of Art, Religion and Science*. London: Thames & Hudson.

Movius, H. L. (1953). Mousterian cave of Teshik-Tash, southeastern Uzbekistan, Central Asia. *Bull. Am. Sch. prehist. Res.* **17,** 11–71.

Newell, R. (1984). The archaeological, human biological, and comparative contexts of a catastrophically-terminated Kataligaaq house at Utqiagvik, Alaska (BAR-2). *Arctic Anthrop.* **21,** 5–51.

Noble, W. & Davidson, I. (1989). Reply to comments on "The archaeology of perception: traces of depiction and language," by I. Davidson and W. Noble. *Curr. Anthrop.* **30,** 337–340.

Noble, W. & Davidson, I. (1991). The evolutionary emergence of modern human behaviour: language and its archaeology. *Man (N.S.)* **26,** 602–632.

Noble, W. & Davidson, I. (1993). Tracing the emergence of modern human behavior: methodological pitfalls and a theoretical path. *J. anthrop. Archaeol.* **12,** 121–149.

Noble, W. & Davidson, I. (1996). *Human Evolution, Language and Mind: A Psychological and Archaeological Inquiry*. Melbourne: Cambridge University Press.

Okladnikov, A. (1949). Issledovanie musterskoi stoianki i pogrebeniia neandertaltsa va grotet Teshik-Tash, iuzhnyi Uzbekistan (Sredniaia Aziia) [Investigation of the Mousterian site and burial of a Neanderthal in the cave of Teshik-Tash, Southern Uzbekistan (Central Asia). In *Teshik-Tash: Paleoliiticheskii chelovek [Teshik-Tash: Palaeolithic Man]*, pp. 7–85. Moscow: Trudy Nauchno-Issledovatelskogo Instituta Antropologii.

Peyrony, D. (1921). Les moustériens inhumaient-ils leur morts? *Bull. Soc. Hist. Archaeol. Périgord,* 132–139.

Peyrony, D. (1930). Le Moustier: ses gisements, ses industries, ses couches géologiques. *Rev. anthrop.* **40,** 48–76, 155–176.

Peyrony, D. (1934). La Ferrassie: Moustérien, Périgordien, Aurignacien. *Préhistoire* **3,** 1–92.

Rak, Y., Kimbel, W. H. & Hovers, E. (1994). A Neandertal infant from Amud Cave, Israel. *J. hum. Evol.* **26,** 313–324.

Roe, D. (1992). Comment on "The excavations in Kebara Cave, Mt. Carmel," by O. Bar-Yosef *et al. Curr. Anthrop.* **33,** 538.

Rolland, N. & Dibble, H. L. (1990). A new synthesis of Middle Paleolithic variability. *Am. Antiq.* **55,** 480–499.

Rosenberg, K. R. (1992). Comment on "The excavations in Kebara Cave, Mt. Carmel," by O. Bar-Yosef *et al. Curr. Anthrop.* **33,** 538–539.

Schepartz, L. A. (1992). Comment on "The excavations in Kebara Cave, Mt. Carmel," by O. Bar-Yosef *et al. Curr. Anthrop.* **33,** 539.

Schepartz, L. A. (1993). Language and modern human origins. *Yearb. phys. Anthrop.* **36,** 91–126.

Schick, T. & Stekelis, M. (1977). Mousterian assemblages in Kebara Cave, Mount Carmel. *Eretz Israel* **13,** 97–149.

Schiegl, S., Goldberg, P., Bar-Yosef, O. & Weiner, S. (1996). Ash deposits in Hayonim and Kebara Cave, Israel: macroscopic, microscopic and mineralogical observations, and their archaeological implications. *J. archaeol. Sci.* **23,** 763–781.

Shackley, M. (1980). *Neanderthal Man*. London: Duckworth.

Smirnov, Y. (1989). Intentional human burial: Middle Paleolithic (Last Glaciation) beginnings. *J. World Prehist.* **3,** 199–233.

Smith, F. H. (1992). Comment on "The excavations in Kebara Cave, Mt. Carmel," by O. Bar-Yosef *et al. Curr. Anthrop.* **33,** 540–541.

Smith, P. & Arensburg, B. (1977). A Mousterian skeleton from Kebara Cave. *Eretz Israel* **13,** 164–176.

Solecki, R. (1955). Shanidar Cave, a Paleolithic site in northern Iraq. *Smithsonian Institution Annual Reports for 1954*, 389–425.

Solecki, R. (1960). Three adult Neanderthal skeletons from Shanidar Cave, northern Iraq. *Smithsonian Institution Annual Report for 1959*, 603–625.

Solecki, R. (1961). New anthropological discoveries at Shanidar, northern Iraq. *Trans. N.Y. Acad. Sci.* **23,** 690–699.

Solecki, R. (1963). Prehistory in the Shanidar Valley, N. Iraq. *Science* **139,** 179–193.

Solecki, R. (1971). *Shanidar: The First Flower People*. New York: Knopf.

Solecki, R. & Leroi-Gourhan, A. (1961). Paleoclimatology and archaeology in the Near East. *Ann. N.Y. Acad. Sci.* **95,** 729–739.

Stiner, M. C. (1991). The faunal remains from Grotta Guattari: a taphonomic perspective. *Curr. Anthrop.* **32,** 103–117.

Stiner, M. C. (1994). *Honor Among Thieves: A Zooarchaeological Study of Neandertal Ecology*. Princeton, NJ: Princeton University Press.

Stiner, M. C. & Kuhn, S. L. (1992). Subsistence, technology and adaptive variation in Middle Paleolithic Italy. *Am. Anthrop.* **94,** 306–339.

Straus, L. G. (1982). Carnivores and cave sites in Cantabrian Spain. *J. anthrop. Res.* **38,** 75–96.

Stringer, C. & Gamble, C. (1993). *In Search of the Neanderthals: Solving the Puzzle of Human Origins*. London: Thames & Hudson.

Sutcliffe, A. J., Bramwell, D., King, A. & Walker, M. (1976). Cave paleontology and archaeology. In (T. D. Ford & C. H. D. Cullingford, Eds) *The Science of Speleology*, pp. 495–520. New York: Academic Press.

Suzuki, H. & Takai, F. (Eds) (1970). *The Amud Man and His Cave Site*. Tokyo: University of Tokyo Press.

The Oxford Dictionary of Quotations. (1979). *The Oxford Dictionary of Quotations*. Oxford: Oxford University Press.

Theunissen, R., Balme, J. & Beck, W. (1998). Headroom and human trampling: cave ceiling-height determines the spatial patterning of stone artefacts at Petzkes Cave, northern New South Wales. *Antiquity* **72,** 80–89.

Tillier, A.-M. (1990). Une controverse dépassée: l'existence de pratiques funéraires au Paléolithique moyen. *Les Nouvelles de l'archéologie* **40,** 22–24.

Tillier, A.-M., Arensburg, B., Vandermeersch, B. & Rak, Y. (1991). L'Apport de Kébara la palethnologie funèraire des néanderthaliens du Proche-Orient. In (O. Bar-Yosef & B. Vandermeersch, Eds) *Le Squelette Moustérien de Kébara 2*, pp. 89–95. Paris: C.N.R.S.

Toots, H. (1965). Sequence of disarticulation in mammalian skeletons. *University of Wyoming Contributions to Geology* **4,** 37–39.

Trinkaus, E. (1989). Comment on "Grave shortcomings: the evidence for Neandertal burial" by R. H. Gargett. *Curr. Anthrop.* **30,** 183–185.

Trinkaus, E. & Shipman, P. (1993). *The Neandertals: Changing the Image of Mankind*. New York: Knopf.

Tuohy, D. R. & Dansie, A. (1996). Oldest mummy in North America is at Nevada State Museum. *Nevada St. Mus. Newsl.* **24,** 4–5.

Valladas, H., Joron, J. L. & Valladas, G. (1989). Application de la thermoluminescence à la datation des niveaux moustériens de la Grotte de Kébara (Israel): ages Préliminaires des unités XII, XI et VI. In (O. Bar-Yosef & B. Vandermeersch, Eds) *Investigations in South Levantine Prehistory*, pp. 97–100. Oxford: British Archaeological Reports.

Valladas, H., Joron, J. L., Valladas, G., Arensburg, B., Bar-Yosef, O., Belfer-Cohen, A., Goldberg, P., Laville, H., Meignen, L., Rak, Y., Tillier, A. M., Tchernov, E. & Vandermeersch, B. (1987). Thermoluminescence dates for the Neanderthal burial site at Kebara in Israel. *Nature* **330,** 159–160.

Valladas, H., Reyss, J. L., Joron, J. L., Valladas, G., Bar-Yosef, O. & Vandermeersch, B. (1988). Thermoluminescence dating of Mousterian "Proto-Cro-Magnon" remains from Israel and the origin of modern man. *Nature* **331,** 614–615.

Vandermeersch, B. (1996). Nouvelles découvertes de restes humains dans les couches Levalloiso-moustériennes du gisement de Qafzeh (Israël). *C.r. Acad. Sci. Paris* **D:262,** 1434–1436.

Vandermeersch, B. (1969). Les nouveaux squelettes moustériens decouverts à Qafzeh (Israël) et leur signification. *C.r. Acad. Sci. Paris* **D:268,** 2562–2565.

Vandermeersch, B. (1970). Une sépulture moustérienne avec offrandes découverte dans la grotte de Qafzeh. *C.r. Acad. Sci. Paris* **D:270,** 298–301.

Vandermeersch, B. (1976). Les sépultures néandertaliennes. In (H. de Lumley, Ed.) *La Préhistoire Française*, pp. 725–727. Paris: C.N.R.S.

Vandermeersch, B. (1981). *Les Hommes Fossiles de Qafzeh (Israel)*. Paris: C.N.R.S.

Vandermeersch, B. (1990). De Neandertalers en de eerste mensen. In *5 miljoen jaar menselijk avontuur*, pp. 68–86. Brussels: King's printer.

Vandermeersch, B. (1993). Was the Saint-Césaire discovery a burial? In (F. Lévêque, A. M. Backer & M. Guilbaud, Eds) *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition*

to Upper Paleolithic Adaptations at Saint-Césaire, Charente-Maritime, France, pp. 129–131. Madison, WI: Prehistory Press.

Vermeersch, P. M., Paulissen, E., Stokes, S., Charlier, C., Van Peer, P., Stringer, C. & Lindsay, W. (1998). A Middle Palaeolithic burial of a modern human at Taramsa Hill, Egypt. *Antiquity* **72,** 475–484.

Villa, P. (1989). Comment on ''Grave shortcomings: the evidence for Neandertal Burial,'' by R. H. Gargett. *Curr. Anthrop.* **30,** 325–326.

Voorhies, M. R. (1969). *Taphonomy and Population Dynamics of an Early Pliocene Vertebrate Fauna, Knox County, Nebraska*. Laramie: University of Wyoming.

Weigelt, J. (1989). *Recent Vertebrate Carcasses and their Paleobiological Implications*. Chicago: University of Chicago Press.

Weiner, S. & Goldberg, P. (1990). On-site Fourier transform-infrared spectrometry at an archaeological excavation. *Spectroscopy* **5,** 46–50.

Weiner, S., Goldberg, P. & Bar-Yosef, O. (1993). Bone preservation in Kebara Cave, Israel using on-site Fourier-transform infrared spectrometry. *J. archaeol. Sci.* **20,** 613–627.

Weiner, S., Schiegl, S., Goldberg, P. & Bar-Yosef, O. (1995). Mineral assemblages in Kebara and Hayonim, Israel: excavation strategies, bone preservation and wood ash remnants. *Israel J. Chem.* **35,** 143–154.

White, T. D. & Toth, N. (1991). The question of ritual cannibalism at Grotta Guattari. *Curr. Anthrop.* **32,** 118–124.

White, W. B. (1988). *Geomorphology and Hydrology of Karst Terrains*. New York: Oxford University Press.

Willermet, C. & Clark, G. A. (1995). Paradigm crisis in modern human origins research. *J. hum. Evol.* **29,** 487–490.

Wolpoff, M. H., Spuhler, J. N., Smith, F. H., Radovcic, J., Pope, G., Frayer, D., Eckhardt, R. & Clark, G. (1988). Modern human origins. *Science* **241,** 772–773.

Worsaae, J. J. A. (1843). *Danmarks Oldtid*. Copenhagen.

Wright, R. V. S. (1992). *MV-Arch: A Multivariate Statistical Package for Archaeology*. Sydney: R. V. S. Wright.

Wylie, A. (1989). Archaeological cables and tacking: the implications of practice for Bernstein's ''Options beyond objectivism and relativism''. *Phil. soc. Sci.* **19,** 1–8.

Wynn, T. (1993). Two developments in the mind of early *Homo*. *J. anthrop. Archaeol.* **12,** 299–322.

Yellen, J. E. (1996). Behavioural and taphonomic patterning at Katanda 9: a Middle Stone Age site, Kivu Province, Zaire. *J. archaeol. Sci.* **23,** 915–932.