ritual tradition arose only after brain volumes in modern humans had already stabilized. There is no compelling evidence for pigment use pre-dating the middle of the Middle Pleistocene [Watts 1999, Barham 2002], and there are no reports of black pigment pre-dating the Late Pleistocene. Watts (1999) reported a dramatic increase in red ochre use in the southern African Middle Stone Age rather than a "gradual" increase "from the Middle Stone Age onwards." This increase was tentatively placed in the early Late Pleistocene; revised dates for the Border Cave sequence [Grün and Beaumont 2001] may push this back to the terminal Middle Pleistocene, while Barham’s (2002) and McBrearty’s (1999) research suggests that regular use may be earlier still in the African Tropics. Claims of ubiquity, particularly those made by Bednarik (1999a), need to be carefully evaluated.

The temporal contrasts that Hovers et al. draw between the Levantine and African ochre records are interesting, but we don’t know how significant a presence modern humans had in the Levant during the Late Mousterian. Furthermore, an absence of ochre need not imply a lack of interest in red pigments—in the Kalahari, scarcity obliged Khoisan to employ plant substitutes [Watts 1999:133], and henna is widely used in the Near East. Hovers et al. argue that the symbolic contexts of ochre use in the Levant and Africa differed as early as the Middle Paleolithic/Middle Stone Age, but all that we can be sure about is that, in contrast to their Levantine counterparts, Middle Stone Age people did not bury their dead in caves.

Finally, where symbolic culture exists, local symbolic meanings will vary. What strikes us is that, regardless of variability on this level, structural features of ritual show extreme conservatism, red pigments being used to generate multiple meanings. It is on this syntactical level that our model can account for such recurrent features as red-ochre burials in the global archaeological record of modern humans in the Late Pleistocene.

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Much of the debate concerning the origin of modern human behavior stems from disagreements about what constitutes symbolic behavior and what standards of proof are required to establish it. I am pleased to see a paper that situates this discussion firmly in the material world, independent of unverifiable speculation about language or the nature of the symbolic content itself. The method employed here, treating archaeological remains as tokens, may ultimately prove to be as important to understanding Paleolithic symbolic behavior as it has been to clarifying the origins of writing [Schmandt-Besserat 1996].

Hovers and her coauthors provide solid empirical evidence for the collection and manipulation of ochre in the Levantine Middle Paleolithic. The archaeological, lithological, chemical, and mineralogical evidence provided here supports the conclusion that the ochre was selected for its color properties, that it was transported to the site, that coloring matter was obtained by scraping it with stone tools, and, intriguingly, that it was perhaps further processed in the concavity of a Levallois core. I think that the case for ochre, fire, and burials functioning together as a symbolic system is less firmly established. The materials do not seem to be in direct archaeological association, and the debris in which they are found is estimated to have accumulated over a period of perhaps 10,000 years.

It would be very interesting to compare the behavior reflected in the lower, ochre-bearing levels at Qafzeh, presumably the product of anatomically modern Homo sapiens, with that in the upper layers, apparently accumulated by Neanderthals. Lieberman and Shea (1994) have outlined a model for the Middle Paleolithic of the Levant which contrasts the foraging behavior and ranging strategies of modern humans with those of Neanderthals. Does the Qafzeh evidence support or refute their ideas?

The linguistic evidence for the universality of red in human color classifications [Berlin and Kay 1969] is strong circumstantial evidence for the very great antiquity of the color red as a symbolic category. While I happen to believe that the use of ochre is in itself evidence for symbolic behavior, I doubt that this paper will convince those who do not share my view, and no doubt utilitarian uses for the ochre will be invoked.

One of the most difficult tasks for the prehistorian is to identify the emergence of novel behaviors. The challenge is similar to that encountered in recognizing the origin of biological species. The earliest members of a new species will be few and will probably resemble not only their ancestral but also their sibling species. Traits in a new species may be hypervariable until they are canalized by adaptation, sexual selection, or other weeding-out processes. Similarly, it may be problematic to recognize innovations in the archaeological record prior to their becoming stereotypical or "normal" behavior for the society.

Populations of both Neanderthals and early H. sapiens were geographically widespread, and one would not expect the behavior of either of them to have been uniform throughout their range. Specific case studies such as the one provided here allow a richer view of the behavior of H. sapiens in the Levant of 90,000 years ago, and it will be interesting to compare it with cases of pigment use elsewhere at a similar time depth.

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Hovers et al. provide important archaeological and geological evidence for the use of ochre during the late Middle Paleolithic at Qafzeh Cave. Their paper is a sig-
significant addition to the recent discussion of the Middle Paleolithic use of ochre at Blombos Cave [Henshilwood et al. 2001, 2002]. The far earlier Middle Paleolithic cave of Bečov in Middle Europe, ca. 250,000 B.P., produced a piece of intentionally striated ochre, an abraded quartzite rubbing stone, and a huge quantity of ochre powder dispersed in a circle around the stone on which the abrader had sat [Marshack 1981]. The feet of the abrader were outlined on the ground as ochre-free, negative footprints. Particularly important was the fact that a piece of ochre, a rubbing stone, and apparently a container had been brought from different places to this particular cave at a particular time for a particular purpose—processes similar to those inferrable for the use of ochre at Qafzeh and Blombos. The production of ochre at Bečov, while archeologically and quantitatively unique for the period (see Chase and Dibble 1987, Chase 1991), was clearly a learned, cultural and social behavior under frontal-lobe mediation and probably therefore, at some level, "symbolic."

There was no evidence that ochre had been produced elsewhere in Bečov or anywhere else in Middle Europe during this period, and Chase and Dibble would consider this quantitative singularity a statistical argument against Middle Paleolithic "culture" or the cultural use of ochre. There may, however, be a need for caution in drawing such an inference. The Middle Paleolithic hunter-gatherers at Bečov were seasonally mobile. Social, cultural, and ritual events would therefore have been periodic and space-and-time-specific, as in a regional aggregation, or aperiodic, as in the death of an elder, a birth, the failure of a resource, or a sudden epidemic. The lower levels at Qafzeh represented ephemeral seasonal camps (Bar-Yosef 1994:43). The production of ochre in these early cultures may thus always have been time-, context-, and place-specific and so not always available archeologically. Besides, the major rituals or burials of mobile hunter-gatherers are often conducted not within the habitation cave or on its terrace but in a culturally specified ritual place [Marshack 2001]. It is likely that early ochre was often prepared and used elsewhere and that its absence from a particular cave would not denote its absence from the culture.

There is another problem. Hovers et al. note that one of the trichromatic colors is white. White is an important color in body painting and other modes of surface decoration. In the Franco-Cantabrian caves, white was effectively used within images by leaving areas of limestone wall blank or by scraping a coating of surface clay or dust to create an area of white. The bichrome "Chinese horse" in Lascaux has an unpainted white underbelly that is indexical of the dark creamy tan of its summer coat. Could white have also been used as an applied color, say, in body painting, during the Levantine Paleolithic or the European Upper Paleolithic and not be evident archeologically?

In the Middle Magdalenian decorated cave of Bedeilhac (Ariège) a large number of flat, irregularly shaped clay plaquettes had been peeled and lifted from the ground and incised with images. One hand-sized pure-white clay or "chalk" plaquette (11.5 x 8 cm [Field Museum # 212709]) differed from the others in that while the rear retained its original sharp edge of breakage the front half had been lightly abraded and thinned to produce a white powder, shaped to a point, and, as the edge polish revealed, used as a pencil or crayon to mark a smooth surface—probably a skin garment or a human body in a ritual (fig. 1). After use for its color it had been symbolically incised (see Henshilwood et al. 2002 for the overmarking of ochre at Blombos Cave).

These rare data pose a number of interpretive problems. Red and red ochre have profound affective and symbolic resonance, but white, through less common archeologically, has its own powerful semantic: in bones, skulls, and skeletons. White is common as body paint in shamanic and popular ritual and, like black, is symbolic in many cultures. However, white paints, when derived from a mixture of water and clay or chalk, would probably not have survived archeologically as well as ochre, manganese, or charcoal. White would surely have been effective in human perception and the functional color palette. Have archeologists investigated the sources and possible uses of Middle and Late Paleolithic clays and chalk as a possible pigment?

Hovers et al.'s paper has made it possible to address a number of issues. Reference to human neurology in an attempt to understand the human productive, cultural, and symboling capacity and its relation to the archeological record has taken many routes, but, as far as I know, this is the first paper to discuss trichromatic hu-

![Pure white chalk plaquette (11.5 x 8 cm), abraded to produce a white powder and then used as a crayon, probably for ritual marking of a body or a hide. Magdalenian IV, Bedeilhac (Ariège).](image-url)
man perception as an aspect of early, pre-Upper Palaeolithic symboling behavior.

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Hovers et al. are to be congratulated for advancing our understanding of prehistoric colour systems in a major way. Their detailed analysis of ochre procurement and usage by the Middle Palaeolithic occupants of Qafzeh Cave is as persuasive as it is thought-provoking. They argue that layers XXIV-XVII, the ochre-bearing deposits at Qafzeh, represent a unique episode in the history of the site, specific to the conditions of the time, in which the hominids found themselves constructing new social behaviours that in part revolved around colour symbolism. Moreover, for reasons presumably associated with different modes of symbolic expression, ochre usage all but disappeared in later layers at the site.

It seems that the Qafzeh hominids most likely had a number of desirable criteria in mind when they targeted the nearby ochre sources (ferruginous oolites embedded in sandy limestone) at Mt. Devora and Mt. Tavor. Hovers et al. quite correctly suggest that the hominids probably valued a range of characteristics in the ochre, which may have included texture as much as colour. Certain modern societies also value the lustre that can be obtained from ochre with specific impurities. While the silty quality of the archaeological samples found in the cave at Qafzeh may have been more desirable than matrix from the sources that were not exploited (veins of iron oxide in dolomitic rocks and ferruginous concretions), it would also be useful to know how they compared in terms of colour (i.e., content of iron oxide). If these unexploited sources are indeed redder, it could support the idea that although redness was the preeminent attraction, the intensity of red was not necessarily the sole criterion.

There is good evidence that certain Australian Aboriginal communities, for instance, bypassed ochre sources that were very red and embedded in undesirable matrices in favour of less colour-saturated sources that had a more desirable plasticity.

While it seems, judging from the absence of random samples of yellow ochre, that goethite was not heated at Qafzeh, I am not sure I would agree that mining and subsequently heating goethite would have required a greater investment of time and energy. Goethite can be transformed into red haematite quite readily—it would have simply required “roasting” of the lumps of ochre in an open fire. If a source of ochre is interlayered or speckled from yellow through red, collecting ochre as it came, irrespective of colour, and then heating it might in fact have been less time-consuming than following haematite veins.

Hovers et al. distinguish between practical and symbolic uses of ochre. This distinction concurs with traditional views that often separate subsistence strategies and related activities from ritual and ceremony, which are conventionally viewed as epiphenomenal. Increasingly, however, the argument is that the boundaries between the cultural, natural, and economic worlds of the past were blurred and were rich in symbolic meaning (Bradley 1998, 2000; Gosden 1994). Therefore, while ochre may not have been used for tanning hides (a “practical” activity) at Qafzeh, for instance, we should not assume that such an activity was necessarily devoid of symbolism.

I find the idea that the hearths in the ochre-bearing layers at Qafzeh may have had symbolic meaning a tantalizing one even though the authors choose to err on the side of caution. For later prehistoric complex societies, especially the highland communities of Anatolia, for example, there is a growing body of contextual evidence that the hearth was not only the focus of the household but, through an association of deliberately placed objects, had a multiplicity of purposes ranging from utilitarian to ritual (Sagona 1998). Similarly, there may well have been a package of symbolic elements of the Middle Palaeolithic including the hearth as the authors suggest.

Finally, the Qafzeh data make one reflect on the extraordinary longevity of the symbolism of red, which has persisted into modern times. Although ubiquitous, ochre usage was nonetheless historically and culturally contingent. In terms of colour symbolism what is so intriguing is that certain societies—early Archaic states in the Near East, for instance—appear to have abandoned, wholly or in part, their attachment to red in favour of blue (Sagona 1996). This change in symbolism appears to have embraced a new set of values and social constructs. While we shall never know what the colours actually meant to the people who used them, it is worth making a suggestion. If at Qafzeh we see the beginnings of red as a symbolic colour for life, vigour, blood, fertility, and so on, the appearance of blue may represent the need for an apotropaic colour at a time when there was a conspicuous increase in personal wealth and prestige.

Reply

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We thank the editor of CURRENT ANTHROPOLOGY, Ben Orlove, for insisting on our turning a lengthy technical report on the ochre of Qafzeh Cave into a broader (and even lengthier) article. We thank the commentators for their thoughtful and illuminating responses. It pleases us that all of them see much merit in the presentation of the data and in the analytical methods we employed in our study and that, to varying degrees, they accept our conclusions. The commentators are diverse and