

# Dense Forests, Cold Steppes, and the Palaeolithic Settlement of Northern Europe<sup>1</sup>

by Wil Roebroeks,  
Nicholas J. Conard, and  
Thijs van Kolfschoten

Contemporary models for the evolution of human behaviour place heavy emphasis on the ecology of the settlement of northern latitudes. Researchers including Gamble and Whallon have presented models that are based on inferred differences in ecological tolerances between archaic and anatomically modern humans. Palaeoecological data from a large number of archaeological sites in Northern Europe show, however, that the range of environments that Middle and Late Pleistocene hominids were able to exploit was wider than is commonly acknowledged. These data indicate that recent models for the colonization of northern latitudes exaggerate the differences in the ecological tolerances of archaic and modern humans. While the archaeological record suggests significant behavioural differences between modern and pre-modern hominids, major differences in the ecology of settlement cannot be proven on the basis of the available evidence from Northern Europe.

WIL ROEBROEKS is University Lecturer in Prehistoric Archaeology at Leiden University (Postbus 9515, 2300 RA Leiden, The Netherlands). Born in 1955, he was educated at the Universities of Nijmegen (M.A., 1979) and Leiden (M.A., 1982; Ph.D., 1989). His research centers on the archaeology of Pleistocene hunter-gatherers. Among his publications are (with J. Kolen and E. Rensink) "Planning Depth, Anticipation, and the Organization of Middle Palaeolithic Technology: The 'Archaic Natives' Meet Eve's Descendants" (*Helinium* 28:17-34) and two coedited volumes (with T. van Kolfschoten) and a monograph on his excavations at Maastricht-Belvèdère, *From Find Scatters to Early Hominid Behaviour: A Study of Middle Palaeolithic Riverside Settlements at Maastricht-Belvèdère (The Netherlands)* (*Analecta Praehistorica Leidensia* 21 [1988]).

NICHOLAS J. CONARD is Assistant Professor of Anthropology at the University of Connecticut. He was born in 1961 and educated at the Universities of Rochester (B.A., 1983; M.S., 1986) and Yale (Ph.D., 1990). His research centers on the European

1. In formulating the ideas presented here we have profited from conversations with many colleagues, some of whom read and criticized earlier drafts of this paper. We are especially grateful to C. Gamble, J. Kolen, and W. H. Zagwijn and further to C. C. Bakels, G. Bosinski, R. Dewar, S. Gaudzinski, L. P. Louwe Kooijmans, E. Rensink, J. Schäfer, F. Timmermans, and A. Tuffreau.

Palaeolithic, and he has worked in northeastern North America and Egypt. Among his publications are studies of the applications of radioisotopes in archaeology and the earth sciences and forthcoming reports on his excavations at the Middle Palaeolithic site Tönchesberg (*Tönchesberg and Its Position in the Palaeolithic Prehistory of Northern Europe* [Römisch-Germanisches Zentralmuseum Mainz, in press]).

THIJS VAN KOLFSCHOTEN is Lecturer in Palaeontology of Pleistocene mammals at Leiden University. He was born in 1952 and educated at the University of Utrecht (M.A. 1980), where he received his Ph.D. in 1988. From 1987 to 1991 he had a research post at the University of Bonn and at Utrecht. His research focuses on the stratigraphy and palaeoecology of mammal faunas from the European Pleistocene. His publications include "The Evolution of the Mammal Fauna in the Netherlands and the Middle Rhine Area (Western Germany) during the Late Middle Pleistocene" (*Mededelingen Rijks Geologische Dienst* 43:1-69).

The present paper was submitted in final form 22 IV 92.

Palaeolithic studies have since their beginnings focused on reconstructing the environments occupied by Pleistocene hominids. This tendency can be traced back to the last century, when researchers addressed questions concerning the antiquity of humankind on the basis of the geological and palaeontological context of human fossils and artefacts. Apart from this, the importance of the environment in studies of Pleistocene hunter-gatherers doubtless lies in the fact that both recent and Pleistocene hunter-gatherers have been seen as "very close to nature." This perspective has led many researchers to view hunter-gatherers in terms of human-land relationships rather than in terms of their social lives (cf. Bender 1985, Conkey 1987). In recent years archaeologists, focusing on regional studies in terms of past environments, have paid special attention to the settlement history of the colder parts of Europe, discussing the adaptation of a tropical hominid to northern conditions. Some of the obstacles that needed to be overcome were the long winters with no plant growth and the consequent greater dependence on animal resources, the cold, and, from a longer-term perspective, the periodic shifts in climate and environment. Several explanations have been presented for the adaptation to northern regions, mostly stressing several kinds of technological innovations (e.g., Bordes and Thibault 1977, Bosinski 1982) or pointing to physiological adaptations (Trinkaus 1989).

The ecology of hominid colonization has increasingly been used to monitor the character of past cultural adaptations. In this approach, the adaptation of recent and Upper Palaeolithic hunter-gatherers to a wide range of environments is implicitly used as a measuring device in assessing earlier adaptations (see Binford 1989). For example, Gamble (1986a) has argued for differences in the scale of social organization between fully modern humans and earlier hominids, as registered by the Pleistocene settlement history of Northern Europe. In his view, pre-modern humans could not live in the northern climates that fully modern humans mastered in the Upper Palaeolithic; these "high-risk environments" could

be inhabited only by societies possessing extensive alliance networks which minimized risk by permitting the free movement of information and people. In his approach the main obstacle to long-term occupation of a specific habitat is not so much a lack of technology as the absence of appropriate social structures. Without these social structures pre-modern humans were incapable of coping with extreme environmental conditions—not only colder climates but also fully interglacial environments. In Gamble's view interglacial environments were successfully exploited for the first time in the Holocene, and some workers suggest that not even modern hunter-gatherers are well suited to a heavily forested environment (Bradley et al. 1989). Although the Pleistocene interglacial forests had abundant plant and animal resources, Gamble (1987:86; cf. Kelley 1983) sees the dispersed nature of many of the animal species and the small sizes in which plant foods came as contributing to exploitation costs:

Intercepting animals required complex planning based on accurate and detailed information, whereas the large species that existed—hippopotamus, rhino, and elephant—all had low reproduction rates so that sustained hunting was ruled out. Many of the plant foods were costly as measured by the time taken to prepare them for consumption. The combined schedule to use both plant and animal resources would have resulted in many intricate and minutely planned decisions that had to balance limited time and labor budgets.

Gamble compares the apparent absence of Pleistocene interglacial occupation with the Holocene settlement of northwestern Europe. During the Holocene the region was "covered in a carpet of mesolithic sites." These sites date to the earlier, more open phases of the Holocene interglacial as well as to the period of full forest conditions. According to Gamble the fact that more or less comparable environments carried very different archaeological signatures indicates that earlier human populations were unable to find social solutions to the problem of capturing usable energy from the interglacial forests: "It is inescapable that the settlement histories of the regional model are measuring between these two periods a process of social change that led to intensification, one outcome of which was to tap for the first time the vast potential of these resources" (Gamble 1986a:370; see also 1986b). Prior to the advent of fully modern humans Gamble sees occupation only in his stage 2 environments, the long periods between fully interglacial (his stage 1) and glacial maximum (his stage 3) conditions. The duration of these "intermediate" climates accounted for approximately 60% of the time of the last 700,000 years (see Gamble 1986a; 1987). Pre-modern hominids were adapted to these "long-term" conditions, not to the comparatively short-lived fully glacial or interglacial ones.

Whallon (1989) has used the environmental background of the Upper Palaeolithic demographic expansion to infer fundamental differences in adaptive strategies

between Upper Palaeolithic and earlier hominids. In his view Upper Palaeolithic strategies were based on complex language systems with "displacement" (that is, reference to things beyond the here-and-now, the ability to discuss the possible outcome of future actions and the results of past activities and experiences), on the presence of capacities for anticipation on the basis of a group memory, resulting in the development of a number of mechanisms for information storage, retrieval, and use, and on the existence of extensive alliance networks that functioned as a kind of social safety net in the unpredictable environments. In his opinion Upper Palaeolithic societies were able to store practical information on how to cope with subsistence crises in a form that could be transmitted, as a kind of "tribal encyclopedia" (cf. Pfeiffer 1982), over periods considerably longer than an individual life-span (cf. Minc 1986).

The shift from protolinguistic systems to more complex systems with displacement and the shift from anticipation strategies on an individual basis to strategies based on a group memory are seen to occur around the Middle/Upper Palaeolithic transition. In Whallon's model this shift is indicated by occupation of "marginal," high-risk environments such as the Australian desert and the Siberian arctic tundra on a permanent basis. Both these areas share, in his view, the features of large-scale geographical homogeneity, low resource density, diversity, and high unpredictability in key factors such as rainfall in comparison with previously inhabited environments. The relatively sudden expansion into new and difficult environments whose sustained exploitation demanded all the above-mentioned capacities argues for their emergence at this time. The ecology of the human occupation of Pleistocene Eurasia has become very important in Palaeolithic archaeology (see, e.g., Binford 1989, Frenzel 1985, Goodenough 1990, Graves 1991, Müller-Beck 1988, Soffer 1991, Soffer and Gamble 1990), probably because more traditional archaeological evidence, such as stone tools, is regarded as less well suited to the study of social and cultural change.

In this paper we will show that crucial elements of some of these new ecologically based models lack empirical support. We will review the environmental background of the Palaeolithic occupation of Northern Europe (western and central Europe north of the Alps, from England via the northern part of the continent to the eastern parts of Germany), examining key sites many of which have been excavated very recently or are still under excavation and which have been the objects of multidisciplinary research on the palaeoecological setting and the age of the archaeological assemblages (table 1). We focus here on the extremes of Pleistocene environmental and climatic fluctuations (interglacials and major cold phases), for these play a crucial role in the models mentioned. These extremes are considered by many researchers to be the phases "where pain and penalty reside, where variables are stressed and strained beyond the breaking point, where selection happens and where most change occurs" (Wobst 1990:330). We also review

TABLE I  
*Sites and Their Ecological and Chronological Settings*

Period	Interglacial Environments	Intermediate Environments	"Cold Steppic" Environments
Late Pleistocene: Upper Palaeolithic			Gönnersdorf Andernach Mainz-Linsenberg Sprendlingen Maisières Lommersum Bocksteinschmiede Balve Kartstein Salzgitter-Lebenstedt Ariendorf 3
Late Pleistocene: Middle Palaeolithic	Neumark-Nord Grabschutz Rabutz Gröbern Lehringen Veltheim Taubach, Weimar, Burgtonna Stuttgart-Bad Cannstatt Ehringsdorf Maastricht-Belvédère	Seclin Wallertheim Tönchesberg 2 Königsau	
Late Middle Pleistocene		Biache-Saint-Vaast	Achenheim "Sol 74" La Cotte de St. Brélade Schweinskopf Wannen Tönchesberg 1 Ariendorf 2 Ariendorf 1 Mesvin 4
Early Middle Pleistocene	Bilzingsleben Clacton-on-Sea Kärlich Miesenheim 1 Boxgrove	Cagny-l'Épinette Hoxne	

sites from "intermediate" settings to demonstrate that Northern Europe was occupied during a wide range of environmental conditions. Finally, we briefly discuss the implications of this database for existing models. Our focus on evidence from Northern Europe is warranted because of the large database of considerable time depth that stems from more than a century of Palaeolithic research. The emphasis we place on the environment of early hominid occupation of Europe does not, however, mean that we consider the environment as the determinant of human behaviour. We see it rather as the background against which social processes took place (cf. Gamble 1986a).

### The Chronological Framework

When considering the settlement history of an area as large as Northern Europe, one is confronted with the problem of putting the evidence from various geographically dispersed sites in a chronological framework that can be applied to the whole area. Recent work on the biostratigraphical subdivision of the European Quaternary and new developments in absolute dating techniques (cf. Aitken 1990) have greatly increased the possibility of putting sites in a relative sequence. The limits of absolute dating methods and especially of many of the correlations based on them are nonetheless quite significant. The recent discussion between two groups using electron spin resonance on shell samples from the Middle Pleistocene Holstein interglacial beds in the

type area provides an example of the persisting uncertainties in chronostratigraphical correlations: Sarntheim, Stremme, and Mangini (1986) conclude that the Holsteinian interglacial correlates with oxygen-isotope stage 11, whereas Linke, Katzenberg, and Grün (1985) assign it to stage 7 (see also Schwarcz and Grün 1988 versus Barabas et al. 1988).

As this paper deals with the settlement history of Northern Europe, we will use the chronostratigraphic scheme that is currently in general use in that area. This scheme is mainly based on work carried out in the Netherlands, an actively subsiding sedimentary area—the southern North Sea Basin, where thick beds of deltaic and marine deposits formed in the Quaternary. The biostratigraphical subdivision of these Quaternary beds is based mainly on pollen analysis (Zagwijn 1985). So far, analysis has revealed 15 stages of temperate climatic conditions after the first major cooling of the pre-Tiglian cold stage, which started about 2.3 million years ago. In this paper the Middle and Late Pleistocene are of special interest. Figure 1 reviews the climatic evolution for these periods in the Netherlands. Here we wish to stress the existence of at least four interglacials within the "Cromerian complex." The Saale "glacial" stage also displays a complex climatic development, with at least two major interstadials (Zagwijn 1973). The Dutch Quaternary climatic curve shows some striking similarities with the deep-sea oxygen-isotope record, although more dating checks will be necessary to demonstrate exact matches. Figure 2 gives a tentative correlation of isotope stages 1–23 with the Dutch climatic stages. In this pa-



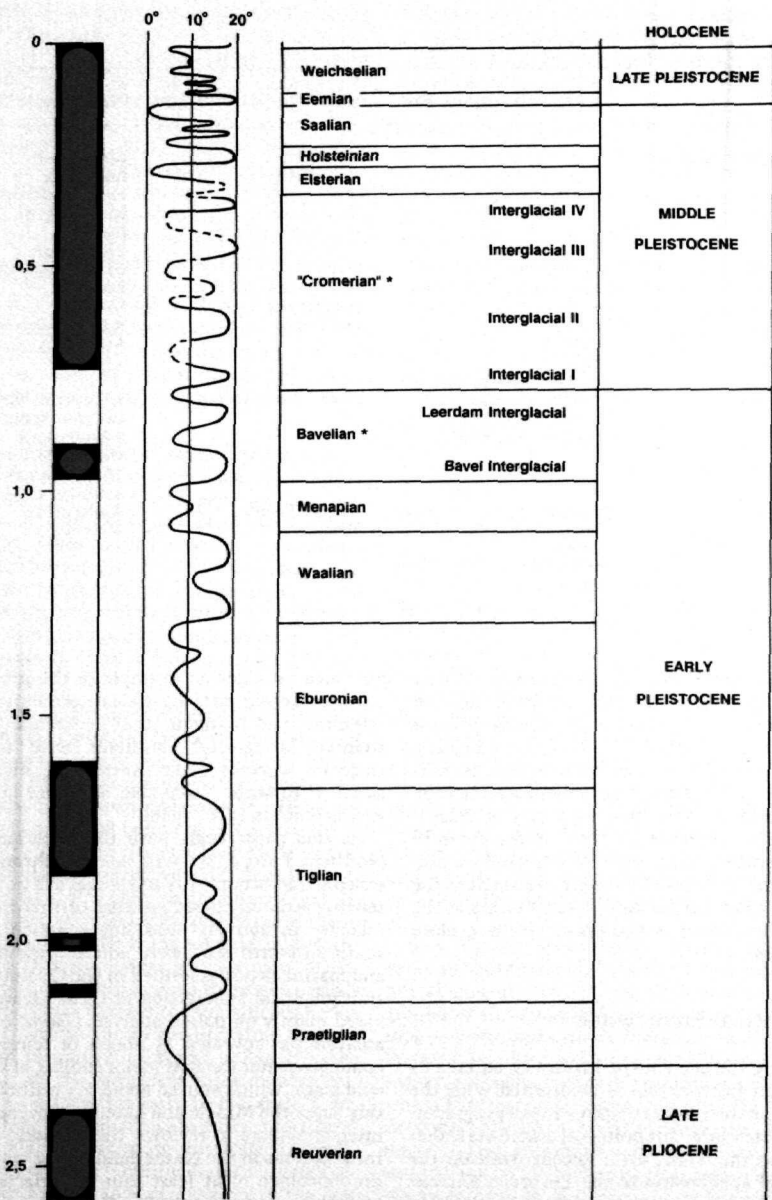
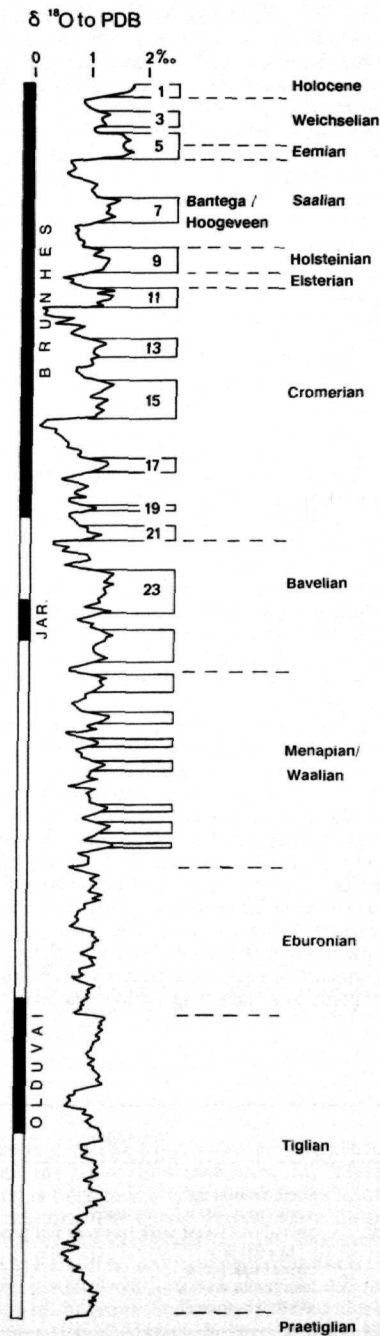


FIG. 1. Climate curve for the Quaternary in the Netherlands (after Zagwijn 1985). Age in million years; temperature in degrees C, estimated mean for July. \*, includes several glacials and interglacials.





per both the Dutch Quaternary nomenclature and the oxygen-isotope stages will be used in discussing the ages of sites, not to pinpoint them exactly but to give an idea of the time periods with which we are dealing.

The relative ease with which different correlations can be posited means that archaeologists working with data from this time range have to be careful in developing models depending strongly on behavioural events "precisely" pinpointed in the Pleistocene. These problems with dating and correlations preclude working with fine time scales. We will therefore discuss the sites mentioned here in two broad chronological groups, a Middle and a Late Pleistocene one. In the first group the sites are divided into a pre-stage 7 and a later subgroup, a division facilitated by the results of recent biostratigraphical work—especially studies of the Pleistocene micromammal faunas of Northern Europe [e.g., Heinrich 1987, van Kolfschoten 1990a]. The Late Pleistocene evidence will, for clarity's sake, also be presented in two subgroups, one dealing with the Middle Palaeolithic data and one with the Upper Palaeolithic.

#### The Palaeoecological Assessment of Landscapes

The climatic and environmental changes characteristic of the Quaternary are best known for the last interglacial/glacial cycle. The detailed knowledge of this cycle is derived from both terrestrial and deep-sea-core data. The cycle begins with a relatively short interglacial, from 128,000 to 118,000 years ago, stage 5e of the oxygen-isotope record. The short duration of this Eemian interglacial is comparable to the estimates of the duration of other Pleistocene interglacials, as inferred from counts of organic varves in interglacial lake deposits of England and Germany (Meyer 1974, Müller 1974, Turner 1975). The Eemian interglacial was followed by the Weichselian glacial, a period with many climatic oscillations. At the beginning of this period several rather warm interstadials are represented in pollen diagrams. During these periods the northern parts of Europe were covered with coniferous woods. These Early Weichselian interstadials were separated by periods of open vegetation and often strong cooling. The coolest part of the Weichselian also witnessed some climatic fluctuations, but no significant reforestation occurred then, the landscape remaining open. The period roughly between 30,000 and 10,000 years ago saw a rapid build-up of continental ice-sheets and a corresponding fall in sea level. At around 18,000 B.P. the glacial maximum was reached, followed by a rapid amelioration of the climate leading to the retreat of the ice-sheets. The return

FIG. 2. Tentative correlation of the Quaternary in the Netherlands with the isotope stages in deep-sea core V 28-239 (modified, after de Jong 1988 and Shackleton and Opdyke 1973, 1976).

of interglacial conditions of the Holocene marked the beginning of a new cycle. According to the oxygen-isotope record and some more fragmentary terrestrial data, earlier cycles must also have broadly followed this pattern. Within the rough limits of this pattern, climatic changes were relatively rapid and numerous, as can easily be observed in the pollen record and the oxygen-isotope data for the last cycle.

Because of the importance of interglacials in our and other views of the Pleistocene settlement of Europe, we need to consider carefully how to define them and address their variation. As early as 1928, Jessen and Milthers defined an interglacial as a period with a vegetational and hence climatic evolution similar to that of the Holocene. This included a clear expansion of thermophilous trees, an essential difference from interstadial periods (cf. Zagwijn 1989). As has been pointed out by many researchers, a clear-cut distinction between interglacials and interstadials is not always possible, because climate and vegetation may vary from one area to another during the same period. In general, however, the interglacial stages of the last 900,000 years are characterized by a clear succession of warmth-loving trees that follows a pattern of vegetational change through the four pollen zones shown in table 2. The middle phase of an interglacial is characterized by deciduous forests (pollen zones 2 and 3). Coniferous and birch woodland and more extensive herbaceous vegetation characterize the beginning and the end of an interglacial (pollen zones 1 and 4). Within this general framework, however, the character of the interglacials and the interglacial vegetation in the Quaternary varied from one interglacial to another (Zagwijn 1989, 1991a). The Eem and the Holstein interglacials, for example, have been characterized as very oceanic in western as well as in central Europe. This is indicated, for example, by the frequent occurrence of ivy (*Hedera*) and holly (*Ilex*) in Eemian and Holsteinian pollen sequences in western Russia, far to the east of their present distribution. The Eemian and the Holsteinian must have been interglacials with a high sea level and an oceanic climate similar to or warmer than the present one, with vegetation and climate rather uniform over large areas. This uniformity permits distinct pollen-stratigraphic correlations (fig. 3). In the Eemian,

for instance, silver fir (*Abies*) had a distribution far into the European lowlands, and in the Holsteinian it spread even farther into South Eastland. On the level of the specific forest succession, the Eemian and the Holsteinian differed somewhat, probably in connection with a more rapid temperature increase in the Eemian as compared with the Holsteinian and the Holocene. These warm-oceanic interglacials with rather homogeneous vegetation cover contrast with interglacials of a more continental type, which show a distinct north-south and east-west gradient in vegetation. During these "low-sea-level" interglacials *Abies* is missing north of the Alps.

Independent of these palynological data, oxygen-isotope studies have yielded a comparable picture. Shackleton (1987), addressing the sea levels of the glacial and interglacial periods of the Brunhes period, concludes on the basis of the analysis of a large number of deep-sea cores that the extremes of stages 1 (the Holocene), 5e (the Eemian), 9, and 11 are very similar, indicating that these interglacials had comparable sea levels. These four interglacial peaks are isotopically significantly lighter than those of stages 7, 13, 15, and 19. Shackleton suggests that during these latter more extensive ice caps remained present in the northern hemisphere, resulting in a relatively low sea level.

The question now is whether the differences between interglacials are important for our understanding of the ecology of the settlement of Northern Europe and, if so, whether we can detect any differences between the archaeological records for the two kinds of interglacials. At present we do not know if the low-sea-level interglacial environments had more open vegetation than the oceanic ones, but according to Zagwijn (1989) the environmental gradient must have been steeper, meaning less ecological homogeneity. The problem here is differentiating these two kinds of interglacials at the level of sites. Zagwijn suggests that the presence of *Abies* may be a good indicator for oceanicity in the region discussed here. Because few sites have yielded good botanical data, however, we must often rely on faunal remains for our environmental reconstructions, and we simply do not know how to identify low-sea-level interglacials on the basis of fauna. There are some sites where absolute dates strongly point to a stage 7 age, a low-sea-level interglacial

TABLE 2  
Vegetational Changes through an Interglacial

Vegetational Aspect	Zone	Important Pollen Types	Vegetation
[Early glacial]		[herb]	[herb-dominated]
Post-temperate	4	<i>Pinus</i> , <i>Betula</i> (higher herb)	coniferous forest (more open)
Late temperate	3	mixed-oak forest genera + <i>Carpinus</i> ( <i>Abies</i> )	mixed-oak forest with tree taxa not prominent in zone 2
Early temperate	2	mixed-oak forest genera	mixed-oak forest
Pre-temperate	1	<i>Betula</i> , <i>Pinus</i>	coniferous forest
[Late glacial]		[herb]	[herb-dominated]

SOURCE: Turner and West (1968).

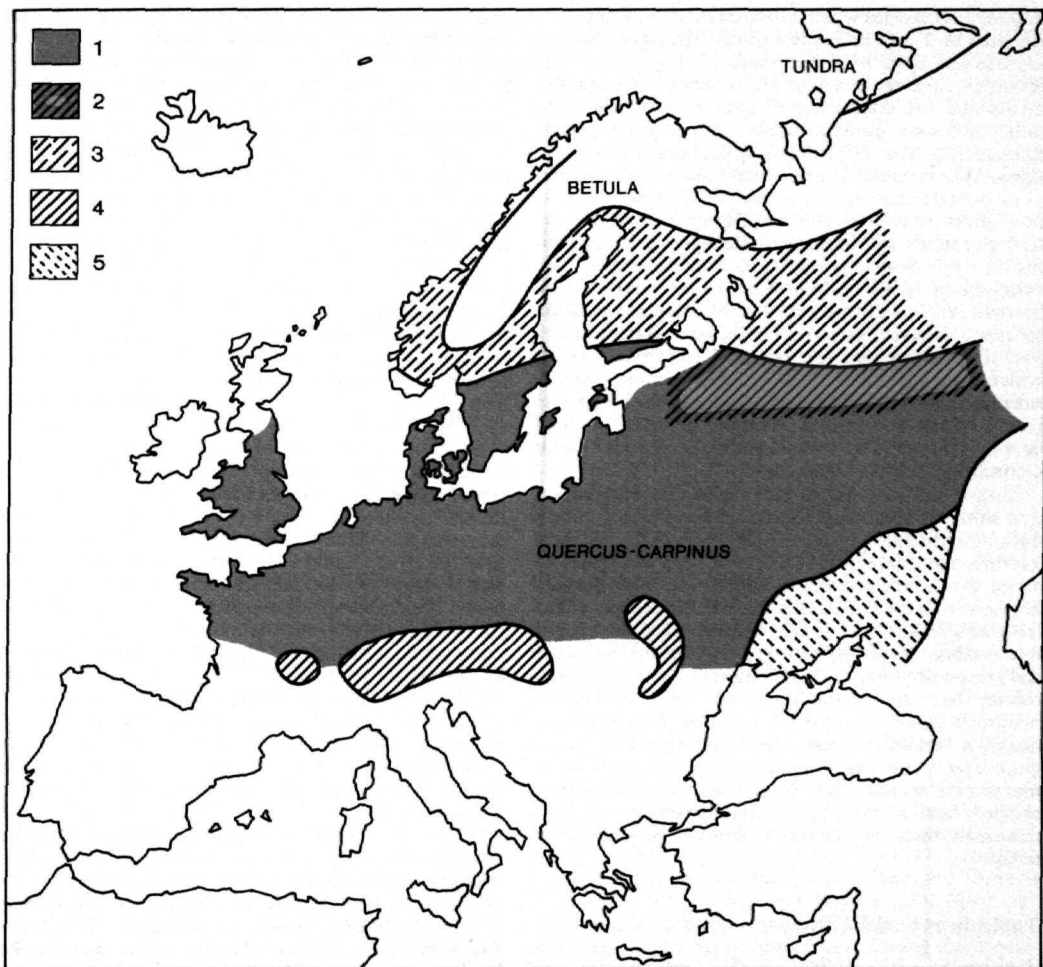


FIG. 3. Vegetation map of the Eemian interglacial (after Zagwijn 1989). 1, Carpinus-Quercus forest; 2, Carpinus-Quercus forest with *Picea*; 3, *Picea*-Quercus forest with *Betula*; 4, *Picea*-*Abies* mountain forest; 5, steppe-forest.

cial according to the oxygen-isotope data (Shackleton 1987), but the fauna from such sites (e.g., Maastricht-Belvédère) is fully interglacial and suggests heavily forested conditions. The Lower Travertines at Ehringsdorf are similar in biostratigraphical and absolute age to Maastricht-Belvédère, and here abundant floral remains indicating a mixed-oak forest confirm the full interglacial nature of the fauna (Steiner 1979). If our chronological interpretation of Maastricht-Belvédère and Ehringsdorf is correct, high- and low-sea-level interglacials may

be extremely difficult to identify on the basis of fauna alone.

The Northern European Middle and Late Pleistocene vertebrate faunas can, very roughly, be divided into three categories: (1) cold-stage faunas, (2) steppe faunas, and (3) interglacial faunas. Cold-stage faunas are characterized by woolly mammoth, woolly rhino, and reindeer, with a small-mammalian fauna consisting of tundra-dwelling species [e.g., the Arctic lemming [*Dicrostonyx gulielmi*] and the ground squirrel [*Spermophilus* (*U.*) un-



*dulatus*] and species which nowadays inhabit steppic areas such as *S. superciliosus* and the hamsters *Cricetus cricetus* and *Cricetulus migratorius*). Steppe faunas differ from cold-stage faunas in the absence of tundra elements and the dominance of species which indicate rather arid warm climatic conditions and an open environment [e.g., the steppe lemming [*Lagurus lagurus*] and *Equus hydruntinus*]. The temperate phases (zones 2 and 3) of interglacials are characterized by species with a more southern distribution [e.g., European pond tortoise [*Emys orbicularis*], dormouse, *Hippopotamus amphibius*, the wild boar [*Sus scrofa*], and *Dama dama*]. The composition of Pleistocene interglacial faunas varies, however, especially in terms of the presence of "exotic species": *Macaca*, *Hippopotamus*, and water buffalo [*Bubalus murrensis*]. The several combinations in which these species co-occur indicate, according to von Koenigswald (1991), that the intensity of an interglacial period cannot be deduced from the presence of these exotics—that climate is apparently not the only factor controlling their immigration.

Guthrie has long argued that Pleistocene reconstruction suffers from an inadvertent application of a uniformitarian principle of vegetational control. In his view (Guthrie 1990) data from Pleistocene large mammals indicate that a very productive arid steppe existed across northern Eurasia and Alaska even at the height of the last glacial. Mammalian fossil evidence suggests that ice-free northern areas had both greater carrying capacities and greater diversity of large mammals during the Pleistocene than we see today (Storch 1969). Pleistocene mammals from the northern latitudes were not on a marginal tundra or polar desert but were able to acquire large quantities of quality forage during the summer growth season. This environment, the "mammoth steppe," was a more productive rangeland for large mammals than the natural vegetation in those areas today.

### Taphonomy and Climate

Any consideration of Palaeolithic settlement history must acknowledge that we are basing our interpretations on the very fragmentary evidence that has escaped destruction and redeposition by a large number of geological and biological forces. The evidence that we have is shaped by these natural forces as well as by sampling biases that have led to the discovery of a disproportionate number of sites in caves and in areas where there is an incentive to conduct large-scale mining. As far as these natural forces are concerned, it has been stated many times that the known Palaeolithic sites represent only the smallest fraction of the original number of sites.

An obvious factor affecting the distribution of finds in Northern Europe is the destructive influence of the glaciers themselves. Glaciers have repeatedly scoured the landscape and destroyed or redeposited sites. River and stream drainages have also reworked innumerable

sites; the wide river valleys of Northern Europe, including the Rhine, the Somme, and the Thames, were responsible for large-scale redeposition of sediments. Studies of trace minerals indicate that the major river drainages of northwestern Europe are the sources of the enormous volumes of loess that covered much of the continent in recent glacial cycles. Such large-scale movements of sediments doubtless destroyed large numbers of sites in the primary river drainages and their tributaries. Many sites were also lost to the marine transgressions of our and preceding interglacials.

This brings us to the difficult topic of identifying our climatic biases. For example, in a typical stratigraphic section through a long series of loessic deposits, one frequently observes thick yellow loesses divided by darker Bt (clay illuviation) horizons which formed during temperate climatic conditions. These darker bands are loessic sediments in which iron, manganese, and clay-sized particles have become concentrated by aqueous soil chemistry during temperate phases. The humic topsoil deposits were nearly always eroded at the close of an interglacial, leading to destruction of the surface sites formed in these temperate climatic conditions. Well-preserved sites dating to temperate periods can therefore usually be found only in travertines and lacustrine and fluvial deposits—deposits formed in "wet" environments. The generally fine-grained character of interglacial sedimentation and the associated superb state of preservation of many of these sites is a good explanation for the relative abundance of well-preserved sites from these brief periods as compared with other climatic settings. In fact, many of the well-preserved Pleistocene sites from Northern Europe are of Lower and Middle Palaeolithic age, which may be a consequence of the character of the sedimentation in the more temperate periods of this time-span.

In light of the variety of post-depositional processes that may have affected primary scatters and caused association of elements deposited in different time periods and under varying ecological settings, we will have to focus here on remains in *primary context*. This necessitates omitting the vast majority of the traces of Palaeolithic occupation. Nevertheless, we have a strong enough database to demonstrate that hominid settlement of Northern Europe was not limited to a narrow range of environmental conditions. The following pages will present some of the more important sites that document the diversity of the Pleistocene settlement of Northern Europe.

### The Palaeolithic Occupation of Northern Europe

#### THE PRE-STAGE 7 EVIDENCE

Discussing the settlement history of an area of course means identifying the earliest evidence for occupation. In the European context this is a hotly debated topic around which several congresses have been organized

in recent years (Andernach 1988: "Die erste Besiedlung Europas"; Paris 1989: "Les premiers peuplements humains de l'Europe" [Bonifay and Vandermeersch 1991]; Milan 1990: "The Earliest Inhabitants of Europe"). As Cook et al. (1982) have stated, claims for early sites must be subjected to critical evaluation concentrating on the artefactual character of the lithic assemblages and their ages. When this scrutiny is applied to the evidence from Northern Europe, there seems to be no sound evidence for occupation prior to the Middle Pleistocene. Elsewhere in Europe, only a few sites seem to be found in sediments deposited just before the Brunhes/Matuyama magnetic reversal (around 700,000 years B.P.). Examples of such sites include the open-air site Soleilhac in the Massif Central and Vallonet Cave (Alpes Maritimes). A site that has often been mentioned as a very reliable indicator of occupation just prior to the Brunhes/Matuyama boundary is Isernia la Pineta, but judging from its faunal content it must be considerably younger (von Koenigswald and van Kolfschoten n.d.). In Northern Europe the oldest convincing evidence for occupation dates to about 500,000 to 400,000 years B.P., in the later part of the Cromerian complex or, in terms of the oxygen-isotope chronology, around stages 13 to 11.

One of the earliest sites is Amej's Eartham Pit, near Boxgrove, West Sussex, England (fig. 4). This pit has been under excavation since 1984 (Roberts 1986, 1990). In the Middle Pleistocene units 3 and 4 numerous lithic remains have been found over a large area, often in primary-context concentrations and sometimes in association with bone which has been artificially modified in butchering processes. The dominant tool at Boxgrove is the biface, ovate in form and extremely well made. Conjoining studies have yielded a large number of refitted groups. The deposits in which the flint industry is present were formed through a variety of changing environmental conditions, ranging from open shoreface through intertidal lagoon to stable terrestrial land surface (Roberts 1990). The rich vertebrate fauna clearly indicates full interglacial conditions during the hominid occupation. The presence of woodland is attested to by species such as *Apodemus sylvaticus*, the dormouse *Muscardinus avellanarius*, a squirrel, *Sciurus* sp., the badger *Meles meles*, *Myotis beeksteini*, and some larger mammals. The age of the Boxgrove deposits is hotly debated, and the application of a large number of dating methods has not yielded a coherent picture. The biostratigraphical evidence, however, indicates a late Cromerian age. A correlation with minimally stage 11 or with stage 13, with an estimated age of 478,000 to 524,000 years B.P. (Shackleton and Opdyke 1976), seems most likely (Roberts 1990).

Boxgrove is, from a faunal point of view, contemporaneous with a German site still under excavation, Miesenheim 1, in the Neuwied Basin in the Middle Rhine area (Turner 1991). This site has yielded a small lithic assemblage which according to the limited pollen data was deposited at the end of an interglacial: species of the mixed-oak forest were still present, but *Pinus* and *Betula* dominated the forested environment, in which

*Abies* was also present (Boscheinen et al. 1984). The well-preserved rich vertebrate and molluscan fauna supports this interpretation, containing woodmice (*Apodemus*), dormice (*Eliomys* and *Muscardinus*), and roe deer. Biostratigraphically and on the basis of heavy-mineral studies the fauna has been correlated with the youngest interglacial of the Cromerian (Cromer IV) (van Kolfschoten 1990a), roughly 400,000–450,000 years B.P. (van Kolfschoten and Turner n.d.).

Another Middle Pleistocene interglacial locality in the Neuwied Basin is a site excavated in limnic sediments in the Kärlich clay pit. This site was located on the bank of a small lake that had formed in a depression. Pollen analysis of the sediments shows that the archaeological material was deposited in the *Carpinus*-mixed-oak-forest-*Abies* phase of an interglacial, with *Carpinus* representing 30–40% of the pollen (Kröger et al. 1988). The site is still under excavation, but so far Lower Palaeolithic artefacts have been found scattered over a large area in which tusks, molars, and bone fragments of four straight-tusked elephants have been recorded along with other mammalian species and very well-preserved wood remains (Kröger et al. 1988, Kröger 1990). The site is younger than Miesenheim 1, but its exact age is still uncertain (see van Kolfschoten and Turner n.d.). At both Miesenheim 1 and Kärlich *Abies* is present.

The famous mandible from the Grafenrain sand quarry at Mauer near Heidelberg, the oldest human fossil in Europe, was associated with a Middle Pleistocene fauna of full interglacial character, including *Dicerosaurus etruscus*, *Elephas antiquus*, and *H. amphibius*. Although the context is far from secure, its age and environmental evidence warrant mention here (cf. Cook et al. 1982).

Pollen studies have placed the "freshwater beds" at Clacton-on-Sea (Essex, England), containing the type-Clactonian industry and the Clacton "spearpoint" (cf. Oakley et al. 1977), in zone Ho 2, the early-temperate phase of the Hoxnian interglacial (Pike and Godwin 1953, Turner and Kerney 1971, Wymer 1988). Many correlations have been proposed for the Clacton sediments, but a pre-stage 7 age seems certain. During the deposition of the freshwater beds conditions were interglacial, with a mixed-oak forest including yew (*Taxus*)—from which the spear was made—and *Abies*. The occurrence of *Hedera* and *Ilex* indicates that the climate was oceanic. The fauna (see Singer et al. 1973) also testifies to interglacial conditions.

The evidence for human occupation around Lake Hoxne, the type site of the Hoxnian stage of the British Quaternary sequence, during the actual Hoxnian interglacial has to be treated with some caution (Wymer 1983), but there is much evidence for human occupation in the overlying fluvial deposits, where two Acheulean industries in primary context have been recovered (Wymer 1983). The Hoxne Lower Industry, found and excavated over nearly 300 m<sup>2</sup>, has been placed by pollen analyses in a cool phase following the Hoxnian interglacial or at least at the very end of the post-temperate zone 4 of the interglacial. The mint condition of the flints

enabled Keeley (1980) to draw inferences about their use from microwear analysis. The Lower Industry was associated with a large number of faunal remains including beaver (*Castor fiber*), giant beaver (*Trogotherium cuvieri*), *Macaca* sp., otter (*Lutra* sp.), straight-tusked elephant, horse, rhinoceros, pig, giant deer, red deer, roe deer, and aurochs/bison.

The palaeoecological evidence from the Lower Loam at Barnfield Pit, Swanscombe, is more ambiguous. Waechter's excavations revealed horizons in these deposits in which "Clactonian" artefacts occur. The finds were left on temporary land surfaces during the formation of the loam (Waechter, Newcomer, and Conway 1970). These fine-grained, silty sediments are interpreted as having accumulated in the still fresh water of a lake or a very watery fenland or marshland. Several conjoinable flakes in very fresh condition represent fragments of knapping areas to which disturbance must have been minimal. According to Roe (1981) the faunal remains from the Lower Loam are much the same as those found in the Lower Gravel, which are considered typical of the Hoxnian interglacial.

The travertine site of Bilzingsleben, 35 km north of Erfurt, Germany, is well known for having produced hominid fossils, a large assemblage of small artefacts, and a huge quantity of palaeoecological material (Mai et al. 1983, Mania, Toepfer, and Vlček 1980, Mania and Weber 1986). The absolute dates available for the important Steinrinne site display a wide range of ages, from approximately 180,000 to 400,000 years B.P. (see Mania 1988). On the basis of the faunal evidence we are probably dealing with a pre-stage 7 interglacial occupation under rather dry, continental conditions. Mai (1983) has identified 40 species among the plant remains from the site including taxa characteristic of a full interglacial mixed-oak forest. The ostracods and molluscs also point to full interglacial conditions. Fourteen percent of the gastropod fauna consists of "exotic" species that today have a Mediterranean or southern European distribution (Mania 1989). They present a picture comparable to that given by the floral and ostracod data. The well-preserved faunal remains also testify to the interglacial character of the hominid occupation. Among the micromammals, water vole (*Arvicola terrestris cantiana*), bank vole (*Clethrionomys glareolus*), and the beavers *C. fiber* and *T. cuvieri* are present. The macrofauna contains among other species straight-tusked elephant, forest rhinoceros, steppe rhinoceros, horse, boar, red deer, fallow deer, roe deer, bison, and aurochs.

On the basis of its position in the terrace stratigraphy of the Somme River in northern France, the site Cagny-l'Épinette is thought to date to around stage 9 (Tuffreau et al. 1982b, Tuffreau et al. 1986, Antoine 1990). Excavations in the fine-grained fluviatile deposits uncovered an Acheulean-type industry associated with large-mammal remains dominated by cervids and bovids. The pollen, the molluscs, and the mammals indicate temperate continental climatic conditions and a rather open mosaic environment consisting of a mix of boreal forest and steppe. Aurochs, roe deer, and horse are among the

large mammals. *A. terrestris cantiana*, *Microtus gregalis*, and *M. cf. malei* are present in the small-mammal assemblage.

Early Saalian artefacts have been recovered from deposits in the Karl Schneider quarry at Ariendorf in the Middle Rhine area. Silty deposits in the top part of Rhine Middle Terrace sediments yielded a small lithic assemblage associated with a fauna dominated by horse, woolly rhinoceros, and large bovids (Ariendorf 1), comparable to faunas recovered from loess deposits in the Neuwied Basin (Turner 1986, 1989). The large- and small-mammalian faunas indicate an open environment with herbaceous vegetation during a very cold climatic phase. Among the Ariendorf 1 small mammals ground squirrel (*S. cf. undulatus*), hamster (*C. cricetus cf. praeglacialis*), and the lemmings *D. gulielmi* and *Lemmus lemmus* are present. These species live today in either open tundra or steppe biotopes (van Kolfschoten 1990a, b). On the basis of the loess stratigraphy and the biostratigraphy of the small mammals, the site may date to the first cold phase of the Saalian (i.e., stage 8).

Evidence for relatively early "cold-period" settlement of Northern Europe also comes from a site in south-central Belgium, Mesvin 4, near the city of Mons (Cahen and Michel 1986). This site within the Mesvin terrace has yielded a rich concentration of Middle Palaeolithic artefacts and bones. Both the flints and the bones have been subjected to lateral displacement, but the large number of refitted artefacts, the freshness of the artefacts, and taphonomic study of the bones (van Neer 1986) indicate that disturbance was minimal. Mammoth, woolly rhinoceros, horse, reindeer, bison, and Arctic fox, among other species, constitute this early Saalian fauna, indicating that the hominid occupation took place in a cold and open, probably steppe-like environment.

#### THE LATER MIDDLE PLEISTOCENE

As a result of recent work on the biostratigraphy of small mammals and the application of recently developed dating techniques, an increasing number of sites has been placed in a pre-Eemian, post-Holsteinian interglacial phase, usually correlated with oxygen-isotope stage 7. This is not the place to go into detail on the dangers involved in these correlations (see Roebroeks 1988). In this context it is relevant to state that there indeed seems to be more between "the" Holsteinian and the Eemian than was formerly acknowledged (cf. Cook et al. 1982). We have seen that humans were present in Northern Europe under full interglacial conditions and probably also in colder periods in the first part of the Middle Pleistocene. Evidence from the subsequent time period yields essentially the same picture, though with considerably more data on cold-stage occupations.

Since 1980 a series of well-preserved archaeological sites has been excavated at the Maastricht-Belvédère loess and gravel pit (Roebroeks 1988). The pit is located at the southern tip of the Netherlands, in the northern zone of the European loess belt. The main find layer is



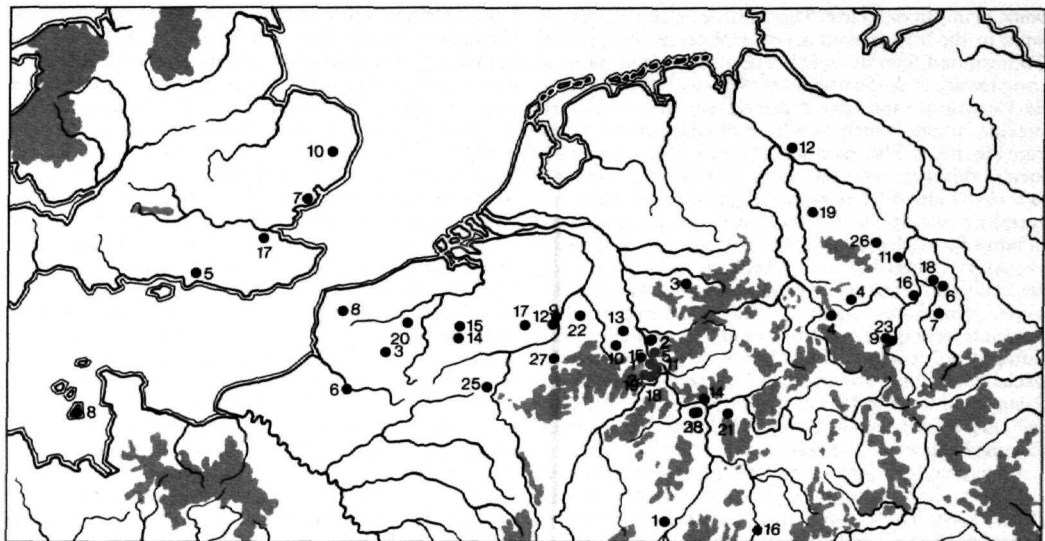


FIG. 4. Middle Pleistocene sites discussed in the text. 1, Achenheim; 2, Ariendorf; 3, Biache-Saint-Vaast; 4, Bilzingsleben; 5, Boxgrove; 6, Cagny-l'Épinette; 7, Clacton-on-Sea; 8, La Cotte de St. Brélade; 9, Ehringsdorf; 10, Hoxne; 11, Kärlich; 12, Maastricht-Belvédère; 13, Mauer; 14, Mesvin; 15, Miesenheim; 16, Stuttgart; 17, Swanscombe; 18, Tönchesberg; 19, Wannan.

situated in fine-grained fluvial deposits of the River Maas that have been dated by several independent lines of evidence [e.g., biostratigraphy, electron spin resonance [ESR], and thermoluminescence [TL]]. The interglacial Middle Palaeolithic industry, sometimes associated with faunal remains, has a TL date on burnt flints of  $250,000 \pm 22,000$  years B.P. (Huxtable 1992). The conjoining studies of the lithic assemblages have yielded spectacular results, clearly pointing to the in situ character of the assemblages. The interglacial character of the hominid occupation is well attested by the vertebrates, with *Ursus* sp., straight-tusked elephant, steppe rhinoceros, red deer, roe deer, and giant deer present together with the garden dormouse *E. quercinus*, *C. glareolus*, and *E. orbicularis*, alongside more than 70 species of molluscs, and charcoal of ash (*Fraxinus* sp.) and oak (*Quercus* sp.) (van Kolfschoten and Roebroeks 1985, Roebroeks 1988). According to the results of the malacological analyses, hominid occupation took place in the climatic optimum of the interglacial [Meijer 1985].

The travertine quarries at Ehringsdorf, near Weimar, have been producing large amounts of faunal remains for almost two centuries (Steiner 1979). The age of the lower and upper travertines has been debated over and over [e.g., Steiner 1979, Cook et al. 1982, Mania 1988]. Judging from the small mammals from both sites (van Kolfschoten 1990a) the lower travertines seem to predate the Eemian interglacial and may correlate with the

interglacial deposits at Maastricht-Belvédère. Uranium-series dating of the occupation layers with ash and charcoal in the lower travertines seems to support this stage 7 interpretation, giving ages in the range of 200,000 to 250,000 years B.P. (Brunnacker et al. 1983, Blackwell and Schwarcz 1986, Schwarcz et al. 1988). Excavations in the lower travertines revealed six in situ archaeological horizons associated with cranial and post-cranial remains of several hominid individuals. The large amounts of floral and faunal remains overwhelmingly point to fully interglacial conditions for the lower travertines. More specifically, studies of the floral remains have placed the occupation layers in the climatic optimum of this interglacial, the mixed-oak forest phase (Steiner 1979).

The travertines from Stuttgart-Bad Cannstatt are probably comparable in age to the lower travertines at Ehringsdorf. Leaves and fruits of *Buxus sempervirens* and remains of *E. orbicularis* are only two of the indications of the interglacial character of the travertines and the enclosed archaeological remains. We can furthermore mention the presence of *Quercus robur*, *C. betulus*, *Ulmus* sp., cf. *Pterocarya fraxinifolia*, and *Fraxinus excelsior* among the floral remains and *D. kirchbergensis* and *E. antiquus* among the fauna (Adam, Reiff, and Wagner 1986; Wagner 1984, 1990).

The beginning of the following cold stage of the Saale complex (oxygen-isotope stage 6) is documented at the important site of Biache-Saint-Vaast, between Arras and

Douai in northern France. This multilevel site was excavated in the seventies in a series of rescue operations (Tuffreau and Sommé 1988). The fluvial deposits of a lower terrace of the Scarpe River yielded a very rich Middle Palaeolithic industry and large amounts of faunal remains, among which two fragmentary human skulls were identified. The mammalian fauna is dominated by bovids, rhinoceroses, and bears, together representing 90% of the identified remains (Auguste 1988). The stratigraphy of the site indicates a Saalian age, and a TL date on burnt flints places the site at  $175,000 \pm 13,000$  years B.P. (Aitken, Huxtable, and Debenham 1986). Studies of the biological remains recovered from the Biache sediments (vertebrates, molluscs, and pollen) show that hominids were there just after the end of an interglacial, during "cool-temperate" or "boreal-continental" early glacial conditions, intermediate between the full interglacial conditions at Maastricht-Belvédère, Ehringsdorf, and other sites discussed above and the cold-period sites described below (cf. Tuffreau et al. 1982a).

Above the Ariendorf 1 find level mentioned above is a second archaeological level (Bosinski, Brunnacker, and Turner 1983, Turner 1986) in a Saalian loess unit, Ariendorf 2. Here a small, partially conjoinable lithic assemblage consisting of simple flakes made from local raw material was associated with a dense concentration of bone, also dominated by horse, woolly rhinoceros, and large bovids. The mammals again indicate occupation in an open environment with herbaceous vegetation during a cold climatic phase. The biostratigraphy of the assemblage points to a late Saalian age, possibly oxygen-isotope stage 6.

In the Neuwied Basin, just to the south of Ariendorf and across the Rhine, there is a group of Middle Pleistocene volcanoes whose loessic crater infillings often contain stone artefacts and humanly modified faunal remains (Bosinski et al. 1986). Although the taphonomic context of these sites is not always very clear, three of them, the Schweinskopf-Karmelenberg, Tönchesberg 1, and Wannenvolcanoes, have yielded clear evidence for occupation of a cold and open steppe environment during the penultimate glaciation (Schäfer 1990, Conrad 1990, Justus, Urmersbach, and Urmersbach 1987). Woolly rhinoceros, mammoth, reindeer, and Arctic fox are among the faunal remains at these sites, while find horizon 5 at Schweinskopf and the loess at Wannenvolcanoes and Tönchesberg 1 contained fossils of *D. gulielmi* and *L. lagurus*.

For decades the loess sections in a pit near Achenheim, in the French Upper Rhine Valley, have yielded among the many find horizons important evidence for cold-period habitation during the penultimate glaciation (Wernert 1957, Heim et al. 1982). Excavations in the 1970s uncovered new archaeological finds from "Sol 74," also dating to the penultimate glaciation (Thévenin and Sainy 1974), including the remains of mammoth, reindeer, and horse.

Another site, on the western fringe of the European "continent," also contains evidence of human occupation under cold conditions: La Cotte de St. Brélade on

Jersey (Callow and Cornford 1986). The site is on an island now, but in colder periods low sea level connected the island to the European continent. Rich occupation debris was found in the loessic matrix of late Saalian (stage 6) layer A in association with a fauna including mammoth, woolly rhinoceros, horse, and reindeer. At the base of the overlying loess deposit (layer 3) excavators found a concentration of bones of several rhinos and mammoths, associated with flint artefacts. A similar situation is seen in layer 5, where occupation debris was present at the base of a second boneheap. A loess (layer 6) deposited under extremely cold climatic conditions immediately follows the bone concentration in the stratigraphic sequence. In layer 5 as well as in layer 6, *Dicrostonyx* and *M. gregalis* are present, leading Chaline and Brochet (1986) to infer that these layers were formed when the area was covered by a cold windswept steppe, "a typical environment of the periglacial zone." Scott's (1986) study of the boneheaps indicates that the bones of each level accumulated on one occasion and were covered by loess soon after deposition. The bones must have been blanketed with loess while the bone surfaces were still in excellent condition and while some elements remained in articulation. This clearly indicates, independent of the faunal species, that human occupation occurred under cold and dry conditions immediately preceding considerable loess deposition. Scott mentions several instances of bones that must have been buried by loess while there still was muscle or ligament holding them together (p. 169).

#### THE LATE PLEISTOCENE: THE MIDDLE PALAEO-LITHIC EVIDENCE

Contrary to Gamble's (1986a) opinion on the Eemian occupation of Northern Europe, a number of sites can be placed unambiguously in this interglacial phase (fig. 5). Some are very recent discoveries in the fill of sedimentary basins that came into existence after the retreat of the Saalian glaciers in northeastern Germany. The sites in travertine deposits in this region have been known to Palaeolithic archaeologists for decades. Gamble ignores them because he thinks they date to the beginning of the Weichselian glacial—to the early-glacial, rather warm interstadials. We consider this interpretation unwarranted, unsupported by the large amount of floral and faunal data from these sites. As has been mentioned above, Zagwijn (1989) describes the vegetation of large parts of western and central Europe as a broad-leaved forest dominated by hornbeam (*Carpinus*). The climate was oceanic far into central Europe; the sea had invaded many coastal lowlands. The forest succession during the Eemian interglacial was remarkably uniform over large parts of the continent, and the vegetational gradient was very gradual. The archaeological evidence demonstrates that this environment supported a human population.

The travertine sites in the region of Weimar have been known since the end of the 18th century. Here a series of Pleistocene travertines are present, of which the Eemian are the youngest. The Taubach travertines have

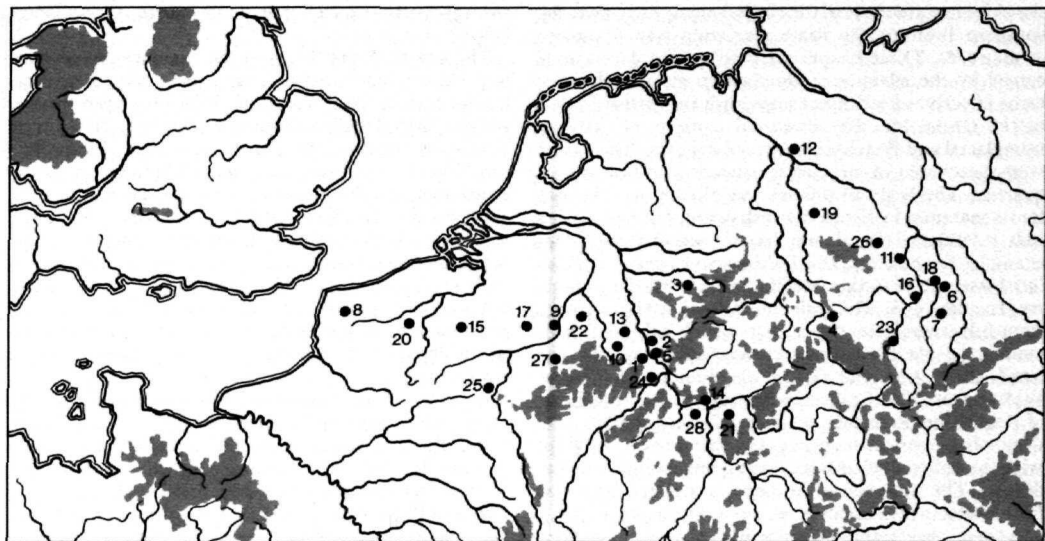


FIG. 5. Late Pleistocene sites discussed in the text. 1, Andernach; 2, Ariendorf; 3, Balve; 4, Burgtonna; 5, Gönnersdorf; 6, Grabschutz; 7, Gröbern; 8, Hallines; 9, Kanne; 10, Kartstein; 11, Königsau; 12, Lehringen; 13, Lommersum; 14, Mainz-Linsenberg; 15, Maisières; 16, Neumark-Nord; 17, Orp; 18, Rabutz; 19, Salzgitter-Lebenstedt; 20, Seclin; 21, Sprendlingen; 22, Sweikhuizen; 23, Taubach; 24, Tönchesberg; 25, Vaucelles; 26, Veltheim; 27, Verlain; 28, Wallertheim.

traditionally been assigned an Eemian age on the basis of their stratigraphical position and the enclosed floral and faunal remains. Uranium-series age determinations have confirmed this assessment (Brunnacker et al. 1983, Blackwell and Schwarcz 1986). These fully interglacial deposits, with an *E. antiquus* fauna, contain evidence for the presence of hominids including many flint artefacts and some human teeth (Behm-Blancke 1960, Toepfer 1970, Mania 1988). The neighbouring Eemian travertines of Weimar provide a similar palaeontological and archaeological picture. To the west of these two sites, the travertines of Burgtonna yield, alongside many plant remains, 102 mollusc species, indicating that the few flint artefacts found there were deposited in the climatic optimum of the Eemian interglacial (Schäfer 1909, Mania 1978, Toepfer 1978). The travertines of Veltheim, near Halberstadt, are about 100 km north of the sites just mentioned, and they too yield an interglacial fauna and floral remains characteristic of a mixed-oak forest, together with a small flint assemblage (Toepfer 1970).

The Lehringen site, in the northern lowland area of western Germany, is well known because of the find of a yew spear amidst bones of *E. antiquus* and the 25 flint artefacts associated with these faunal remains (Adam 1951, Thieme and Veil 1985). The site has aroused much speculation about the hunting (cf. Thieme and Veil 1985) and scavenging (Gamble 1987) techniques of Middle Palaeolithic hominids. Here it is important to stress

once again that the finds were present in Eem-interglacial lake sediments, deposited in a sedimentary basin that came into existence after the retreat of the Saalian glaciers. The sediments of the basin have yielded a rich fauna indicative of full interglacial conditions. Pollen analyses of the deposits indicated that human occupation took place in the lime-elm-hazel period of the Eem-interglacial forest [see Thieme and Veil 1985].

A site that shows some striking similarities to the Lehringen one has recently been excavated in a pit at Gröbern, near Leipzig, in Eem-interglacial lake deposits (Litt 1990, Erfurt and Mania 1990). The excavators recorded 195 well-preserved bones of *E. antiquus*, lying together in an area of 20 m<sup>2</sup> and forming an almost complete skeleton. Among the bones 27 flint artefacts were found. Some of the artefacts show traces of use, and the flake inventory closely resembles the one from Lehringen (Heussner and Weber 1990). The elephant bones belonged to an adult individual with an estimated age of 35 to 40 years. The skeleton displayed traces of osteitis and may be the remains of a scavenged animal. Pollen analysis of the deposits indicates that humans visited the site in the Eem interglacial, around the transition between the hazel-yew-lime period and the hornbeam period, that is, under full interglacial conditions.

The Gröbern site is situated in one of the three Eemian sedimentary basins with archaeological remains in



the older moraine belt of the Halle-Leipzig area, near the southern limit of the Saale glaciation (see Eissmann et al. 1988). These basins are confined to depressions carved by the advance of the Saalian glaciers that became effective as sediment traps with the disintegration of the glacial ice. The basin fill consists of Eemian-interglacial and Weichselian-glacial deposits. The basins were discovered in large-scale exposures in brown coal quarries. The basin of Rabutz was already well known for its mammal fossils in the 19th century. It has yielded rich interglacial floral and faunal remains (with, for example, *E. antiquus*, *D. kirchbergensis*, and *E. orbicularis*), associated with a Middle Palaeolithic flint industry (Toepfer 1958). The majority of these artefacts comes from full interglacial deposits in which oak dominates among the plant remains representing 69 species and hazel, alder, lime, and ash are also present (cf. Toepfer 1958, 1970). The Grabschutz basin, 10 km northeast of Rabutz, contained *E. antiquus*, *Cervus elaphus*, and *Capreolus capreolus* among its vertebrates, together with the pollen evidence indicating full interglacial conditions. The presence of humans is attested by a few flint artefacts (Eissmann et al. 1988, Eissmann 1990).

A very important site recently excavated is Neumark-Nord, in the valley of the Geisel, near Halle (Mania and Thomae 1989, Mania et al. 1990). From 1985 onwards an important series of archaeological occurrences has been recovered from interglacial sediments in the brown coal quarry of Neumark-Nord. The sediments were deposited in a flat basin formed by coal diapirism following the retreat of the Saalian glacier. The age of the interglacial sequence has been the subject of some discussion between those favouring an Eemian age (e.g., Eissmann 1990, Zagwijn 1991b) and proponents of an intra-Saalian interglacial age (Mania et al. 1990). In the interglacial sequence two shore levels are especially conspicuous from an archaeological point of view. Excavations of these shore regions have yielded remains—sometimes nearly complete skeletons—of large mammals (rhinoceros, giant deer, red deer, aurochs, and especially fallow deer) that are sometimes associated with Middle Palaeolithic flint assemblages dominated by unmodified flakes. The full interglacial character of the hominid occupation of the shores of a small lake is demonstrated by the abundant floral remains, with *Quercus*, *Corylus*, *Carpinus*, *Taxus*, *Tilia*, *Buxus*, and *Ilex* present. *E. orbicularis*, again, is one of the species represented in the fauna.

Recent excavations in the East Eifel (Bosinski et al. 1986) have also yielded evidence relevant to our understanding of the Late Pleistocene settlement of Northern Europe. Although many of the find horizons from the craters of the East Eifel are not in pristine contexts, finds from the Early Weichselian humic colluvium of layer 2B at Tönchesberg demonstrate occupation of the region during a period immediately following the Eemian interglacial. Here a diverse lithic assemblage is associated with a warm-period fauna including *Bos primigenius* and *D. dama* and molluscan species indicative of relatively warm but not fully interglacial conditions (Con-

ard 1990, van Kolfschoten 1990c, Roth 1990, Tinnes 1987).

The site of Wallertheim in the drainage of the Wiesbach 20 km southwest of Mainz also provides evidence for the occupation of the Rhine Valley between the Eem and the first glacial maximum of the last glacial cycle. The major excavations of 1927 and 1928 (Schmidtgen and Wagner 1929) recovered faunal remains and lithic artefacts from a thick series of stream deposits that probably post-date the Eem and pre-date the main Weichselian loess of Wallertheim (Bosinski et al. 1985b). The rich molluscan fauna from the stream deposits indicates an open landscape with cool temperatures (Brunnacker in Bosinski et al. 1985b). Bison dominates among the large mammals, with the remains of at least 59 individuals which appear to have been butchered at the site (Gaudzinski 1992).

A series of well-preserved Middle Palaeolithic find levels was excavated in the 1970s and 1980s at Seclin, near Lille in northern France (Tuffreau et al. 1985). Early Weichselian humic sediments yielded a flint industry with numerous blades. The large number of refits (Révillion 1988) indicates the primary-context character of this site. Pollen analyses showed that human occupation took place in a "prairie boisée," with pine, spruce-fir, hazel, and alder (Leroi-Gourhan, Sommé, and Tuffreau 1978). Burnt flints from the site yielded a TL age of 70,000–100,000 years B.P. (Aitken, Huxtable, and Debenham 1986).

The deposits of the Ascherleben lake at Königsau yielded a Middle Palaeolithic industry with abundant faunal remains, deposited in an early part of the Weichselian period. The fauna includes reindeer, mammoth, woolly rhinoceros, horse, and red deer, together with palaeobotanical evidence pointing to the existence of a steppic environment with scattered woods (Mania and Toepfer 1973).

In the loess pit at Ariendorf a small assemblage (Ariendorf 3) was found in a humic soil horizon at the base of the last-glacial loess. The larger-mammal remains indicate an open herbaceous environment, with mammoth, woolly rhinoceros, and horse. Temperate elements, such as those recorded at the nearby site of Tönchesberg 2B, are absent (Turner 1989).

An important site is Salzgitter-Lebenstedt, located in the southern part of the northern German plain, about 20 km southwest of Braunschweig. The site was discovered in 1952, when artefacts and faunal remains were found in digging operations 4 m below the groundwater level (Tode et al. 1953, Tode 1982). The combination of the preservation of organic remains and the presence of a rich Middle Palaeolithic flint industry was one of the reasons for further excavation in 1977 (Grote 1978, Grote and Preul 1978). The excavators are of the opinion that the archaeological material was deposited in an earlier part of the Weichselian, an interpretation supported by several  $^{14}\text{C}$  dates, which point to a minimum age of 58,000 years B.P. for the site (Grote and Thieme 1985). Bosinski (1963), however, on typological grounds, considers the site to date from an earlier glacial cycle. Dur-

ing the formation of the archaeological assemblage the site was situated at the mouth of a wide glacial valley. The environment has been described as a "grassy tundra," with scattered coniferous trees, the dwarf birch *B. nana*, and cold-adapted willows (*Salix polaris* and *S. herbacea*). In this subarctic environment reindeer, mammoth, woolly rhinoceros, bison, and horse were present. The faunal remains from the 1952 and 1977 excavations are dominated by reindeer, which represents about 80% of all identified remains (Staesche 1983).

In the German province of Nordrhein-Westfalen, the cave sites of Balve and Kartstein provide evidence for cold-period occupation during the last glaciation (Bosinski 1967). At Balve, the Mousterian layers 3 and 4 produced rich lithic industries and faunal remains of cold-period mammals. The younger layer 4 yielded bones of reindeer, mammoth, woolly rhinoceros, and Arctic fox, whereas the older Mousterian finds were associated with remains of mammoth, woolly rhinoceros, horse, reindeer, and cave bear. The finds from the Mousterian layer 3 of the Kartstein cave include abundant faunal remains of horse and reindeer (Bosinski 1967).

From a comprehensive study of over 300 sites and archaeological layers of the Middle Palaeolithic from west-central Europe, Bosinski (1967:68) concluded that the Mousterian of the region is, when faunal remains are preserved, always associated with a cold fauna that invariably includes horse, reindeer, mammoth, and woolly rhinoceros.

Evidence from numerous cave sites in southern Germany also testifies to Middle Palaeolithic adaptation to cold and open landscapes that were not very different from the ones occupied by their Upper Palaeolithic successors. Bocksteinschmiede and the adjacent cave of Bocksteinloch in the Lone Valley are two of these sites (Wetzel and Bosinski 1969). The Middle Palaeolithic find levels in the Upper Danube region contain faunal assemblages with horse, woolly rhinoceros, mammoth, musk-ox, bison, and reindeer. The microfauna also indicates cold conditions, with typical representatives of arctic tundras in association with and in some levels dominating steppe elements. The small- and large-mammal fauna furthermore indicates that in protected valleys some gallery forests may have been present in an otherwise open environment (Hahn and Kind 1991). Müller-Beck (1988) has focused on this topic, concluding that Late Middle Palaeolithic groups had adjusted to the same environmental conditions as Aurignacian ones—a *Mammuthus-Rangifer-Equus* fauna with remains of *Cervus*—and that earlier Middle Palaeolithic occupation was marked by even colder and more extreme conditions.

#### THE LATE PLEISTOCENE: THE UPPER PALAEO-LITHIC EVIDENCE

The evidence from Northern Europe indicates that anatomically modern humans were not present at the late-glacial maximum (Bosinski 1983, Otte 1990, Schmider 1990) or in the period of glacial recession immediately

following it. The Magdalenian site of Hallines in northern France (Fagnart 1984) is the only site that is placed in this period. This assessment is based on a  $^{14}\text{C}$  date of  $16,000 \pm 300$  B.P. The significance of this site, isolated in the north of the Paris Basin, and the doubts that have been raised about the archaeological significance of the  $^{14}\text{C}$  date (Hemingway 1980:251) necessitate new excavations at Hallines. Otte (1990) has placed the Magdalenian open-air sites of Kanne and Orp (Belgium) and Sweikhuizen (the Netherlands) in the same time range as Hallines. However, the TL dates for Orp indicate a much younger age (Vermeersch 1991), and the excavators of the three sites consider a Bölling age the most probable. Apart from these sites, the earliest evidence for reoccupation of the study area after the late-glacial maximum comes from two Belgian cave sites, Vauclelles and Verlainne, where a few  $^{14}\text{C}$  dates place Magdalenian levels in the Dryas I cold phase, at about 14,000–15,000 B.P. (Otte 1990). These assessments are, however, based on a very small number of  $^{14}\text{C}$  dates, and we know from sites where a substantial amount of  $^{14}\text{C}$  work has been done (e.g., Gönnersdorf [see Street 1990]) how problematic such dates can be.

The virtual absence of human occupation around the late-glacial maximum applies therefore to Belgium (Otte 1983, 1984), northwestern France, and the German Rhineland. In these areas occupation seems to have stopped for approximately 10,000 years (Bosinski 1983). Bosinski has stressed that this long period without occupation is surprising in that the climatic amelioration of the Lascaux interstadial (from around 18,000 to 17,000 B.P.) is well reflected in the form of a clear soil horizon in the loess sections of this region. The human absence in the region, however, ended only in the Bölling interstadial, with Magdalenian sites like Gönnersdorf and Andernach, both in the Neuwied Basin. The absence of occupation in and around the late-glacial maximum is of great significance here. The ecological evidence for Upper Palaeolithic occupation before and after it yields a picture that is not significantly different from what we have seen in earlier periods.

Excavations at the Aurignacian open-air site of Lommersum (near Euskirchen) uncovered a series of find levels, some of which seemed to be in primary context (Hahn 1972, 1978). Palaeoenvironmental studies (sediments, pollen, molluscs) have assigned one of these, level 2c, to a cold-dry phase. Reindeer and horse are present in this level, which has several  $^{14}\text{C}$  dates giving it an age of roughly 33,000–31,000 B.P.

The majority of the Upper Palaeolithic evidence from Belgium comes from sites excavated in the 19th century. Evidence from the few well-documented sites shows that Aurignacian occupation took place under cool-temperate, probably interstadial conditions (Otte 1979). The Perigordian data point to occupation in open steppe environments with gallery forest along watercourses. The best site is Maisières-Canal (Hainaut), with a  $^{14}\text{C}$  age of approximately 28,000 B.P. (Haesaerts and de Heinzelin 1979). According to palaeoenvironmental studies the climate was not extremely cold. Although the envi-

ronment can be described as steppic, the biotope certainly displayed some forest patches. The fauna includes bison (or aurochs), reindeer, red deer, horse, mammoth, and Arctic fox (Haesaerts and de Heinzelin 1979).

The open-air sites of Spredlingen and Mainz-Linsenberg, in the German Rheinland, are part of a series of sites testifying to the Gravettian occupation of Germany well before the late glacial maximum (Bosinski 1983). The loess site of Spredlingen, excavated in the seventies, yielded a flint industry with much conjoinable material associated with a fauna of reindeer and horse (Bosinski et al. 1985a). Mainz-Linsenberg, situated south of the city of Mainz on a high plateau, was excavated in the 1920s in a surprisingly "modern" way. The flint industry was recovered from a loess section, together with a fauna dominated by reindeer. Remains of horse, woolly rhinoceros, *Ursus* sp., and mammoth were recovered too (Hahn 1969).

Gönnersdorf and Andernach are situated in the Neuwied Basin. At the time of the resettlement of this area by Late Magdalenian groups it formed an open steppe biotope dominated by herds of large-game animals such as horse, reindeer, and bison and inhabited by the last surviving mammoth and woolly rhinoceros. (These and other species are even depicted on the engraved slate plaquettes from the two sites.) Pollen analysis has situated both sites at the end of a milder climatic oscillation with more forested conditions, interpreted as the Bölling interstadial (Leroi-Gourhan in Brunnacker 1978, Veil 1982). The animal remains recovered from Gönnersdorf and Andernach are numerous, reflecting the diversified fauna of the late-glacial steppe. The Gönnersdorf fauna—with a larger range of species than the Andernach Magdalenian level—includes horse (the dominant source of food at both sites), reindeer, Arctic fox (*Alopex lagopus*), Arctic hare (*Lepus timidus*), wolf, red fox, mammoth, woolly rhinoceros, bison (*Bison* sp.), chamois (*Rupicapra rupicapra*), saiga antelope (*Saiga tatarica*), elk, and red deer. In the small-mammal assemblage, steppe pika (*Ochotona pusilla*) and *D. gulelmi* are present (Turner 1991).

#### DISCUSSION

The data presented here provide clear evidence for the occupation of Northern Europe during fully interglacial periods beginning in the first half of the Middle Pleistocene. Certainly by the penultimate glaciation we see occupations of the cold loess steppes, while an earlier settlement of these is very probable. This should come as no surprise, given the richness of these environments, which supported a great diversity of large mammals (Guthrie 1990). In the Late Pleistocene, where we have reasonably good control over the environmental and chronological setting of sites, we see occupations in all but the harshest glacial maxima. Furthermore, after the appearance of anatomically modern humans in Northern Europe there is a significant hiatus in occupation between roughly 20,000 and 13,000 years B.P. Even after a special symposium dedicated to the archaeological rec-

ord of the last-glacial maximum and its aftermath (Soffer and Gamble 1990), no convincing evidence for occupation of Northern Europe during this period is known.

The range of environments occupied by archaic *Homo sapiens* is clearly significantly broader than a number of workers have argued in recent years. While the evidence for occupation in very cold periods is striking, the interglacial sites presented here especially undermine important elements of Gamble's (1986a, 1987) model. We have already stressed the fact that one cannot treat the Pleistocene interglacials as climatic stages identical in every respect and that spatial as well as temporal variations did occur. This having been said, we have shown that archaeological sites were formed in various interglacial settings from the early Middle Pleistocene onwards. In some cases the combined floral and faunal evidence indicated occupation in a mixed-oak forest environment, for instance, at Kärlich, Clacton, Ehringsdorf, and Neumark-Nord. At Clacton and Kärlich, the presence of *Abies* suggests that the interglacial was of particularly oceanic character.

In Gamble's model, the Eemian settlement history of Northern Europe and especially that of England is compared with the Mesolithic settlement during the early Holocene. In the former period no occupation took place, while in the latter archaeological traces are abundant. This difference is interpreted as indicating a behavioural change, the advent of modern humans with the ability to cope with extreme environments, be they glacial or full interglacial. The data discussed in this paper show that this model must be modified to account for the presence of full interglacial Eemian sites in Northern Europe, but how significant are these sites for refuting it? Do they indicate that earlier hominids were able to live in these forested environments, or are they traces of unsuccessful attempts at doing so? Compared with the number of Mesolithic scatters, we do have very few Eemian sites, and most are from travertines and lakeshore situations at the southern edge of the German lowlands. However, such a direct comparison of the scatter of Eemian sites with the carpet of Mesolithic sites is probably unwarranted. The fibres of the Mesolithic carpet are different from those of the old Eemian rug. They consist in most cases of flint scatters, with no organic remains preserved, and often can only be classified as Holocene, as Mesolithic, because our typochronology allows us to assign an age to these scatters. Typochronology, however, does not work in the Middle and Lower Palaeolithic. There is no typical Eemian scraper or last-interglacial variant of the Levallois technique. It would be better to compare patterns based on sites identified as "Mesolithic" in the same way as one identifies "Eemian" sites—with stratigraphical and palaeoenvironmental arguments. To do so we would have to ignore most of the Mesolithic scatters, and what is left is sites in very specific riverbank or, especially, lakeshore environments, for instance, the lacustrine biotopes in the fresh post-glacial landscape of Denmark (see the maps in Andersen et al. 1990). If typochronology biases Eemian site density compared with that of the



Mesolithic, differences in age also have a role in evaluating the number of sites. A complete glacial-interglacial cycle separates the two patterns. What would be left of the surface scatters and the few well-preserved buried sites after a 120,000-year glacial-interglacial cycle? Furthermore, in addition to the primary-context sites described above there are more Eemian sites in the region discussed here, for instance, at Stuttgart-Untertürkheim (Adam, Reiff, and Wagner 1986). Other candidates are one of the occupation layers in the cave of Sclayn, Belgium (Otte 1983; personal communication, 1992), and a site recently discovered in fine-grained fluvial deposits at Saint-Sauveur, in the Somme River valley in north-western France (Antoine 1990).

We conclude that Gamble's statement that the interglacial forests of Northern Europe "appear to be human deserts even though they were warm, well stocked ladders" (Gamble 1986a:369) is unwarranted. He may have been led to this opinion by the last-interglacial evidence from England, where well-documented Eemian sites are unknown (Wymer 1988). That hominids were there in earlier interglacials is beyond any doubt, and this makes the explanation of the Eemian absence an interesting research topic. A look at Quaternary geological processes might be helpful in finding an explanation. According to West (1977) and Zagwijn (1989), in the Eemian the sea level may have risen above its present height in the early temperate substage, much more quickly than in the Holocene. This early rise in sea level would have cut England off from the mainland and may explain the differences between the English and continental Eemian pollen diagrams (e.g., the apparent absence of *Picea* in England versus its commonness on the continent). In the Hoxnian the rise above present sea level was probably much later, and this may account for the similarity of vegetation in England and on the continent. Alternatively, in the Hoxnian there may have been a landbridge with the continent (West 1977), the Straits of Dover having been fully cut out only in a subsequent glaciation. The apparent absence of human occupation in the Eemian in England and the human presence in Middle Pleistocene interglacials might also be explained along these lines.

That pre-modern hominids crossed the threshold of archaeological visibility indicates, in our opinion, that we are not dealing with short-term, opportunistic colonization of interglacial environments (cf. Gamble 1987). Judging from the number of sites from interglacial as compared with "intermediate" settings, the Northern European interglacial forests seem to have presented no particular problems for colonization. From the Middle Pleistocene onwards, hominids were present in heavily forested conditions that some view as environments in which one had to plan ahead or die out (cf. Gamble 1986a, 1987), environments not very hospitable even for modern hunter-gatherers (cf. Bradley et al. 1989).

Both Gamble and Whallon assume the existence of an "Upper Palaeolithic package" that enabled humans to find a living in previously uninhabited regions. Whereas Gamble stresses differences in the archaeological signatures of Pleistocene interglacials and the Holocene in Northern Europe, Whallon considers what he calls marginal environments on a continental scale, focusing on Australia and Siberia. While the data from Northern Europe are clearly insufficient to test Whallon's model, they do suggest that his position may overstate the differences in the capabilities of archaic and modern hominids for occupying "inhospitable" environments. As we have said, in Northern Europe we see no obvious difference in the range of environments occupied by modern and pre-modern hominids. Following Hopkins et al. (1982) and Guthrie (1990), we also question whether Siberia was a homogeneous, marginal region with low densities of essential resources. However, any real test of Whallon's model must be based on a careful consideration of the topics and the regions he addresses directly, and such a test falls outside the scope of this paper.

The aim of this paper is to test some thought-provoking and elegant models with a body of up-to-date information from a well-studied region. We do this to stimulate further discussion on the topics dealt with in these models, and we hope that the resulting discussion will lead to the formulation of new models as inspiring as the ones considered here.

If we are correct in our reconstruction of a gross similarity between the ranges of settlement of modern and pre-modern hominids in Northern Europe, one cannot use the environmental data from this region to posit the existence of major behavioural differences between archaic and modern humans. Of course we do not wish to deny the existence of differences in many aspects not discussed here, such as art, stone tools, site structures, and subsistence strategies. At the same time, however, it has become increasingly clear in recent years that it is unwarranted to assume a direct link between the behavioural changes documented around the Middle/Upper Palaeolithic transition in Europe and the anatomical changes around that time (cf. Mellars 1989, Gamble 1991). Some workers have therefore emphasized the mosaic nature of cultural and biological evolution in the Pleistocene (e.g., Chase and Dibble 1990).

Coping with a wide range of environments is another element that is not limited to the behavioural repertoire of anatomically modern humans, at least in the region discussed here. This behavioural trait, considered by some researchers as typical for a specific period and a specific biological form, once again calls into question the practice of thinking about the past in terms of rigidly fixed sets of chronologically ordered behavioural characteristics.

## Comments

R. W. DENNELL

*Department of Archaeology and Prehistory,  
University of Sheffield, Sheffield S10 2TN, England.  
29 v 92*

This paper makes some very valuable points but reaches, I believe, an unsound conclusion. The main part examines Gamble's (1986a) hypothesis that pre-anatomically modern European populations could not cope with either fully interglacial or fully glacial conditions. It shows convincingly that at least some of the pre-Upper Palaeolithic sites he considered were occupied in fully interglacial conditions and provides useful additional data from new sites such as Maastricht-Bélvèdere that were unavailable to him a few years ago. As the authors state, Gamble's argument is seriously flawed in that anatomically modern populations were not the first in Europe to cope with fully interglacial conditions. They also show that, in general, pre-modern and modern groups in Northern Europe coped with similar ranges of environmental conditions, except for glacial maxima. Their case would have been strengthened by including Pontnewydd, North Wales. Although the evidence from this site is not in a primary context, it was locally derived, and it shows that hominids were exploiting decidedly cold environments at ca. 200,000 years B.P. and considerably farther north than any other European Lower Palaeolithic site (Green 1981). Conversely, their case is not weakened by such Upper Palaeolithic sites as Paviland in South Wales and Hallines in northern France, if these are confirmed as dating to around the glacial maximum. Neither seems to have been an occupation site, and both could indicate seasonal, long-distance forays into periglacial areas for ivory (Dennell 1983:132). Roebroeks et al. make a very good point in comparing the small amount of archaeological data from the Eemian with the much greater amount for the Mesolithic: that the Mesolithic is readily identifiable typologically, whereas Eemian artefacts are not, and that we need to bear in mind the effect of a full glacial-interglacial cycle on the Eemian landscape of Northern Europe. As they succinctly state, "the fibres of the Mesolithic carpet are different from those of the old Eemian rug." They might have made their point better by assessing how many Mesolithic sites have the same kind of primary data and are from the same kind of sedimentological contexts as Eemian ones. One unexpected implication of their argument is that there may be Eemian (and earlier) sites in areas that were subsequently glaciated—for example, Ireland, Denmark, southern Sweden, or northern Britain. It is intriguing to speculate how much undiagnostic surface lithic material from before the last glaciation might have been classified as Mesolithic.

Whilst I accept their inference that pre-modern hominids coped with as wide a range of habitats in Northern Europe as later, anatomically modern ones, I disagree

profoundly with their main conclusion. A "gross similarity between the ranges of settlement of modern and pre-modern hominids in Northern Europe" need not indicate behavioural similarity. It is not the range of habitats that matters so much as what people did in them. Instead of focusing on range of habitat or, for that matter, choice of prey or type of tools in isolation, one has to look at the ways societies were organised, and this means looking at several lines of evidence simultaneously and in interrelation. As I argued some years ago (Dennell 1983:79-102), there are profound differences in the way in which European Palaeolithic societies operated before and after 30,000 years ago, and I agree with Whallon and Gamble about some kind of "Upper Palaeolithic package" that enabled hominids, amongst other things, to colonise areas previously vacant. However, assessments of behavioural change have to include consideration of more than gross similarities in habitat range. Environmental factors that need to be taken into account include seasonal range, year-to-year unpredictability, predator competition, and spatial scale. Behavioural considerations include how and what foods were obtained, processed, and distributed, how seasonal shortages and gluts were overcome, how humans coped in winter with short daylight hours and cold temperatures, how groups organised themselves, how mating and information networks were maintained, demographic factors, and so on. To argue that gross similarities in habitat range imply behavioural continuity between the Eemian and the Mesolithic is like arguing that hunting strategies remained unchanged between the Riss and the late glacial simply because both involved reindeer.

ROBERT C. DUNNELL

*Department of Anthropology DH-05, University of  
Washington, Seattle, Wash. 98195, U.S.A. 26 v 92*

Archaeologists frequently talk about "arable land" as if they knew the edaphic requirements of plants long dead; the habitat preferences of equally long-dead animals are treated as matters of fact. Such characterizations are the foundations of still more elaborate social and cultural "inferences" that are regarded by many as archaeological "knowledge." In point of fact, rarely do those who talk about habitat preferences and arable land know anything about the biochemistry of ancient plants or what environmental factors effectively determined animal ranges. The bases of such inferences lie in unremarked analogies, analogies that depend upon an essentialist, typological view of reality. If the plant or animal belongs to the same species, then its behavior is the same. Nowhere is this tautological approach more pernicious than when the "kind" of hominid becomes the basis of behavioral reconstruction, a problem in archaeological inference recognized decades ago (e.g., Slotkin 1952).

For a nonspecialist like me, the great strength of Roebroeks et al.'s paper lies in its quiet and effective demonstration that this analogic approach is not necessary. One can, as they do, carry out empirical studies to deter-

mine what the habitat tolerances of hominids are at any particular time, just as one could do the biogeography of ancient plants or animals. Their realistic consideration of taphonomic issues, dating, and environmental data as well as the archaeological evidence is convincing. The happy result is that their conclusions are not entailed by their assumptions but tied to empirical knowledge. Those conclusions will change as we learn more about paleoenvironments, improve dating, and locate new materials, not because of shifting interpretive fads—a condition not apparently true of the alternative positions they criticize.

The authors do not treat their paper as a methodological paragon, and the lack of conscious structuring in these terms may account for the occasional lapse into the typological mode. These minor lapses, however, in no way impinge on their general conclusions.

CLIVE GAMBLE

*Department of Archaeology, University of Southampton, Southampton SO9 5NH, England.*

I VI 92

Three main issues are raised by this paper: (1) the significance of interglacials for understanding early hominid behaviour, (2) the environment "as the background against which social processes took place," and (3) the weighing of hominids in the scales of "humanity." Roebroeks et al. have provided a timely review of important new palaeoenvironmental and archaeological data from the Middle and Late Pleistocene of Northern Europe. Far from challenging my ecological approach to the archaeological assessment of modern humans, they have instead done us the service of refining the data relevant to my model. Moreover, viewed ecologically, these new data suggest further questions for our understanding of variability in hominid behaviour prior to 40,000 B.P.

My model of changing regional settlement histories determined by environmental structure but increasingly dominated during the later Pleistocene by more complex social relations (Gamble 1983, 1984, 1986a) stemmed from the question of how we "think primitive" (1987:95) when it comes to interpreting the earlier Palaeolithic. Do we use our imaginations (Gamble n.d. a) or strip away those aspects of an ethnographic model we feel are just unlikely or unsupported by archaeological findings [a technique used by Isaac (1978) in his earlier discussions of home bases and sharing]? My point in raising the question was the suspicion that Middle Pleistocene hominids might have been very different—that they were not "ourselves" simply waiting for a Head Start program (Binford 1992:51) to realise their potential as moderns.

My solution was to treat the ecology of settlement and colonization as an integrated expression of a number of interlinked and fundamental behaviours—mobility, time budgeting, social networks, technology, and information processing. To get at those differences in early hominid behaviour I identified the limiting environ-

mental factor facing small, mobile groups in Northern Europe as the availability of food in winter, especially if storage was not practiced. This limiting factor was relevant to all phases of an interglacial/glacial cycle in that area. In addition, when considering the archaeological evidence for settlement I was struck by the absence of occupation in what many regarded as an optimum habitat for the earlier Palaeolithic—the broadleaf forests of the last interglacial (substage 5e). Here a further limiting factor was the distribution of resources. These twin constraints—dearth and inaccessible plenty—were identified in the extremes of the last glacial/interglacial cycle (isotope stage 2 and substage 5e). These were compared with the cycles of the Middle Pleistocene (Gamble 1986a:fig. 3.12), and it was emphasised, as others have pointed out (Roberts 1984, Shackleton 1987), for how little of this 730,000-year period conditions were comparable to substage 5e, the 10,000-year-long last interglacial—conditions for most of that time ranging from temperate (but not extreme interglacial) to cold stepic (but not equivalent to the last glacial maximum of stage 2).

Since we know most about the 5e interglacial (e.g., Woillard 1978), when I compare interglacials for their settlement records I ideally want to compare the climatic extremes as established isotopically by this substage. My analyses (1984, 1986a) have attempted nothing more. Moreover, I recognize the present difficulties of dating human occupations to a comparable 10,000-year spike within interglacial stages 9 and 11, the only ones (apart from the present interglacial) with isotopic peaks comparable to 5e (Shackleton 1987). All I argued was that settlement by earlier hominids would meet the limiting factor of inaccessible plenty for about 8% of the Middle and Late Pleistocene (1987:83). A glance at the isotope curve (fig. 2) and its divisions (Gamble 1986a:fig. 3.12) shows that interglacial stages 9 and 11 will eventually be subdivided as have stages 5 (Shackleton 1969) and 7 (Andrews 1983). Most of the time covered by the Middle and Late Pleistocene will be confirmed, in my terms, as early glacial—temperate and open conditions (Gamble 1986a:table 3.5). It is these broad environmental contexts we need to address rather than the old interglacial/forest bias for explaining early hominid occupation and culture (e.g., McBurney 1950) from which I was trying to escape.

Therefore I couldn't agree more with Roebroeks et al.'s mosaic characterisation but believe they have missed the wood by concentrating on the trees—their own climatic bias. Just as the 10,000 years of our present interglacial have seen a complicated mosaic of environments, so too, we must assume, did those isotopic peaks in 5e, 9, and 11. Such a conclusion is hardly surprising when we recall that stage 11 lasted for 61,000 and stage 9 for 36,000 years while stage 5, including 5e, had a duration of 57,000 years. Therefore I agree that hominids lived in woodlands, but I reject the claim that I said or implied that they never lived in interglacial (*sensu lato*) forests. Let me make it clear: they never lived in those 8% forests.



The reason for this is a route to an understanding of social processes which Roebroeks et al. are keen to tackle but do not pursue. The very fact that the Mesolithic abundances in type-fossils that can be assigned a relative age and area while the Middle Palaeolithic lacks these (Gamble 1986a:248-49) suggests to me a change in the way lithics were used. But to infer a social process from a single category of data is to fall into the trap of presenting an irrefutable account of history; hence the settlement/colonization model which integrates the analysis of a variety of key behaviours listed above. One explanation for the absence of hominids in the older 8% of interglacials may have as much to do with their rates of re-colonization of northern areas following glacial maxima as with the specific resources (e.g., hippos) and their accessibility to hunting and foraging strategies. Therefore, the changes in social processes have to do with the ecology of range extension, itself a question of the evolutionary trajectory of a species, hominids included (Gamble n.d. b).

To demonstrate the integrative power of my settlement/colonization model, I offer the following interpretation of the data Roebroeks et al. have so usefully assembled. In my table 1 I have partitioned their two maps into four longitudinal transects, each 300 km wide. The distribution of sites in those transects highlights the concentration of prime last-interglacial sites in the east. In fact, interglacial (their definition) occupation sites are always rare in the west. This trend is apparently confirmed by a comparable eastward "migration" between the two periods of sites in "intermediate" environments. I would suggest from their small sample that significant human habitation in these northern areas during oceanic interglacials, such as 5, required at the very least the dampening effect of continentality, presumably to open up the forests and produce conditions for the biomass more comparable to those in the later intermediate environments of the west. Therefore, the absence of humans in last-interglacial England is no longer a special research question. If it is, we must also include France, Belgium, and western Germany (my transects 1-3), where the quality of last-interglacial sites

is such that they are not considered worthy of inclusion in Roebroeks et al.'s table 1.

What we seem to have here is a west-east shift in settlement in Northern Europe to escape the full effects of oceanic interglacials. It is worth remembering in this context that in the present interglacial the July isotherms are distributed zonally while in January they follow a meridional pattern. The °C isotherm differentiates between today's oceanic and continental provinces (Lockwood 1974:fig. 9.2). It roughly follows the division between transects 3 and 4 in my table, which elsewhere represents the boundary between two regional analytical units, the North-West and the North-Central (Gamble 1986a:fig. 3.1). This critical winter isotherm presumably oscillated east and west as the ocean volumes of the interglacials varied. I do not have space here to explore the possible implications of such shifts, which might have controlled the availability of frozen carcasses in local regions, foraging for which provided one possibility of surviving the winter without setting up artificial stores.

Even so, the extreme character of interglacial 5e may have provided a check to settlement in the east. While not wishing to claim undue accuracy for the U-series dates from the travertine quarries (Brunnacker et al. 1983), I find it interesting that with one exception the range for these age estimates falls outside 5e and in 5a-5d, in the less oceanic, more open phases, as my limiting-factors model would predict (Burgtonna 101,000-111,000 B.P., Taubach 110,000-116,000 B.P., Ehringsdorf [upper travertine] 114,000 B.P., Weimar 115,000-151,000 B.P.).

The question of change, that element of social process, among earlier occupations in the Middle Pleistocene can also be profitably re-examined with my interpretation of Roebroeks et al.'s data. My table 1 shows an ability to cope with intermediate and cold steppic environments in the Late Pleistocene. This coincides with the extension of population onto the Russian and Ukrainian plains during the later Middle Palaeolithic (Soffer 1989). Previously these had remained vacant during all climatic conditions not because of an absence of food but rather, as I have argued elsewhere (Stringer and Gamble 1992), because they lacked the alliances to cope with a marked increase in seasonality and risk (see also Whallon 1989). These and other geographical expansions during the later Middle Palaeolithic represent a pioneer phase (ca. 60,000-40,000 B.P.) in human global colonization that is one of the most interesting processes of range extension during the Pleistocene (Gamble n.d. b). I therefore cannot agree with Roebroeks et al. that all that is currently lacking is an adequate archaeology in Siberia or all that social process requires is *enough time* and, hey presto! the moderns will evolve and the world will be theirs. One of archaeology's great discoveries has been that world colonization was a punctuated process, largely completed in prehistory. Explaining the punctuation requires an investigation of social processes, not a recourse to gradualism to explain eventual outcomes. For example, they might have concentrated more upon

TABLE 1  
Distribution of Sites by Environmental Setting  
and Longitudinal Transect (West to East)

Period and Setting	Transect			
	1	2	3	4
Middle Pleistocene				
Interglacial	1	1	4	2
Intermediate	-	3	-	-
Cold steppic	1	1	4	-
Late Pleistocene				
Last interglacial	-	-	-	7
Intermediate	-	1	2	1
Cold steppic	-	1	8	1

TABLE 2  
*Earlier Palaeolithic Sites: A Tentative Correlation*

Stage	Site	Technology	Wooden Implements	
High-sea-level interglacials	5	Lehringen	Flake/scrapper	Yes
		Gröbern	Flake/pebble tool	
		Grabschutz	Flake/pebble tool	
	9	Taubach, Weimar, Burgtonna	Flake/pebble tool	Yes
		?Bilzingsleben	Flake/pebble tool	
		?Kärlich	Flake/pebble tool/biface	
	11	Clacton	Flake/pebble tool	Yes
		Swanscombe Lower Loam	Flake/pebble tool	Yes
		Miesenheim	Flake	
		?Barnham	Flake/pebble tool	
Low-sea-level interglacials	7	Maastricht-Belvédère	Flake/scrapper	
		Ehringsdorf	Scrapper	
		Pontnewydd	Biface/flake	
	13	Boxgrove	Biface/flake	
		High Lodge	Scrapper/flake	

the variability in their own data set. I have tried to tease out some of the possibilities for studying variation in behaviour during the earlier Palaeolithic in my table 2. I have added Swanscombe (Bowen et al. 1989), Pontnewydd (Green 1984), Barnham (Ashton n.d.), and High Lodge (Cook and Ashton 1991). While fully recognising the provisional nature of these correlations, I believe they are worth setting down if only to move the discussion to more interesting questions about the variety of earlier hominid strategies. The pattern that emerges from this admittedly selective table now needs investigating. For example, what is the relation between environment and technology? Should we follow Mithen (n.d.), who argues for environmental constraints on social learning to explain such contrasted technologies, or should we break down these patterns further to investigate possible sexual division as regards foraging, mobility, and technology (Stiner 1991, Kuhn 1991, Binford 1992)? In effect, how do we account for such long-term, recursive behavioural patterns?

I would phrase the problem as understanding the process of colonization and settlement through an ecological approach. This would serve to integrate the key behaviours, and how they varied, among hominids that probably had social premises very different to anything we know. The present interglacial broke the patterns that by and large had previously revolved with the climatic cycles, but the pattern had been fractured earlier, during the Late Pleistocene, with the spectacular bursts of colonization into Australia (Allen 1989), the Pacific (Allen and Gosden 1991), Siberia (Tseitlin 1979), and the Americas (Fagan 1987). The question which needs explaining is a very pertinent one for 1992, 500 years after Columbus: Why were humans everywhere? Understanding the evolutionary ecology of range extension is a framework for a world prehistory whereby we can begin

to leave behind us the stumps of outmoded models and theories.

PAUL GRAVES

36 New Rd., Littlehampton, West Sussex, England.  
 I5 VI 92

Roebroeks and his colleagues have assembled an impressive and important set of data, and for this they are to be congratulated. I find little else particularly satisfying in this article, which is a bit of an anticlimax after Roebroeks's previous stimulating collaboration (Roebroeks, Kolen, and Rensink 1988).

At the outset I should perhaps state that I belong to neither the multiregionalist nor the "replacementist" (if such a word exists) camp, as I hope my recent work (Graves 1991) indicates. I suspect that Roebroeks, at least, is of the multiregionalist persuasion and that this motivates the argument of this paper, particularly in its critique of Gamble (who at times appears to be the straw man of the piece).

I can agree that there is no "Upper Palaeolithic package" and that modern humans do not have a monopoly on inhabiting a "wide range of environments." But I cannot accept that there is no link between anatomical and behavioural change or that the environment is just "the background against which social processes took place." I notice that I have been lumped together with other perpetrators of ecological follies but do not resent this. Oddly, Roebroeks and his colleagues express a concern with social processes which they might have found paralleled in my own work. The difference is that I don't see environments and anatomical change as irrelevant to social process.

The authors set out to test the evidence for differences

in ecological "niche" between "archaic" and "modern" humans and find it wanting. It may well be that, in respect of Northern Europe, Gamble's particular model has inaccuracies or is incorrect. I don't have the detailed knowledge to argue with the authors on this point. But does this really constitute an adequate test of the general proposition? The authors state that their focus on Northern Europe "is warranted because of the large database of considerable time depth," but I don't think it follows that the size of the database determines the suitability of a region for testing the hypothesis. With a maritime, temperate climate, the environments of North-West Europe do not compare with the dense tropical forest which Bradley et al. (1989) are talking about, nor, indeed, is western Europe comparable with the Siberian taiga. What really constitutes an obstacle to colonisation?

At the same time, I fully agree that Siberia was not a highly marginal environment during the last glacial. With the apparent retreat of the taiga forest and lower sea levels, Siberia and Beringia were probably rich in terms of secondary biomass. But it is then even more surprising that there is no real evidence of settlement north of the Amur River before about 20,000 B.P.

The comparison between the last interglacial and the Mesolithic leaves me puzzled. Granted that a lot of evidence from the Eemian (or whatever one chooses to call it) has been lost, this doesn't prove that it was like the Holocene. The Mesolithic led to the Neolithic, and most of the forest in North-West Europe has been cut down; evidence for increasing population density in Europe extends from the Upper Palaeolithic onwards (Mellars 1989, 1991). Arguments on the basis of lack of evidence for earlier periods really don't stand up.

In the next-to-last paragraph of the paper we finally get an acknowledgement of differences in "art, stone tools, site structures, and subsistence strategies." Are we to believe that all of these changes took place without some change in the way in which humans appropriated their environment? If Roebroeks and his colleagues can't see any evidence of this in their data, perhaps they don't have the right data! What is a change in subsistence strategy if not a change in the way the environment is used? Or is this change in subsistence strategy conceived of as an entirely hermetic "social" process which takes place irrespective of the environmental "background"? I find this improbable.

The implication of this paper seems to be that the environment is irrelevant to the last 150,000 years of human evolution. I suspect that the subtext here is that indeed *there has been no evolution at all* and that the "archaic natives" were just like modern humans. Whilst it seems perfectly reasonable to me that the environment is not the *only* determinant of human behaviour, it seems quite unreasonable to claim that it is not *one* of the determinants. Whilst I respect the authors' desire to stimulate discussion, I would have wished that they had developed and expressed their own hypotheses rather than simply applying a rather unconvincing test to the hypotheses of others.

KENNETH JACOBS

Département d'anthropologie, Université de Montréal,  
CP 6128/Succ. A, Montréal, Québec, Canada H3C  
3/7. 27 v 92

At first reading, it might seem that Roebroeks et al. have simply provided us with a brief but thorough and informative summary of our current knowledge regarding the what, when, and where of the hominid presence in Middle and Upper Pleistocene Northern Europe. Their chronostratigraphic scheme, based on well-documented sequences in the southern North Sea Basin, is especially interesting, complementing as it does Kukla's (1977) review centering on Central and Eastern Europe. In addition, as they themselves note on occasion, some of what they present expands upon and revises the previous major review of European Middle Pleistocene chronology by Cook et al. (1982). Further, they have assuaged a clearly endemic, if sometimes forgivable, ignorance of the facts concerning early Paleolithic settlement in Northern Europe. This they have accomplished merely by documenting the remarkable quantity of pertinent archaeological sites. These latter include both the new sites that are discussed and the several long-known sites whose interpretation and significance change as a result of on-going research projects. Were all of these purely empirical documentary exercises the sole contribution made by this article, the authors would nonetheless merit our appreciation. However, a closer reading of this article reveals it to be far more than simple reportage. In a refreshingly understated fashion, Roebroeks et al. call into question the way in which we approach the interpretation of the paleoanthropological record.

What Hammond (1988), in his historical analysis of interpretive models in human paleontology, has called the "shadow man paradigm" can for present purposes be taken to signify the view that virtually all known paleontological or archaeological traces of an ancient hominid presence may be interpreted as representing "failed evolutionary experiments whose . . . [features] . . . had doomed them to extinction without ancestry. The search then focus[es] on the quest for our true parents, lost somehow in the shadows of prehistory" (Hammond 1988:117). The invention of the particular suite of biological and behavioral characteristics by which we ultimately will recognize our missing parents usually occurs according to a process described by Wobst (1989). Very briefly, the minimal criteria of modernity (whether in biology or in behavior or in both) are defined, and a "cone of origination" is imagined. The base of this cone is set in the present, encompassing all "modern" moderns. A series of progressively more ancient time-slices produces continuously smaller samples of "things" (fossils, archaeological sites or assemblages, and so on) that meet the minimal membership criteria for modernity. The point of origin is where no further example of a "modern modern" can be identified, all else at that point thereby becoming "other" and essentially irrelevant to the understanding of "modernity."



It seems evident to me that the conjunction of this peculiar paradigm with such a theoretically vacuous methodology has created of late an irrepressible urge in paleoanthropology to institute ever more restrictive membership criteria for the "modernity club." The inescapable result of this urge is the construction of a very shallow origination cone and the genesis of an extremely elusive "shadow man." Paleoanthropology, to an extent not seen since the days when Piltdown reigned as the measure of modernity among fossils, finds itself in the process of disinheriting its ancestors. The analysis of human mitochondrial DNA data thus has led many routinely to judge as phylogenetically irrelevant to "modern" humans any pre-200,000-years-B.P. non-African hominid fossil (e.g., Wilson and Cann 1992). Similarly, numerical cladistic analyses (e.g., Stringer 1989) serve to reduce the wealth of the hominid fossil sample to a welter of dead-end "poor relations" accompanied by a very small set of fairly recent and at least "plausible" ancestral exemplars. On the behavioral plane, after several decades of "putting a human face" on our fossil antecedents, we are now reversing that tendency. Among the many manifestations of this syndrome we find (1) that *Homo habilis* has been "demoted" to the status of an occasionally successful scavenger (e.g., Shipman 1984), (2) that *H. erectus* didn't really make either hearth or home (e.g., Binford and Ho 1985), and (3) that Neanderthals, having at least gained the ability to hunt small-to-medium-sized game (e.g., Binford 1985), remained maladaptively slow talkers and/or listeners (e.g., Lieberman 1991).

While these and similar efforts seek to "dehumanize" our pre-Upper Paleolithic predecessors, the arguments of Gamble (1986) and Whallon (1989), by "superhumanizing" some later Upper Pleistocene populations, are a reciprocal facies of the same revisionist urge. For example, because "modern" adaptive capacities are defined as being essential to the effective exploitation of dense forests and cold steppes, the "pre-modern" effective exploitation of these zones can be safely ignored as a logical impossibility. Fortunately, Roebroeks et al. have presented us with data exposing the error of such reasoning. Further, the data, although clearly not as copious as the authors would have liked, are adequate to this task. Much as Marshack (1990:488) has argued with regard to the Middle and early Upper Pleistocene evidence for hominid symbol manipulation, the *statistical rarity* of the evidence is of far less significance than the mere presence of any evidence at all.

Viewed on this level, then, the documentation of the hominid (human?) presence in Middle and Upper Pleistocene Northern Europe takes on added importance. At the absolute least, it forces a confrontation with our choice of criteria for modernity and thus with our image of the shadowy ancestor perched at the tip of our origin cone. Even more, by showing that hominids seem to have been doing quite adequately where our best models assured us they should not even be, it ought to force us to confront the very manner in which we have chosen to construct these models.

MARCEL OTTE

*Préhistoire, Université de Liège, 7 Place du XX Août, A1, B-4000 Liège, Belgium. 1 VI 92*

This paper is important because it presents ideas and data known in Europe but poorly diffused worldwide. In general, anthropological theories about early human abilities come mostly from the New World and are based on old-fashioned documentation and interpretation (and also limited to the literature on the southwest of France). The conception followed here is much broader, more critically examined, and better understood. Roebroeks et al. do not hesitate to confront the most rigid preconceptions of the late "New Archaeology." Current data on Pleistocene archaeology are difficult to obtain outside Europe because this requires knowledge of various languages and because the data have been gathered by researchers of very different, sometimes opposing schools divided by sharp political boundaries. These difficulties must first be discerned from inside, as has been done here, before the data can be used in a general theory.

On the whole, I agree with the general ideas developed in this paper. From my point of view, and judging from my own experience, there are no clear-cut differences between Middle Palaeolithic and Upper Palaeolithic behavioral abilities. I would go farther to say that physiologically Upper Palaeolithic humans were no more "modern" than their predecessors in Europe; the differences appear to be of racial rather than specific grade. This means that only differences in the kind (not the stage) of technology reflect the distinction between the two periods. In other words, again, this is no longer a question of anthropology (conceived as a biological science) but already a question of history, with movements of people and ideas within a single species.

I only regret the absence of some important sites, particularly from Britain (High Lodge), Poland (Zwollen), and Russia (Molodova). Also, there might have been more attention to technologies (the wood component is crucial) and to language. Both points are crucial to this debate in that they justify and reinforce the abandonment of the "abilities theory" now in vogue. But of course these matters will be discussed in forthcoming papers.

DEREK ROE

*Donald Baden-Powell Quaternary Research Centre, Oxford University, Oxford OX2 6PN, England. 22 V 92*

Roebroeks, Conard, and van Kolfschoten have contributed an interesting review and made some important points. They also show how the continuing uncertainties about matters of basic importance (such as chronology) still inhibit our search for a clear understanding of the earlier Palaeolithic settlement of Northern Europe. Their paper offers many fringe benefits: for example, they very usefully summarise and assess many European

sites of outstanding quality where recent work has been carried out and definitive accounts have sometimes not yet appeared in print. They provide abundant evidence to make their case that the anatomically pre-modern North Europeans could operate in many different environments, ranging from the periglacial to the fully interglacial.

We are fortunate to have so many different lines of faunal and botanical evidence on which to base conclusions about climate and environment at such sites. Pollen spectra by themselves can give misleading results: it is easy to overlook the different mechanisms and rates of progress involved in the "colonisation" or "occupation" of an area by animals, birds, insects, and humans, on the one hand, and trees and plants, on the other. The actual nature and productivity of the "mammoth steppe" is important, too, when one considers the huge weight of food required daily to sustain a single adult mammoth, let alone large herds.

I myself particularly welcome the authors' comments about "high-sea-level" and "low-sea-level" interglacials, agreeing entirely that understanding of these could greatly assist our perception of the earlier Palaeolithic of Britain. It has never been clearly established just when Britain was a peninsula of northwestern Europe and when it was a group of islands during the Pleistocene. When every allowance is made for the shortcomings of evidence derived from lithic typology and technology (and some make greater allowances than others), there are still, for example, important differences between the Acheulian industries of southeastern England and northern France which I am not in the least ashamed to find surprising if the two regions really were in uninterrupted physical contact throughout the Middle Pleistocene.

In Britain we are still far from knowing how many different interglacials are represented in the existing body of field evidence and which they are; researchers generally remain reluctant to assign oxygen-isotope stage numbers to British Lower Palaeolithic or Pleistocene sites. Thus the classic sequence at Barnfield Pit, Swanscombe, may well incorporate two or three separate cycles, or fragments of them: Lower Gravels and Lower Loam, Middle Gravels, Upper Loam. How much time is really represented there? Other important British sites, not mentioned in this article, include High Lodge, Suffolk, where artefact-bearing horizons were dramatically disturbed by glacial action presumably representing the peak of our Anglian glaciation (Cook and Ashton 1991): High Lodge is presumably at least as old as Boxgrove. Pontnewydd Cave, North Wales, is as remote as any European Lower Palaeolithic site; it has artefacts and hominid remains, admittedly not in primary context but with reasonable evidence for a stage 7 date and interesting use of local rocks to manufacture handaxes and Levallois flakes (Green 1984). I do not want to place undue emphasis on Britain, but, given that Britain marks the northwestern limit of Lower Palaeolithic penetration and is a receiving rather than a source area for

human movement, any discoveries there, especially dated ones, must have implications for regions to the south and east. The same is true of course in the Upper Palaeolithic, with which the authors are also concerned, but we usually view it the other way round, explaining the British sites in terms of the Continental ones.

In their summaries of the important North European sites, the authors have deliberately not considered in any detail the artefact assemblages, which is perfectly fair, given their stated theme. Another paper, however, might one day fill that gap for these same sites, perhaps when we are able to divide the time-scale into more units than simply "stage 7" and "pre-stage 7." It will surely be worth allowing the toolkits and any direct evidence for tool functions to cast their own light on just how the people were exploiting local resources in the widely differing geographical, climatic, and environmental situations—both as time passed during the vastness of the Lower Palaeolithic and also at any single point along that time-scale, whenever demonstrably contemporary sites in different regions of Northern Europe are available for comparison. In expressing this hope I am not yearning for what Roebroeks et al. refer to with proper dismissiveness as "typochronology": it just seems to me that the artefact assemblages form an essential aspect of any study of the range and capabilities of these "pre-modern" humans. It can only enrich any comparison of their behaviour with that of their early-modern counterparts of late Pleistocene and earliest Holocene age. Once, study of the toolkits would have been the starting point and maybe also the finishing point in any overview of the North European Palaeolithic. Such has been the progress in Quaternary studies, including prehistoric archaeology, that now we can happily wait until the gathering of other knowledge makes such a task worthwhile.

JIŘÍ SVOBODA

*Institute of Archaeology, Czechoslovak Academy of Sciences, Koliště 17/19, 66203 Brno, Czechoslovakia.*  
10 v 92

This is a valuable review of settlement history in the context of a changing Pleistocene environment in a particular region. We may imagine what a cold-steppe hunter living somewhere in France, with his range limited by the Fennoscandinavian ice sheet to the north, would have called "Northern Europe" even if this term does not really correspond to the current geographic division of the continent.

This paper shows that there is no basic difference between archaic and modern humans in their capacity for survival in risky environments. In the loess sections north of the Alps (or "Central Europe"), finds dated to the earlier Middle Pleistocene are from soils rather than from pure loess; thus, the first occupations seem to have taken place around warmer oscillations (including the end of the loess deposition which created the substrate

for interglacial pedogenesis). The first evidence of human presence in a glacial climate occurs in the early Saalian. The list of sites from the Northwest presented in this article also shows that the earliest settlements are in temperate environments, although the authors suggest environmental diversity from the beginning. Thus, it turns out that the basic adaptation to the colder climates of northern latitudes had been achieved by the Middle Pleistocene hominids, but it is possible that this process was gradual.

Another question concerns human adaptation to very extreme climates. An important point made by this article is that not even the wooded environments of interglacial maxima posed a real barrier to early occupation. It may be added that the Eemian travertine sites with important paleobotanical evidence continue in a sort of belt from Germany into the Carpathian Basin (Gánovce [Vlček 1969], Tata [Vértés et al. 1964], and others) and that culturally comparable sites appear in interglacial cave sediments and soils in Moravia (Kůlna and Předmostí). For the glacial maxima, evidence of occupation in areas adjacent to the ice sheet is scarce for both archaic and modern humans. The evidence from northern and central Europe clearly shows how the last-glacial maximum caused a retreat of the presumably well-organized modern *sapiens* population from the critical areas (Soffer and Gamble 1990).

Regional reviews based on all sites instead of just the most important ones would suggest an increase in site density around the Middle/Upper Paleolithic boundary in various parts of Europe. One of the explanations for this is the growth of the modern human population, which in uninhabited parts of the world would have presented itself as territorial expansion.

This article is stimulating with regard to several further aspects of human adaptation, although they lie beyond its scope. I believe that means of artificial protection in cold environments should be included in the analysis of adaptational processes. The dwellings of the earlier Middle Pleistocene, as far as we are able to reconstruct them, have their hearths outside, in their entry area (Přezletice and Bilzingsleben), while later and throughout the following last glaciation the hearth is in the center of the presumed hut (Bečov, stage 7). Another question is the extent to which stone tools—as the most abundant archaeological source—may reflect adaptation to radically different environments. In the area north of the Alps, the so-called small-dimensional industries always appear in interglacials (Bilzingsleben and Vértés-szőllős for the Middle Pleistocene and Taubach, Weimar, Gánovce, Onderej, and Tata for the Upper Pleistocene). Researchers have suggested various explanations, ranging from the cultural/stylistic to the adaptive. Later in the Upper Paleolithic, relationships between the lithics and environment are less visible, and multivariate data analysis by Dolukhanov, Kozłowski, and Kozłowski (1980) has shown how difficult it is to correlate typological data and environmental factors directly. The problem of art and the related archaeological evidence

demonstrating the difference in behavior of archaic and modern humans are further topics of current discussion. This difference clearly existed and could, by various social mechanisms, have enhanced modern human adaptability in risky environments. At the same time, the present article is important in showing that a regional review of sites in their environmental context does not really demonstrate the effects of such difference.

ALAIN TUFFREAU

*Centre d'Etudes et de Recherches Préhistoriques,  
Université des Sciences et Techniques de Lille,  
F-59655 Villeneuve d'Ascq CEDEX, France. 5 VI 92*

Roebroeks et al. criticize the notion that the predecessors of modern man were incapable of adapting to the very diverse palaeo-environmental conditions prevailing in Northern Europe, particularly the coldest ones. This notion has been developed notably by Gamble, who has also maintained that the interglacial periods, with their extensive forest cover, corresponded to environments that could not be exploited before the Holocene. I have taken a comparable point of view on the basis of the data for northern France, where all human occupation during the Lower and Middle Palaeolithic occurred in a temperate climatic context of early-glacial type in a wooded-steppe landscape. Roebroeks et al.'s observation of traces of human occupation during cold conditions in a steppelike environment and in typically interglacial conditions does not seem to me to contradict the view that Northern Europe was preferentially occupied during early-glacial climatic phases.

It has been well known since Compton's work at the beginning of this century that the loessic environments in which many traces of human occupation have been found do not necessarily reflect very cold conditions. In fact, in the loessic sequences chipped flints, when they are not found in secondary context in gravel beds, are often deposited in light humiferous layers or in gelified soils that testify to climatic amelioration of the "interstadial" type in a full-glacial context. At the same time, in most instances we have no clues as to the season in which the site was occupied, and we must not underestimate the possibility of seasonal migration over long distances, especially during the recent phase of the Middle Palaeolithic (the last glacial).

It must be kept in mind, however, that the richest deposits, corresponding to the most extensive occupations or to multiple visits fairly close in time, are mostly situated in an early-glacial context, whether involving fine fluvial sediments (as in the terraces of Northern Europe—Cagny, Biache, and others) or colluvial alluviums (Riencourt-les Bapaumes, Seclin, and others). It would thus appear that the climatic context of the majority of human occupations is indeed of this early-glacial type. Taking into account preservation conditions and the relative brevity of the interglacials *sensu stricto*, it is still reasonable to suggest that the wooded-



steppe landscapes characteristic of early-glacial phases in Northern Europe and favorable to the expansion of the herds of large herbivores whose bones are found in large numbers in archaeological deposits did indeed constitute the most propitious environment for the Neanderthals' way of life. They do not seem to have occupied northwestern Europe in a continuous way.

BARBARA A. VOYTEK

*Anthropological Research Facility, University of California at Berkeley, Berkeley, Calif. 94720, U.S.A.*  
13 V 92

Roebroeks, Conard, and van Kolfschoten address the argument that there were differences in ecological tolerance between premodern and modern humans by indicating that a range of environments was exploited by both and therefore differences in ecological tolerance have not been empirically demonstrated. They go about their task in a logical manner, indicating their assumptions, the limitations of the data, and so forth. Their objective appears to be a critique of Gamble and Whallon for "ecologically" based models which, according to them, "lack sufficient empirical support." I would have been happier with this article, which overall is very good, if the authors had constructed it not as criticism but more as a test of one or both of these models. (In fact, in the end, Whallon's model does not get much attention.) As a critique of ecologically based models, their own "broad-brush" approach to the Palaeolithic environment does not appear adequate for their argument, which is based on reconstructing the local ecologies of single sites. Perhaps we shall not be able to go much beyond such broad-brush approaches for the Palaeolithic, but at the same time we need to acknowledge their limitations.

Roebroeks et al. claim that their approach is not environmental determinist, but it fits that description in that the discussion of the sites in question does not include nonenvironmental factors. Before dismissing Gamble's model entirely, I would like to know more about these sites—especially Boxgrove, Miesenheim 1, and Kärlich—including the nature of the association between lithic tools and faunal remains.

Although they have demonstrated the presence of premodern humans during interglacials, Roebroeks et al. have not really proven that these humans were able to tolerate the ecological conditions posed by the Pleistocene—"tolerate" suggests "survive," which they did not, in spite of the fact that they "passed the threshold of archaeological visibility." They themselves sense this dilemma when they ask whether these Eemian and earlier interglacial sites indicate that earlier hominids were able to live in these forested environments or are simply traces of unsuccessful attempts. However, this question is not really answered but merely skirted by alluding to the different nature of tool typologies and different degree of site survival between sites from the Eemian and those from the early Holocene. In this connection, the

decision to dismiss tool typologies as something that archaeologists construct to organize sites and chronologies ignores the role that technology played during the Palaeolithic. The fact that "typochronology . . . does not work in the Middle and Lower Palaeolithic" cannot be divorced from an understanding of the behavioral differences of the archaic and modern humans. This is a matter not solely of lithic analyses but also of the real differences in Palaeolithic assemblages through time.

In sum, although the authors have managed to show "a gross similarity between the ranges of settlement of modern and pre-modern hominids in Northern Europe," it does not necessarily follow that one "cannot use the environmental data from this region to posit the existence of major behavioural differences between archaic and modern humans." It means that environmental data alone are insufficient for such arguments.

FRANCIS WENBAN-SMITH

*Department of Archaeology, University of Southampton, High Field, Southampton SO9 5NH, England.* 11 V 92

The essence of Gamble's and Whallon's ecological approaches to the settlement of higher latitudes by early humans is that the effect of the alternating cold/warm climatic cycles of the Pleistocene upon the nature, distribution, and availability of the flora and fauna is more marked in higher than in lower latitudes. Furthermore, during the more extreme periods of cold and warmth, key natural resources are only seasonally available and come in awkward packages for successful exploitation. These facts pose problems for populations of early humans attempting to colonise and settle permanently in higher latitudes during the Middle and Upper Pleistocene. Certain difficult environments, such as the fully deciduous oak forests of the interglacial climaxes or the subpolar steppes of the glacial climaxes, are only successfully colonised by human groups that have solved these problems by some means, whether cognitive, social, or technological. Gamble sees northwestern European interglacial climax woodland as presenting problems for colonisation which were not solved until the Holocene and the subpolar steppes of northwestern Europe during the final part of the Upper Pleistocene as presenting problems which were only solved by a marked intensification of alliances and support networks reflected in the more complex material culture of the Upper Palaeolithic.

Roebroeks et al. present data which suggest that, ever since the earliest occupation of northern and western Europe at approximately 500,000 B.P., a wide variety of environments associated with all stages of the glacial/interglacial cycle have been successfully inhabited. Contrary to the conclusions of Gamble, there are several instances of human occupation in fully temperate woodland environments, both in stage 5 and earlier, for instance, at the sites of Lehringen, Boxgrove, and Mie-

senheim I. Roebroeks et al. argue that, as the environmental range and ecological tolerances of the late Middle and early Upper Pleistocene inhabitants (archaics) of northwestern Europe are not significantly different from those of the late Upper Pleistocene and early Holocene inhabitants (moderns), the settlement history of northwestern Europe does not reveal any behavioural differences between archaic and modern populations.

Three main points arise from their paper. First, it is necessary to acknowledge the contribution of Bordes and Thibault (1977) and, more recently, Gamble and Whallon in providing a framework within which the traditional empirical data of the chronology and environmental context of Palaeolithic sites become relevant to "big issues" such as the ability to plan ahead or to maintain a body of cultural knowledge.

Secondly, Roebroeks et al.'s conclusions underplay the implications of their data. If one accepts Gamble's (1987:86) premise that survival in a fully interglacial woodland environment required "complex planning based on accurate and detailed information" and "intricate and minutely planned decisions that had to balance limited time and labor budgets," then the presence of such capabilities in the earliest inhabitants of northwestern Europe is strikingly relevant to the debate on differences in mental/conceptual capabilities between moderns and archaics (Mellars and Stringer 1989, Trinkaus 1989, Mellars 1990). In this debate the material cultural or inferred behavioural differences correlating with the replacement in northwestern Europe of archaic Neanderthals by moderns between 35,000 B.P. and 30,000 B.P. are often considered as representing higher orders of mental/conceptual/symbolic capability in moderns. Providing one accepts Gamble's premises on the difficulties of such environments, the success of archaics in colonising northern latitudes in the full interglacials of the Middle Pleistocene reflects similar planning and organisational capabilities to those of moderns regardless of the contrasts recognised in material culture and inferred behaviour. Furthermore, Roebroeks et al. have demonstrated not only the presence of archaics in a single type of (possibly difficult) environmental context but also the wide range of environmental contexts within which archaics lived. The significance of this flexibility is also underplayed. Whatever the difficulties of adapting to a single environmental context, the fact that archaics continued to flourish in all climatic conditions argues for a resourcefulness in managing and organising themselves in the face of occasionally quite dramatic environmental changes that is incompatible with the lack of planning and tactical depth often attributed to them (e.g., Binford 1989). Admittedly, the punctuated and climate-dependent nature of geological deposition and hence site preservation means that the continuity of early human existence in particular areas through periods of environmental change remains slightly speculative.

The third point I want to raise is that, with regard to the mystery of why Britain is apparently unoccupied during the faunal and floral bonanza of stage 5, neither

Roebroeks et al. nor Gamble fully acknowledge the possible significance of a sampling bias imposed on *in situ* Pleistocene artefactual sites by the restricted availability or occurrence of sites with suitable depositional regimes. In the following discussion I take no account of the potential for dispute over whether sites are in substage 5a, c, or e. The relevant issue is whether sites are associated with a fully interglacial environment, whichever part of stage 5 they come from. In practice, the British sites with a hippopotamus fauna which are taken to characterise stage 5 (Currant 1989) almost certainly relate to substage 5e.

The spatial and chronological distribution of British interglacial Palaeolithic sites could be reflecting the occurrence of aggrading but periodically exposed land surfaces in the Pleistocene as much as human presence. The *in situ* interglacial sites mentioned by Roebroeks et al., such as Boxgrove, Hoxne, Swanscombe, and Clacton, consist of flint artefacts knapped onto temporarily exposed land surfaces within a fluvial or estuarine aggradational regime. At sites roughly contemporary with these where the deposits still preserved accumulated within a continuously wet environment, such as Sugworth (Shotton et al. 1980), Marks Tey (Turner 1970), Nechells (Shotton and Osborne 1965), and Barford (Phillips 1976), there is no artefactual evidence included in the sedimentary sequence. Most British stage 5 sites are fluvial aggradational sequences (e.g., Trafalgar Square, Barrington, and Cudmore Grove Restaurant Site [Stuart 1982, Bridgland et al. 1989]) laid down in continuously saturated conditions or in caves (e.g., Joint Mitnor and Victoria [Sutcliffe 1960, Gascoyne, Currant, and Lord 1981]) which are not inhabited till later in the Upper Pleistocene throughout Europe.

The apparent absence of human activity in stage 5 in Britain is argued to be due to the fact that a wide enough sample of suitable geological deposits (i.e., aggrading water-lain sequences with periodically exposed dry surfaces congenial to human activity) to pick up the (always scarce) evidence of human presence has not been examined. The uniqueness of stage 5 in this respect is considered to be attributable to at least three possible factors. First, the particular physical geography and climate of Britain in stage 5 might have combined to produce fewer conveniently accessible locations in which sedimentary sequences with periodically exposed land surfaces were aggrading. Although glacial/interglacial cycles follow broadly similar patterns climatically, this is not necessarily mirrored by similar sequences of terrestrial deposition. Geographical factors such as surface topography and drift geology which affect depositional regimes are constantly changing because of the cumulative effect of previous glacial/interglacial cycles. As the British landscape developed through the Pleistocene, similar climatic regimes could have led to differing depositional regimes. Secondly, the climatic changes which followed stage 5 or occurred within its later part might have acted to destroy the artefact-bearing parts of stage 5 sedimentary sequences. And finally, if such deposits were formed, they might currently be in geographical or geo-

logical situations which are relatively inaccessible in the present-day landscape, such as beneath the modern Thames estuary.

In conclusion, Roebroeks et al. have produced a timely summary of both new work and old which picks out the data from this body of research relevant to a particular, ecological, approach to the investigation of early human behaviour. The value of the paper, besides its own conclusions, is in signposting directions for future research. On the theoretical side, a more detailed critique of the nuts and bolts of ecological reconstructions of past environments and their implications for human survival strategies is evidently required. On the practical side, Roebroeks et al. have highlighted a theoretical perspective on the Pleistocene which requires solid, empirical data on the chronology and environmental context of Pleistocene occupation in northwestern Europe. This paper serves to justify and stimulate further field research to augment and refine an extremely limited base of such data.

J. J. WYMER

*The Vines, The Street, Great Cressingham, Thetford, Norfolk IP25 6NL, England. 15 v 92*

This paper concludes that a much wider range of environments was exploited by the Palaeolithic occupants of Northern Europe during the Middle Pleistocene than is generally acknowledged. This is convincingly demonstrated by the detailed summaries of selected sites where the archaeological material can be confidently related to the contemporary climate and landscape. Sites occurring between what are probably stages 5e and 13 of the oxygen-isotope temperature scale indicate occupation in anything between full interglacial and very cold conditions, with no apparent preference for any one type of habitat. As stated, this is in contrast to the conclusions of Gamble, in particular, who not only sees a difference in ecological tolerance between archaic and modern humans but considers the environment a dominant factor in the choice of settlement, causing people to avoid full-interglacial or very cold ones. I shall restrict my comments to sites in Britain where, similarly, occupation and environment can be related with confidence, that is, mainly primary-context sites. There are some differences to those on the continent, but in my opinion this is most likely because of geographical insularity rather than human choice.

Occupation during fully interglacial periods occurs at Westbury-sub-Mendip, High Lodge (albeit in a secondary position), Boxgrove, Harkstead, Stutton, Ipswich, Clacton-on-Sea, and the earliest phase at Swanscombe. Only Boxgrove has an Acheulian industry; the remainder have non-handaxe industries. Westbury and High Lodge are considered pre-Anglian (= Elster), as is Boxgrove. Harkstead, Stutton, and Ipswich, all in East Anglia, are almost certainly of the interglacial between the Hoxnian and the Ipswichian (in the British terminology), probably stage 7. The deposits in question contain small numbers

of artifacts occasionally produced by the Levallois technique and no handaxes. The Clactonian non-handaxe industries at the type site and in the Lower Gravel and Lower Loam at Swanscombe are post-Anglian but if amino-acid dating is accepted may predate the actual interglacial of the Hoxnian stage.

The two most famous Acheulian sites in Britain, Hoxne and Swanscombe, both occur during the latter stages of interglacials (not necessarily the same one) on the basis of pollen and molluscan evidence. This implies a cooler climate and a more open landscape.

Many other sites must be ignored because they are equivocal. Unfortunately, the same must be said of the vast proportion of the Lower Palaeolithic artifacts found within river gravels in Britain. It is now generally accepted that the terrace-gravel deposits of the major rivers in lowland Britain were produced by braided streams during the non-extreme periods of glacial stages. It is impossible to be certain whether the artifacts found in them were scoured off adjacent interglacial land surfaces or represent occupations on the ever-changing gravel banks of the braided cut-and-fill river channels. The probability is that both are true, and this applies to the mammalian fauna found with them.

What is known in Britain does not contradict the findings on the continent except in one respect: the scant archaeological evidence from the apparent stage 7 interglacial and the total absence of such evidence from the Ipswichian interglacial (*sensu stricto*: Bobbitshole, Trafalgar Square, and Barrington, all with *Hippopotamus*). The most puzzling aspect is that, given that people were certainly present during the earlier episode, no major sites have been found. Were they all destroyed by the climatic events of stage 6, or do they await discovery?

There is much to recommend Gamble's hypothesis: archaic humans coming from tropical climates would at first have adapted only to interglacials, and, once they had, they would have avoided the densely forested landscapes of full interglacials and would have had no choice but to find some other place during glacial extremes. As he and others have pointed out, however, glacial and interglacial extremes are not the norm. The open landscapes of early and late interglacial zones would have facilitated hunting and movement, and undoubtedly human ingenuity soon produced clothes, fire, and shelter to combat the cold and wet. At the same time, although it would be satisfying to consider Westbury, Boxgrove, and High Lodge consistent with the cautious change of environments by ex-tropical migrants, the pattern of fully interglacial occupation seems to persist, and it would seem reasonable to conclude with Roebroeks et al. that responses to environmental factors may be exaggerated. Human behaviour is not necessarily dictated by instinctive responses to difficulties or by applied logic. Even given the simple economies of the Palaeolithic and the scantiness of the evidence, variety is to be seen. If traditional life-styles and activities could be adapted with the least effort to existing circumstances, then they were so adapted. Can any distinction be seen in the environments chosen by people using handaxes as opposed



to those who did not? All that can be said on the slender evidence so far available and recorded so clearly in this paper is that no Acheulian industries are known from fully interglacial sites after the Anglian (= Elster) glaciation. Also, the only industries that can be related to the full interglacial of the Hoxnian stage are Clactonian. This may mean something. Further discoveries may contradict it.

The high sea level of the Eemian, coupled with the widening of the English Channel, probably explains the lack of occupation during the British Ipswichian stage.

## Reply

WIL ROEBROEKS, NICHOLAS CONARD, AND THIJS VAN KOLFSCHOTEN  
*Leiden, The Netherlands. 3 VII 92*

Although science thrives on disagreement, we are, at least for the moment, pleased to see that the comments on our paper are on the whole favourable. Most of the negative remarks, moreover, are not at all related to points we wanted to make but seem to be the result of commentators' having read or, rather, "written" their own concerns and preconceptions into our text. We thank all of the commentators for taking the time to respond to our paper, for raising questions that fall outside its scope, and for mentioning ideas and additional evidence that strengthen our case. In the space available it is of course impossible to discuss all the interesting points they have made. Before briefly considering some of them, a note on a few examples of misreading of our text is in order.

Graves provides us the most extreme example when he states that we think that the environment has been "irrelevant to the last 150,000 years of human evolution" and that our paper carries "the subtext . . . that indeed *there has been no evolution at all.*" We have no problem with Dennell's profound disagreement with the conclusions he attributes to us. We certainly agree with his statement that one cannot conclude that Pleistocene hominids behaved similarly simply because they lived in broadly similar environments. Our point—stated very clearly even in the abstract—is that claims for major differences in the ecology of settlement between modern and pre-modern hominids are not borne out by the archaeological and geological record of the area under consideration. In other words, we have been trying to establish where the differences between archaics and moderns lie. Here we start from the same position as Gamble (and Binford): that "Middle Pleistocene hominids might have been very different—that they were not 'ourselves' simply waiting for a Head Start program." While we readily acknowledge that there are differences in adaptations between modern and pre-modern hominids, we are not willing to assume automatically that

we can see clear differences in all aspects of those adaptations.

We disagree with Voytek's characterization of our approach as "environmental determinist" simply for addressing the environmental background of Palaeolithic settlement. We reject the idea that earlier hominids were very limited in their environmental tolerance and try to make our point with environmental data. This does not, however, mean that we interpret human behaviour solely in terms of the environment. In stark contrast to Voytek, Graves accuses us of seeing social processes as "entirely hermetic," whereas we said only that the environment cannot be the primary determinant of human behaviour because social organizational frameworks guide the perception of and response to environmental phenomena (cf. Conkey 1987). Gamble, finally, ascribes to us a keenness to tackle social processes, and, while we wonder where he finds that in our paper, we readily acknowledge that Palaeolithic archaeology would benefit considerably from paying systematic attention to the development of more "social" approaches to the Pleistocene past—e.g., in the vein of those of Bender (1978, 1989), Conkey (1984, 1985), and Gilman (1984).

The majority of the commentators take the paper in the spirit in which it is intended and introduce new ideas and new evidence into the discussion. We are very pleased to see Gamble using our data to refine his model, but we wholeheartedly disagree with his line of reasoning and his conclusions. Before treating some of the main topics of his comment, we have to repeat what is clearly stated in the text: when we use the term "interglacial" we are always referring to what he calls the "8% interglacials." Furthermore, we have assigned sites to these by the presence of floral and/or faunal indicators of full interglacial conditions—pollen, macro-botanical remains, vertebrates, and invertebrates—and wonder what evidence Gamble would need to accept a site as pre-Holocene interglacial. We are indeed referring to situations comparable to the mixed-oak forest conditions of the last interglacial *sensu stricto*, stage 5e of the oxygen-isotope record. Gamble continues to see no occupation in these environments: hominids "never lived in those 8% forests." This is exactly what we denied and keep denying, despite his comments, in which he neglects to deal with some of the main points made in our paper. For instance, his division of our working area into four transects and his subsequent interpretation of these transects on the basis of *present* climatic patterns treats these as very static, whereas we have stressed the fact that the climate of the Eemian and "the" Holsteinian was far more oceanic than today's (cf. Zagwijn 1989). This has been inferred, for example, from the distribution patterns of Atlantic species such as *Hedera* and *Ilex*, whose eastern limit of distribution was then somewhere in western Russia, more than 1,000 km east of their present easternmost extension (cf. Zagwijn 1989, 1991; Kreeb 1983:fig. 56B). The sites in Gamble's transect 4 occurred in regions with Atlantic vegetation types in both interglacials. Following his line of reasoning, the

archaics very probably had to walk hundreds of kilometres farther eastward to shovel their share of frozen carcasses. We are also puzzled by his remark that in transect 4 continentality would have opened up the forests. Without the recent human interference with the landscape, the area of study would be covered with immense, virtually continuous broad-leaved forests, where differences in density would have been influenced mainly by non-climatic factors such as the local substrate (Kreeb 1983).

Another argument Gamble tends to ignore is our Eem-Mesolithic comparison—a very good point according to Dennell but at the same time puzzling to Graves. Our position is based on both taphonomic arguments and sampling biases (see also Wenban-Smith's comment, which supports our case), and although of course we fully acknowledge—with Voytek—the importance of the fact that typology works in the Mesolithic, that was not our principal concern here. The majority of the Eemian sites are preserved in travertines and in glacial ice-carved depressions that are present and exposed in the eastern part of the area but not in the western. In approximately 90% of the Netherlands, for example, the base of the Quaternary deposits is 100–500 m below sea-level, and accordingly Middle and Late Pleistocene deposits are too deep below the present surface to be accessible for archaeological research (cf. Zagwijn and Doppert 1978).

Furthermore, we cannot but wonder about the meaning of Gamble's table 2. Is he suggesting here that high-sea-level interglacials saw different technologies than low-sea-level ones? To push his argument a little farther, would he not, given the reasoning behind his interpretation of table 1, expect to see an east-west gradient in technology? It is very difficult to make a handaxe out of the small pebbles available at Bilzingsleben, but the material from that site does occasionally contain nice scrapers when the appropriate blanks are available. The artefactual nature of the Bilzingsleben and Kärlich wooden implements is another matter of debate.

To sum up our short reply to Gamble, we think we have presented good evidence that pre-modern people *did* live in the "8% forests," with all the implications of this that Wenban-Smith stresses for our views on their behavioural capacities. In this context, Voytek's question about distinguishing between "failed" and "successful" settlement of a region becomes interesting. We feel—as do most commentators—that the number of sites we have for most of the environmental settings of the Middle and the first half of the Late Pleistocene is sufficient to indicate successful settlement. It seems highly unlikely that archaeologists would repeatedly stumble upon the ephemeral occupations of maladaptive settlement systems in these early periods.

We agree with Tuffreau that the evidence from northern France seems to indicate a "preference" for early-glacial environments. Seen on a larger geographical scale (see Gamble's table 1), the number of primary-context interglacial sites is surprisingly high, especially in the light of the brief duration of interglacials on the Pleisto-

cene time scale (the 8% approach). Together with the evidence for cold-phase occupation, interglacial and early-glacial sites point to considerable climatological tolerance in earlier hominids.

We endorse Dennell's and Roe's pointing to the importance of the northernmost Lower Palaeolithic site in Britain, Pontnewydd Cave, but in contrast to Dennell we do not see any good evidence for cold occupation at this reworked site. The excavator himself suggests occupation under interglacial to cool-temperate conditions, possibly during oxygen-isotope stage 7 (Green 1984). The Pontnewydd archaeological remains were preserved in the interior of a cave filled in from its entrance by debris flow and thus escaped the destructive power of stage 6 glaciation, which must have scoured out most of the traces of earlier settlement in that region (Green 1984). The site is therefore a reminder of the importance of incorporating geological processes into our discussions of site distribution patterns. In this vein Wenban-Smith comes up with some alternative geological explanations for the apparent absence of Eemian traces of human occupation in Britain that we consider very useful. Any consideration of site distributions has to deal with the distorting effect of taphonomic processes if it is to avoid the simplistic and meaningless translation of distribution maps into earlier "settlement patterns."

In addition to the sites mentioned by commentators including Dennell, Otte, Roe, and Wymer (most of them, however, either not in primary context or yielding scant environmental evidence), another interglacial site has just been discovered at Schöningen, near Helmstedt in Germany, where Pleistocene deposits in a brown coal pit have been under geological study for a number of years (Urban, Thieme, and Elsner 1988, Urban et al. 1991). Hartmut Thieme is leading a salvage dig of this site, discovered in deposits of a Middle Pleistocene "8% interglacial" (personal communication, 1992).

We appreciate Svoboda's comments on the ecology of Palaeolithic settlement in Central Europe, and we look forward to a systematic analysis of the evidence from other important regions, such as the Russian Plain, already touched upon by Gamble. While we do not necessarily expect to see the same patterns everywhere in the northern latitudes, the evidence as we read it suggests that a wide range of environments was occupied by Middle Palaeolithic groups there as well. Last-interglacial sites are known from the Russian Plain (Praslov 1984; Hoffecker 1987; Hoffecker, Baryshnikov, and Potapova 1991; N. D. Praslov, personal communication, 1992), and the recent discovery of sites near Perm, about 58° north, has moved the "archaic" occupation front there some 600 km northward (Praslov, personal communication, 1992).

It seems now that proponents of the view that the ecology of settlement in the Upper Palaeolithic differs radically from that of the earlier phases must clearly demonstrate rather than simply proclaim it. The importance of this question to issues including the colonization of Siberia and the New World is clear. At a very

gross level, how are we to explain the lateness in the Pleistocene of the rapid expansion of humans over much of the earth now that the simple equation "modern humans = first ability to colonize difficult environments" does not seem to work?

We agree with Otte that it is difficult for workers to have a firm grasp of both the ideas offered by contemporary Anglo-American researchers and the archaeological evidence that, despite occasional lulls, is continuously accumulating in many languages in a myriad of journals and monographs. Although they can make for tedious reading, review articles of the kind offered here are essential to keep our debates from steering too far from that archaeological evidence.

Jacobs, Wenban-Smith, and others have seen through the laundry lists of plant and animal species of our review to recognize it as "more than simple reportage." Along with Dunnell, they touch upon a point we wanted to make when they call into question the very way in which we approach the past. We also thank Jacobs for his useful combination of Hammond's (1988) "shadow man paradigm" and Wobst's (1989) "cone of origination." We hope that our paper will help us to move away from seeing cultural evolution in terms of all-or-nothing dichotomies (Middle vs. Upper Palaeolithic, proto-cultural vs. cultural). The prehistory of the human species is doubtless composed of a complex mixture of both gradual and punctuated changes, and what we have observed in one region of the world may or may not apply in others. If there are universally valid trends in human evolution, they must be demonstrated rather than assumed.

Finally, a note of clarification: We have not challenged Gamble's ecological approach to the Pleistocene of Europe but presented evidence that leads to a different outcome within this approach than Gamble's previous work. While we disagree with elements of the work of both Gamble and Whallon, we feel very much indebted to them; without their stimulating work on this difficult question we would not have been inspired to mull over the Palaeolithic archive to evaluate some of their points of view, and without their contributions palaeo-anthropologists' discussions about these issues would all but stagnate.

## References Cited

- ADAM, K. D. 1951. Der Waldelefant von Lehringen: Eine Jagdbeute des diluvialen Menschen. *Quartär* 5:79-92.
- ADAM, K. D., W. REIFF, AND E. WAGNER. 1986. Zeugnisse des Urmenschen aus den Cannstatter Sauerwasserkalken. *Fundberichte aus Baden-Württemberg* 11:1-100.
- AITKEN, M. 1990. *Science-based dating in archaeology*. London and New York: Longman.
- AITKEN, M. J., J. HUXTABLE, AND N. C. DEBENHAM. 1986. Thermoluminescence dating in the Palaeolithic: Burned flint, stalagmitic calcite, and sediment. *Bulletin de l'Association Française pour l'Etude du Quaternaire*, suppl., 26:7-14.
- ALLEN, J. 1989. When did humans first colonize Australia? *Search* 20:149-54. [CSG]
- ALLEN, J., AND C. GOSDEN. 1991. *Report of the Lapita homeland project*. Canberra: Department of Prehistory, Research School of Pacific Studies, Australian National University. [CSG]
- ANDERSEN, S. H., A. BIETTI, C. BONSAI, ET AL. 1990. "Making cultural ecology relevant to Mesolithic research, 1: A database of 413 Mesolithic fauna assemblages," in *Contributions to the Mesolithic in Europe*. Edited by P. M. Vermeersch and P. van Peer, pp. 23-51. Leuven: Leuven University Press.
- ANDREWS, P. 1983. Short Ice Age 230,000 years ago. *Nature* 303:21-22. [CSG]
- ANTOINE, P. 1990. *Chronostratigraphie et environnement du Paléolithique du bassin de la Somme*. Publications du CERP 2.
- ASHTON, N. n.d. Interim report: The 1991 excavations at East Farm, Barnham, Suffolk. MS. [CSG]
- AUGUSTE, P. 1988. "Apports paléontologiques et archéozoologiques de l'étude de la faune des grands mammifères de Biache-St.-Vaast (Pas-de-Calais)." *Actes du Colloque international "Cultures et industries paléolithiques en milieu loessique"*, pp. 63-68. Revue Archéologique de Picardie 1-2.
- BARABAS, M., A. MANGINI, M. SARNSTEIN, AND H. STREMMER. 1988. The age of the Holstein interglaciation: A reply. *Quaternary Research* 29:80-84.
- BEHM-BIANCKE, G. 1960. Altsteinzeitliche Rastplätze im Travertingebiet von Taubach-Weimar-Ehringsdorf. *Alt-Thüringen* 4:1-246.
- BENDER, B. 1978. Gatherer-hunter to farmer: A social perspective. *World Archaeology* 10:204-22.
- . 1985. "Prehistoric developments in the American midcontinent and Brittany, Northwest France," in *Prehistoric hunter-gatherers: The emergence of cultural complexity*. Edited by T. D. Price and J. A. Brown, pp. 21-58. New York: Academic Press.
- . 1989. "The roots of inequality," in *Domination and resistance*. Edited by D. Miller, M. Rowlands, and C. Tilley, pp. 83-95. London: Unwin Hyman.
- BINFORD, L. R. 1985. Human ancestors: Changing views of their behavior. *Journal of Anthropological Archaeology* 4:292-327. [KJ]
- BINFORD, L. R. 1989. "Isolating the transition to cultural adaptations: An organizational approach," in *The emergence of modern humans: Biocultural adaptations in the later Pleistocene*. Edited by E. Trinkaus, pp. 18-41. Cambridge: Cambridge University Press.
- . 1992. Interview in: Hard evidence: New ideas about the Neanderthal's strange behaviour have set a lot of tongues wagging, by J. Fischman. *Discover* 13:44-51. [CSG]
- BINFORD, L. R., AND C. K. HO. 1985. Taphonomy at a distance: Zhoukoudian, "the cave home of Beijing Man"? *CURRENT ANTHROPOLOGY* 26:413-42. [KJ]
- BLACKWELL, B., AND H. P. SCHWARCZ. 1986. U-series analysis of the Lower Travertine at Ehringsdorf, D.D.R. *Quaternary Research* 25:215-22.
- BONIFAY, E., AND B. M. VANDERMEERSCH. Editors. 1991. *Les premiers Européens: Actes du 114e Congrès National des Sociétés Savantes (Paris, 3-9 avril 1989)*. Paris: Editions du C.T.H.S.
- BORDES, F., AND C. THIBAUT. 1977. Thoughts on the initial adaptation of hominids to European glacial climates. *Quaternary Research* 8:115-27.
- BOSCHNEINEN, J., G. BOSINSKI, K. BRUNNACKER, U. KOCH, T. VAN KOLFSCHOTEN, E. TURNER, AND B. URBAN. 1984. Ein altpaläolithischer Fundplatz bei Miesenheim, Kreis Mayen-Koblenz/Neuwieder Becken. *Archäologisches Korrespondenzblatt* 14:1-7.
- BOSINSKI, G. 1963. Eine mittelpaläolithische Formengruppe und das Problem ihrer geochronologischen Einordnung. *Eiszeitalter und Gegenwart* 14:124-40.
- . 1967. *Die mittelpaläolithischen Funde im westlichen Mitteleuropa*. Köln: Böhlau Verlag.
- . 1982. "The transition Lower/Middle Palaeolithic in north-western Germany," in *The transition from Lower to Middle Palaeolithic and the origin of modern man*. Edited by A. Ronen, pp. 165-75. British Archaeological Reports International Series 151.



- . 1983. Die jägerische Geschichte des Rheinlandes: Einsichten und Lücken. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 30:81-112.
- BOSINSKI, G., H. BOSINSKI, K. BRUNNACKER, E. CZIESLA, K. P. LANSEER, F. NEUFER, J. PREUSS, H. SPOERER, W. TILLMANN, AND B. URBAN, 1985a. Spredlingen: Ein Fundplatz des Mittleren Jungpaläolithikums in Rheinhausen. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 32:5-91.
- BOSINSKI, G., K. BRUNNACKER, K. KRUMSIEK, U. HAMBACH, W. TILLEMANN, AND B. URBAN-KITTEL. 1985b. Das Frühwürm im Lössprofil von Wallertheim/Rheinhausen. *Geologisches Jahrbuch Hessen* 113:187-215.
- BOSINSKI, G., K. BRUNNACKER, AND E. TURNER. 1983. Ein Siedlungsbefund des frühen Mittelpaläolithikums von Ariendorf, Kreis Neuwied. *Archäologisches Korrespondenzblatt* 17:419-27.
- BOSINSKI, G., K. KRÖGER, J. SCHÄFER, AND E. TURNER. 1986. Altsteinzeitliche Siedlungsplätze auf den Osteifel-Vulkanen. *Jahrbuch Römisch-Germanischen Zentralmuseums Mainz* 33:97-130.
- BOWEN, D. Q., S. HUGHES, G. A. SYKES, AND G. H. MILLER. 1989. Land-sea correlations in the Pleistocene based on isoleucine epimerization in non-marine molluscs. *Nature* 340:49-51. [csc]
- BRADLEY, R. C., G. HEAD, M. JENIKE, B. OWEN, R. RECHTMAN, AND E. ZECHENTER. 1989. Hunting and gathering in tropical rain forest: Is it possible? *American Anthropologist* 91:59-82.
- BRIDGLAND, D. R., P. ALLEN, A. P. CURRANT, P. L. GIBBARD, A. M. LISTER, R. C. PREECE, J. E. ROBINSON, A. J. STUART, AND A. J. SUTCLIFFE. 1989. Report of Geologists' Association field meeting in north-east Essex, May 22nd-24th, 1987. *Proceedings of the Geologists' Association* 99:315-33. [FW]
- BRUNNACKER, K. Editor. 1978. *Geowissenschaftliche Untersuchungen in Gönnersdorf*. [Der Magdalenen: Fundplatz Gönnersdorf, 4.] Wiesbaden: Franz Steiner Verlag.
- BRUNNACKER, K., K.-D. JÄGER, G. J. HENNIG, AND J. PREUSS. 1983. Radiometrische Untersuchungen zur Datierung mitteleuropäischer Travertinvorkommen. *Ethnographische-Archäologische Zeitschrift* 24:217-66.
- CAHEN, D., AND J. MICHEL. 1986. Le site paléolithique moyen ancien de Mesvin IV (Hainaut, Belgique). *Bulletin de l'Association Française pour l'Etude Quaternaire*, suppl., 26:89-102.
- CALLOW, P., AND J. M. CORNFORD. Editors. 1986. *La Cotte de St. Brélade, Jersey: Excavations by C. B. M. McBurney 1961-1978*. Norwich: Geo Books.
- CHALINE, J., AND G. BROCHET. 1986. "The rodent fauna," in *La Cotte de St. Brélade, Jersey: Excavations by C. B. M. McBurney 1961-1978*. Edited by P. Callow and J. M. Cornford, pp. 139-44. Norwich: Geo Books.
- CHASE, P. G., AND H. L. DIBBLE. 1990. On the emergence of modern humans. *CURRENT ANTHROPOLOGY* 31:58-59.
- CONARD, N. J. 1990. Tönchesberg and its position in the Paleolithic prehistory of northern Europe. Ph.D. diss., Yale University, New Haven, Conn.
- CONKEY, M. W. 1984. "To find ourselves: Art and social geography of prehistoric hunter-gatherers," in *Past and present in hunter-gatherer studies*. Edited by C. Schrire, pp. 201-27. New York: Academic Press.
- . 1985. "Ritual communication, social elaboration, and the variable trajectories of Paleolithic material culture," in *Prehistoric hunter-gatherers: The emergence of cultural complexity*. Edited by T. D. Price and J. A. Brown, pp. 299-323. Orlando: Academic Press.
- . 1987. "Interpretive problems in hunter-gatherer studies: Some thoughts on the European Upper Paleolithic," in *The Pleistocene Old World: Regional perspectives*. Edited by O. Soffer, pp. 63-77. New York: Plenum Press.
- COOK, J., AND N. ASHTON. 1991. High Lodge, Mildenhall. *Current Archaeology* 11(3):133-38. [csc]
- COOK, J., C. B. STRINGER, A. P. CURRANT, H. P. SCHWARZ, AND A. G. WINTLE. 1982. A review of the chronology of the European Middle Pleistocene hominid record. *Yearbook of Physical Anthropology* 25:19-65.
- CURRANT, A. P. 1989. The Quaternary origins of the modern British mammal fauna. *Biological Journal of the Linnean Society* 38:23-30. [FW]
- DE JONG, J. 1988. Climatic variability during the past three million years, as indicated by vegetational evolution in northwest Europe and with emphasis on data from the Netherlands. *Philosophical Transactions of the Royal Society, London B* 318:603-17.
- DENNEL, R. W. 1983. *European economic prehistory: A new approach*. London: Academic Press. [RWD]
- DOLUKHANOV, P., J. K. KOZŁOWSKI, AND S. K. KOZŁOWSKI. 1980. *Multivariate analysis of Upper Palaeolithic and Mesolithic stone assemblages*. Warszawa-Kraków: Uniwersytet Jagielloński and PWN. [js]
- EISSMANN, I. Editor. 1990. *Die Eemwarmzeit und die frühe Weichseleiszeit im Saale-Elbe-Gebiet: Geologie, Paläontologie, Paläökologie*. Altenburger Naturwissenschaftliche Forschungen 5.
- EISSMANN, L., T. LITT, T. WEBER, D. HENTSCHEL, R. WIMMER, AND S. WANS. 1988. Bemerkenswerte Eemvorkommen in glaziären Becken der Saaleeiszeit südlich der "Warthe-Linie" im Raum Halle. *Leipziger Zeitschrift für Geologische Wissenschaften* 16:543-55.
- ERFURT, J., AND D. MANIA. 1990. "Zur Paläontologie des jungpleistozänen Waldelefanten von Gröbern, Kreis Gräfenhainichen," in *Neumark-Gröbern: Beiträge zur Jagd des mittelpaläolithischen Menschen*. Edited by D. Mania et al., pp. 215-44. Berlin: Deutscher Verlag der Wissenschaften.
- FAGAN, B. 1987. *The great journey*. London: Thames and Hudson. [csc]
- FAGNART, J.-P. 1984. Le Paléolithique supérieur dans le nord de la France et le bassin de la Somme. Ph.D. diss., University of Lille, Lille, France.
- FRENZEL, B. 1985. Die Umwelt des Menschen im Eiszeitalter. *Quartär* 35:367-33.
- GAMBLE, C. S. 1983. "Culture and society in the Upper Palaeolithic of Europe," in *Hunter-gatherer economy in prehistory*. Edited by G. N. Bailey, pp. 201-11. Cambridge: Cambridge University Press. [csc]
- . 1984. "Regional variation in hunter-gatherer strategy in the Upper Pleistocene of Europe," in *Hominid evolution and community ecology*. Edited by R. Foley, pp. 237-60. London: Academic Press. [csc]
- . 1986a. *The Palaeolithic settlement of Europe*. Cambridge: Cambridge University Press.
- . 1986b. "Hunter-gatherers and the origin of states," in *States in history*. Edited by J. A. Hall, pp. 22-47. Oxford: Basil Blackwell.
- . 1987. "Man the shoveler: Alternative models for Middle Pleistocene colonization and occupation in northern latitudes," in *The Pleistocene Old World: Regional perspectives*. Edited by O. Soffer, pp. 81-98. New York: Plenum Press.
- . 1991. Raising the curtain on modern human origins. *Antiquity* 65:412-17.
- . n.d. a. Figures of fun: Theories about cavemen. *Archaeological Review from Cambridge*. In press. [csc]
- . n.d. b. *Timewalkers: A prehistory of global colonization*. London: Penguin Books. In press. [csc]
- GASCOYNE, M., A. P. CURRANT, AND T. LORD. 1981. Ipswichian fauna of Victoria Cave and the marine palaeoclimatic record. *Nature* 294:652-54. [FW]
- GAUDZINSKI, S. 1992. Wisentjäger in Wallertheim: Zur Taphonomie einer mittelpaläolithischen Freilandfundstelle in Rheinhausen. Ph.D. diss., University of Cologne, Cologne, Germany.
- GILMAN, A. 1984. "Explaining the Upper Paleolithic revolution," in *Marxist perspectives in archaeology*. Edited by M. Spriggs, pp. 154-66. Cambridge: Cambridge University Press.
- GOODENOUGH, W. H. 1990. Evolution of the human capacity for belief. *American Anthropologist* 92:597-612.
- GRAVES, P. 1991. New models and metaphors for the Neanderthal debate. *CURRENT ANTHROPOLOGY* 32:513-41.
- GREEN, H. S. 1981. The first Welshman: Excavations at Pontnewydd. *Antiquity* 55:184-95. [RWD]

- . 1984. *Pontnewydd Cave, a Lower Palaeolithic hominid site in Wales: The first report*. Cardiff: National Museum of Wales.
- GROTE, K. 1978. Salzgitter-Lebenstedt: Die Grabung 1977 in der mittelpaläolithischen Freilandstation. *Archäologisches Korrespondenzblatt* 8:155-62.
- GROTE, K., AND F. PREUL. 1978. Der mittelpaläolithische Lagerplatz in Salzgitter-Lebenstedt: Vorbericht über die Grabung und die geologische Untersuchung 1977. *Nachrichten aus Niedersachsens Urgeschichte* 47:77-106.
- GROTE, K., AND H. THIEME. 1985. "Eiszeitliche Jagdtiere und Jäger der mittleren Altsteinzeit am Beispiel der Freilandstation Salzgitter-Lebenstedt," in *Ausgrabungen in Niedersachsen: Archäologische Denkmalpflege 1979-1984*. Edited by K. Wilhelm, pp. 51-57. Stuttgart.
- GUTHRIE, R. D. 1990. *Frozen fauna of the mammoth steppe: The story of Blue Babe*. Chicago and London: University of Chicago Press.
- HAESAERTS, P., AND J. DE HEINZELIN. 1979. *Le site paléolithique de Maisières-Canal*. Brugge: De Tempel.
- HAHN, J. 1969. Gravettien-Freilandstationen im Rheinland: Mainz-Linsenberg, Koblenz-Metternich und Rhens. *Bonner Jahrbücher* 169:44-87.
- . 1972. Eine jungpaläolithische Feuerstelle aus Lommersum, Kreis Euskirchen. *Rheinische Ausgrabungen* 11:56-80.
- . 1978. "Lommersum, Gem. Weilerswist, Kr. Euskirchen," in *Alt- und Mittelsteinzeitliche Fundplätze des Rheinlandes*. Edited by S. Veil, pp. 93-95. Köln and Bonn: Rudolf Habelt Verlag.
- HAHN, J., AND C.-J. KIND. 1991. *Urgeschichte in Oberschwaben und der mittleren Schwäbischen Alb*. Stuttgart.
- HAMMOND, M. 1988. "The shadow man paradigm in paleo-anthropology, 1911-1945," in *Bones, bodies, and behavior*. Edited by G. W. Stocking, Jr., pp. 117-37. Madison: University of Wisconsin Press. [XJ]
- HEIM, J., J. P. LAUTRIDOU, J. MAUCORPS, J. J. PUISSÉGUR, J. SOMMÉ, AND A. THÉVENIN. 1982. Achenheim: Une séquence-type des loess du Pléistocène moyen et supérieur. *Bulletin de l'Association Française pour l'Etude Quaternaire* 19:147-59.
- HEINRICH, W.-D. 1987. Neue Ergebnisse zur Evolution und Biostatigraphie von *Arvicola* (Rodentia, Mammalia) im Quartär Europas. *Zeitschrift für Geologische Wissenschaften* (Berlin) 15:389-406.
- HEMINGWAY, M. F. 1980. *The initial Magdalenian in France*. British Archaeological Reports 90.
- HEUSSNER, K.-U., AND T. WEBER. 1990. "Das archäologische Inventar-Speziale Untersuchungen zu den Feuersteinartefakten," in *Neumark-Gröbern: Beiträge zur Jagd des mittelpaläolithischen Menschen*. Edited by D. Mania et al., pp. 225-36. Berlin: Deutscher Verlag der Wissenschaften.
- HOFFECCKER, J. F. 1987. Upper Pleistocene loess stratigraphy and Paleolithic site chronology on the Russian Plain. *Gearchaeology* 2:359-84.
- HOFFECCKER, J. F., G. BARYSHNIKOV, AND O. POTAPOVA. 1991. Vertebrate remains from the Mousterian site of Il'skaya I (northern Caucasus, U.S.S.R.): New analysis and interpretation. *Journal of Archaeological Science* 18:113-47.
- HOPKINS, D. M., J. V. MATTHEWS, C. E. SCHWEGER, AND S. B. YOUNG. Editors. 1982. *Paleoecology of Beringia*. New York and London: Academic Press.
- HUKTABLE, J. 1992. Further thermoluminescence dates for burnt flints from Maastricht-Belvédère and a finalised thermoluminescence age for the Unit IV Middle Palaeolithic sites. *Mededelingen Rijks Geologische Dienst*. In press.
- JESSEN, K., AND V. MILTHERS. 1928. Stratigraphical and palaeontological studies of interglacial freshwater deposits in Jutland and north-west Germany. *Denmarks Geologiske Undersøgelse* 2 [48].
- JUSTUS, A., K. H. URMERSBACH, AND A. URMERSBACH. 1987. Mittelpaläolithische Funde vom Vulkan "Wannen" bei Ochtingen, Kreis Mayen-Koblenz. *Archäologisches Korrespondenzblatt* 17:409-17.
- KEELEY, L. H. 1980. *Experimental determination of stone tool uses: A microwear analysis*. Chicago and London: University of Chicago Press.
- KELLY, R. L. 1983. Hunter-gatherer mobility strategies. *Journal of Anthropological Research* 39:277-306.
- KREEB, K.-H. 1983. *Vegetationskunde: Methoden und Vegetationsformen unter Berücksichtigung ökosystemischer Aspekte*. Stuttgart: Verlag Eugen Ulmer.
- KRÖGER, K. 1990. "Die archäologischen Funde in der Tongrube Kärlich," in *Rheingeschichte zwischen Mosel und Maas, DEUQUA-Führer 1*. Edited by W. Schirmer, pp. 75-80. Hannover: Deutsche Quartärvereinigung.
- KRÖGER, K., P. VAN DEN BOOGAARD, F. BITTMANN, AND E. TURNER. 1988. Der Fundplatz Kärlich-Seeufer: Neue Untersuchungen zum Altpaläolithikum im Rheinland. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 35:111-35.
- KUHN, S. L. 1991. "Unpacking" reduction: Lithic raw material economy in the Mousterian of west-central Italy. *Journal of Anthropological Archaeology* 10:76-106. [CSC]
- KUKLA, G. J. 1977. Pleistocene land-sea correlations I: Europe. *Earth-Science Reviews* 13:307-74. [XJ]
- LEROI-GOURHAN, A., J. SOMMÉ, AND A. TUFFREAU. 1978. Weichselien et Paléolithique moyen de Seclin. *Bulletin de l'Association Française pour l'Etude Quaternaire* 15:69-80.
- LIEBERMAN, P. 1991. *Uniquely human*. Cambridge: Harvard University Press. [XJ]
- LINKE, G., O. KATZENBERG, AND R. GRÜN. 1985. Description and ESR dating of the Holsteinian interglacial. *Quaternary Science Reviews* 4:319-31.
- LITT, T. 1990. "Stratigraphie und Ökologie des eeminterglazialen Waldelefanten: Schlachtplatzes von Gröbern, Kreis Gräfenhainichen," in *Neumark-Gröbern: Beiträge zur Jagd des mittelpaläolithischen Menschen*. Edited by D. Mania et al., pp. 193-208. Berlin: Deutscher Verlag der Wissenschaften.
- LOCKWOOD, J. G. 1974. *World climatology*. London: Edward Arnold. [CSC]
- MC BURNEY, C. B. M. 1950. The geographical study of the older Palaeolithic stages in Europe. *Proceedings of the Prehistoric Society* 16:163-83. [CSC]
- MAI, D. 1983. "Die fossile Pflanzenwelt des interglazialen Travertins von Bilzingsleben (Kreis Artern, Thüringen)," in *Bilzingsleben II*, by D.-H. Mai et al. pp. 45-129. Berlin: Deutscher Verlag der Wissenschaften.
- MAI, D.-H., D. MANIA, T. NOTZOLD, V. TOEPPER, E. VLČEK, AND W. HEINRICH. 1983. *Bilzingsleben II*. (Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle 36.) Berlin: Deutscher Verlag der Wissenschaften.
- MANIA, D. 1978. Die Molluskenfauna aus den Travertinen von Burgtonna in Thüringen. *Quartärpaläontologie* 3:69-85.
- . 1988. Le paléolithique ancien et moyen de la région de la Saale et de l'Elbe, Allemagne de l'Est. *L'Anthropologie* 92:1051-92.
- . 1989. Stratigraphie, Ökologie und Paläolithikum des Mittel- und Jungpleistozäns im Elbe-Saalegebiet. *Ethnographische Archäologische Zeitschrift* 30:636-63.
- MANIA, D., AND M. THOMAE. 1989. Neumark-Nord in the valley of the Geisel near Halle/S. (GDR): A new Middle Palaeolithic site with killing and butchering areas. *Anthropologie* 27:1-4.
- MANIA, D., M. THOMAE, T. LITT, AND T. WEBER. Editors. 1990. *Neumark-Gröbern: Beiträge zur Jagd des mittelpaläolithischen Menschen*. (Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle 43.) Berlin: Deutscher Verlag der Wissenschaften.
- MANIA, D., AND V. TOEPPER. 1973. *Königsauve*. (Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle 26.) Berlin: Deutscher Verlag der Wissenschaften.
- MANIA, D., V. TOEPPER, AND E. VLČEK. 1980. *Bilzingsleben I*. (Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle 32.) Berlin: Deutscher Verlag der Wissenschaften.
- MANIA, D., AND T. WEBER. 1986. *Bilzingsleben III*. (Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle 39.) Berlin: Deutscher Verlag der Wissenschaften.
- MARSHACK, A. 1990. "Early hominid symbol and evolution of the human capacity," in *The emergence of modern humans*.

- Edited by P. Mellars, pp. 57-98. Edinburgh: Edinburgh University Press. [KJ]
- MEIJER, T. 1985. The pre-Weichselian nonmarine molluscan fauna from Maastricht-Belvèdère (southern Limburg, the Netherlands). *Mededelingen Rijks Geologische Dienst* 39:75-103.
- MELLARS, P. 1989. Major issues in the emergence of modern humans. *CURRENT ANTHROPOLOGY* 30:349-85.
- . Editor. 1990. *The emergence of modern humans*. Edinburgh: Edinburgh University Press. [FW]
- MELLARS, P. A., AND C. B. STRINGER. Editors. 1989. *The human revolution: Behavioural and biological perspectives on the origin of modern humans*. Edinburgh: Edinburgh University Press. [FW]
- MEYER, K.-J. 1974. Pollenanalytische Untersuchungen und Jahresschichtenzählungen an der holstein-zeitlichen Kieselgur von Hetendorf. *Geologisches Jahrbuch A* 21:87-105.
- MINC, L. 1986. Scarcity and survival: The role of oral tradition in mediating subsistence crises. *Journal of Anthropological Archaeology* 5:39-113.
- MITHEN, S. n.d. Chronology and society during the Middle Pleistocene: Hominid group size, social learning, and industrial variability. MS. [CSG]
- MÜLLER, H. 1974. Pollenanalytische Untersuchungen und Jahresschichtenzählungen an der holstein-zeitlichen Kieselgur von Munster-Breloch. *Geologisches Jahrbuch A* 21:107-40.
- MÜLLER-BECK, H. J. 1988. "The ecosystem of the 'Middle Paleolithic' (late Lower Paleolithic) in the Upper Danube region," in *Upper Pleistocene prehistory of western Eurasia*. Edited by H. L. Dibble and A. Montet-White, pp. 233-53. Philadelphia: University Museum.
- OAKLEY, K. P., P. ANDREWS, L. H. KEELEY, AND J. D. CLARK. 1977. A reappraisal of the Clacton spearpoint. *Proceedings of the Prehistoric Society* 43:13-30.
- OTTE, M. 1979. *Le Paléolithique supérieur ancien en Belgique*. Bruxelles: Musées Royaux d'Art et d'Histoire.
- . 1983. Le Paléolithique de Belgique: Essai de synthèse. *L'Anthropologie* 87:291-321.
- . 1984. "Paléolithique supérieure en Belgique," in *Peuples chasseurs de la Belgique préhistorique dans leur cadre naturel*. Edited by D. Cahen and P. Haesaerts, pp. 157-79. Bruxelles: Institut Royal des Sciences Naturelles de Belgique.
- . 1990. "The northwestern European plain around 18,000 BP," in *The World at 18,000 BP*, vol. 1, *High latitudes*. Edited by O. Soffer and C. Gamble, pp. 54-68. London: Unwin Hyman.
- PFEIFFER, J. E. 1982. *The creative explosion*. New York: Harper and Row.
- PHILLIPS, L. 1976. Pleistocene vegetational history and geology in Norfolk. *Philosophical Transactions of the Royal Society of London B* 275:215-86. [FW]
- PIKE, K., AND H. GODWIN. 1953. The interglacial at Clacton-on-Sea. *Quarterly Journal of the Geological Society, London* 108:261-72.
- PRASLOV, N. D. 1984. "Geologicheskie i paleogeograficheskie ramki paleolita i razvitiie prirodnoi sredny na territorii SSSR i problemy khronologii i periodizatsii paleolita," in *Paleolit SSSR*. Edited by P. I. Boriskovskij, pp. 17-40. Moscow: Nauka.
- RÉVILLION, S. 1988. "Répartition spatiale et technologie de l'industrie lithique du gisement paléolithique moyen de Seclin (Nord): Première approche." *Actes du Colloque international "Cultures et industries lithiques en milieu loessique,"* pp. 157-62. Revue Archéologique de Picardie 1-2.
- ROBERTS, M. B. 1986. Excavation of the Lower Paleolithic site at Amey's Earham Pit, Boxgrove, West Sussex: A preliminary report. *Proceedings of the Prehistoric Society* 52:215-45.
- . 1990. "Amey's Earham Pit, Boxgrove," in *SEQS: The Cromer Symposium, Norwich 1990, Field excursion guide book*. Edited by C. Turner, pp. 62-77. Cambridge.
- ROBERTS, N. 1984. "Pleistocene environments in time and space," in *Hominid evolution and community ecology*. Edited by R. Foley, pp. 25-54. London: Academic Press. [CSG]
- ROE, D. A. 1981. *The Lower and Middle Paleolithic periods in Britain*. London: Routledge and Kegan Paul.
- ROEBROEKS, W. 1988. *From find scatters to early hominid behaviour: A study of Middle Palaeolithic riverside settlements at Maastricht-Belvèdère (the Netherlands)*. *Analecta Praehistorica Leidensia* 21.
- ROEBROEKS, W., J. KOLEN, AND E. RENSINK. 1988. Planning depth, anticipation, and the organisation of Middle Palaeolithic technology: The "archaic natives" meet Eve's descendants. *Helinium* 27(1):17-34. [FG]
- ROTH, G. 1990. "Die Mollusken von Tönchesberg 2," in *Rheingeschichte zwischen Mosel und Maas, DEUQUA-Führer 1*. Edited by W. Schirmer. Hannover: Deutsche Quartärvereinigung.
- SARNTHEIN, M., H. E. STREMMER, AND A. MANGINI. 1986. The Holsteinian interglaciation: Time-stratigraphic position and correlation to stable-isotope stratigraphy of deep-sea sediments. *Quaternary Research* 26:283-98.
- SCHÄFER, H. E. 1909. Über die pleistozäne Säugetierfauna und die Spuren des paläolithischen Menschen von Burgtonna in Thüringen. *Zeitschrift Deutschen Geologischen Gesellschaft* 61:445-69.
- SCHÄFER, J. 1990. Der altsteinzeitliche Fundplatz auf dem Vulkan Schweinskopf-Karmelenberg. Ph.D. diss., University of Cologne, Cologne, Germany.
- SCHMIDER, B. 1990. "The Last Pleniglacial in the Paris Basin (22,500-17,000 BP)," in *The world at 18,000 BP*, vol. 1, *High latitudes*. Edited by O. Soffer and C. Gamble, pp. 41-53. London: Unwin Hyman.
- SCHMIDTGEN, O., AND W. WAGNER. 1929. Eine altpaläolithische Jagdstelle bei Wallertheim in Rheinhessen. *Notizblatt des Vereins für Erdkunde und der Hessischen Geologischen Landesanstalt zu Darmstadt* 11:3-41.
- SCHWARZ, H. P., AND R. GRÜN. 1988. Comment on: The Holsteinian interglaciation: Time-stratigraphic position and correlation to stable-isotope stratigraphy of deep-sea sediments, by M. Sarnthein, H. E. Stremmer, and A. Mangini. *Quaternary Research* 29:75-79.
- SCHWARZ, H. P., R. GRÜN, A. G. LATHAM, D. MANIA, AND K. BRUNNACKER. 1988. The Bilzingsleben archaeological site: New dating evidence. *Archaeometry* 30:5-17.
- SCOTT, K. 1986. "The large mammal fauna," in *La Cotte de St. Brelade, Jersey: Excavations by C. B. M. McBurney 1961-1978*. Edited by P. Callow and J. M. Cornford, pp. 109-38. Norwich: Geo Books.
- SHACKLETON, N. J. 1969. The last interglacial in the marine and terrestrial record. *Proceedings of the Royal Society of London B* 174:135-54. [CSG]
- . 1987. Oxygen isotopes, ice volume, and sea level. *Quaternary Science Reviews* 6:183-90.
- SHACKLETON, N. J., AND N. D. OPDYKE. 1973. Oxygen-isotope and paleomagnetic stratigraphy of equatorial Pacific core V28-238: Oxygen-isotope temperatures and ice volumes on a  $10^3$  and a  $10^6$  year scale. *Quaternary Research* 3:39-55.
- . 1976. Oxygen-isotope and paleomagnetic stratigraphy of Pacific core V28-239, late Pliocene to latest Pleistocene. *Memoirs of the Geological Society of America* 145:449-64.
- SHIPMAN, P. 1984. Scavenger hunt. *Natural History* 93(4):20-27. [KJ]
- SHOTTON, F. W., A. S. GOUDIE, D. J. BRIGGS, AND H. A. OSMASTON. 1980. Cromerian interglacial deposits at Sugworth, near Oxford, England, and their relation to the Plateau drift of the Cotswolds and the terrace sequence of the Upper and Middle Thames. *Philosophical Transactions of the Royal Society of London B* 289:55-86. [FW]
- SHOTTON, F. W., AND P. J. OSBORNE. 1965. The fauna of the Hoxnian interglacial deposits of Nechells, Birmingham. *Philosophical Transactions of the Royal Society of London B* 248:353-78. [FW]
- SINGER, R., J. J. WYMER, B. G. GLADFELTER, AND R. G. WOLFF. 1973. Excavations of the Clactonian industry at the Golf Course, Clacton-on-Sea, Essex. *Proceedings of the Prehistoric Society* 39:6-74.
- SLOTKIN, J. S. 1952. Some basic problems in prehistory. *Southwestern Journal of Anthropology* 8:442-43. [RCD]



- SOFFER, O. 1989. "The Middle to Upper Palaeolithic transition on the Russian Plain," in *The human revolution*. Edited by P. Mellars and C. Stringer, pp. 714-42. Edinburgh: Edinburgh University Press. [csc]
- . 1991. Ancestral lifeways in Eurasia: The Middle and Upper Paleolithic records. Paper delivered at the conference "Origin of Anatomically Modern Humans," 14th Annual Spring Systematic Symposium, Field Museum of Natural History, Chicago, Ill., May 11.
- SOFFER, O., AND C. GAMBLE, Editors. 1990. *The world at 18,000 BP*. Vol. 1. *High latitudes*. London: Unwin Hyman.
- STAESCHE, U. 1983. "Aspects of the life of Middle Paleolithic hunters in the N.W. German Lowlands based on the site Salzgitter-Lebenstedt," in *Animals and archaeology*, vol. 1. Edited by J. Clutton-Brock and C. Grigson, pp. 173-81. British Archaeological Reports 163.
- STEINER, W. 1979. *Der Traverthin von Ehringsdorf und seine Fossilen*. Wittenberg: Ziemsen.
- STINER, M. C. 1991. The faunal remains at Grotta Guattari: A taphonomic perspective. *CURRENT ANTHROPOLOGY* 32:103-17. [csc]
- STORCH, G. 1969. Über Kleinsäuger der Tundra und Steppe in jungeszeitlichen Eulengewässern aus dem nordhessischen Löss. *Natur und Museum* 99:541-51.
- STREET, M. 1990. Guide to Late Glacial archaeological sites buried by pumice of the Laacher See eruption: Archaeometry excursion, 8.04.90, unpublished guide. Neuwied: Forschungsstelle Altsteinzeit Monrepos.
- STRINGER, C. B. 1989. "The origin of early modern humans," in *The human revolution*. Edited by P. Mellars and C. Stringer, pp. 232-44. Princeton: Princeton University Press. [xj]
- STRINGER, C., AND C. GAMBLE. 1992. *The Neanderthal world*. London: Thames and Hudson. In press. [csc]
- STUART, A. J. 1982. *Pleistocene vertebrates in the British Isles*. London and New York: Longman. [fw]
- SUTCLIFFE, A. J. 1960. Joint Mitnor cave, Buckfastleigh. *Transactions of the Torquay Natural History Society* 13[1]:1-26. [fw]
- THÉVENIN, A., AND J. SAINTY. 1974. Une aire de dépeçage préhistorique à Achenheim. *Archéologie* 74:68-69.
- THIEME, H., AND S. VEIL. 1985. Neue Untersuchungen zum eemzeitlichen Elefanten-Jagdplatz Lehringen, Ldkr. Verden. *Die Kunde*, n.s., 36:11-58.
- TINNES, J. 1987. Ausgrabungen auf dem Tönchesberg bei Kruf, Kreis Mayen-Koblenz. *Archäologisches Korrespondenzblatt* 17:419-27.
- TODE, A. 1982. *Der altsteinzeitliche Fundplatz Salzgitter-Lebenstedt 1: Archäologischer Teil*. Köln and Wien: Böhlau Verlag.
- TODE, A., F. PREUL, AND A. KLEINSCHMIDT ET AL. 1953. Die Untersuchung der paläolithischen Freilandstation von Salzgitter-Lebenstedt. *Eiszeitalter und Gegenwart* 3:144-220.
- TOEPFER, V. 1958. Steingeräte und Palökologie der mittelpaläolithischen Fundstelle Rabutz bei Halle (Saale). *Jahresschrift für Mitteldeutsche Vorgeschichte* 41-42:140-77.
- . 1970. "Stratigraphie und Ökologie des Paläolithikums," in *Periglazial-Löss-Paläolithikum im Jungpleistozän der Deutschen Demokratischen Republik*. Edited by H. Richter, G. Hasse, I. Lieberoth, and R. Ruske, pp. 329-422. Leipzig: Gotha.
- . 1978. Die Paläolithischen Funde im Traverthin von Burgtonna in Thüringen. *Quartärpaläontologie* 3:175-78.
- TRINKAUS, E. Editor. 1989. *The emergence of modern humans: Biocultural adaptations in the later Pleistocene*. Cambridge: Cambridge University Press.
- TSEITLIN, S. 1979. *Geology of the Palaeolithic of northern Asia (in Russian)*. Moscow: Nauka. [csc]
- TUFFREAU, A., A. V. MUNAUT, J. J. PUISSÉGUR, AND J. SOMMÉ. 1982a. Stratigraphie et environnement de la séquence archéologique de Biache-Saint-Vaast (Pas-de-Calais). *Bulletin de l'Association Française pour l'Etude du Quaternaire* 2-3:57-61.
- . 1982b. Stratigraphie et environnement des industries acheuléennes de la moyenne terrasse du bassin de la Somme (région d'Amiens). *Bulletin de l'Association Française pour l'Etude du Quaternaire* 19:73-81.
- TUFFREAU, A., S. RÉVILLION, J. SOMMÉ, M. J. AITKEN, J. HUXTABLE, AND A. LEROI-GOURHAN. 1985. Le gisement paléolithique moyen de Seclin (Nord, France). *Archäologisches Korrespondenzblatt* 15:131-38.
- TUFFREAU, A., J. P. BOUCHET, A. M. MOIGNE, AND A. V. MUNAUT. 1986. Les nouveaux acheuléens de la moyenne terrasse de la vallée de la Somme à Cagny-l'Épinette (Somme). *L'Anthropologie* 90:9-27.
- TUFFREAU, A., AND J. SOMMÉ, Editors. 1988. *Le gisement paléolithique moyen de Biache-Saint-Vaast (Pas-de-Calais)*. Vol. 1. *Stratigraphie, environnement, études archéologiques*. Mémoires de la Société Préhistorique Française 21.
- TURNER, C. 1970. The Middle Pleistocene deposits at Marks Tey, Essex. *Philosophical Transactions of the Royal Society of London B* 257:373-437. [fw]
- . 1975. "The correlation and duration of Middle Pleistocene interglacial periods in Northwest Europe," in *After the australopithecines*. Edited by K. W. Butzer and G. Ll. Isaac, pp. 259-308. The Hague: Mouton.
- TURNER, C., AND M. P. KERNEY. 1971. A note on the age of the freshwater beds of the Clacton Channel. *Journal of the Geological Society*, London 127:87-93.
- TURNER, C., AND R. G. WEST. 1968. The subdivision and zonation of interglacial periods. *Eiszeitalter und Gegenwart* 19:93-101.
- TURNER, E. 1986. The 1981-1983 excavations in the Karl Schneider quarry, Ariendorf, West Germany. *Bulletin de l'Association Française pour l'Etude Quaternaire*, suppl., 26:35-42.
- . 1989. Middle and Late Pleistocene macrofaunas of the Neuwied Basin region of West Germany (Rhineland-Palatine). Ph.D. diss., University of Birmingham, Birmingham, England.
- . 1991. Pleistocene stratigraphy and vertebrate faunas from the Neuwied Basin region of western Germany. *Cranium* 8:21-34.
- URBAN, B., R. LENHARD, D. MANIA, AND B. ALBRECHT. 1991. Mittelpleistozän im Tagebau Schöningen, Ldkr. Helmstedt. *Zeitschrift der Deutschen Geologischen Gesellschaft* 142:351-72.
- URBAN, B., H. THIEME, AND H. ELSNER. 1988. Biostratigraphische, quartärgeologische und urgeschichtliche Befunde aus dem Tagebau "Schöningen," Ldkr. Helmstedt. *Zeitschrift der Deutschen Geologischen Gesellschaft* 139:123-54.
- VAN KOLFSCHOTEN, T. 1990a. The evolution of the mammal fauna in the Netherlands and the Middle Rhine area (western Germany) during the late Middle Pleistocene. *Mededelingen Rijks Geologische Dienst* 43[3]:1-69.
- . 1990b. "Die Kleinsäuger von Ariendorf," in *Rheingeschichte zwischen Mosel und Maas, DEUQUA-Führer 1*. Edited by W. Schirmer, pp. 117-20. Hannover: Deutsche Quartärvereinigung.
- . 1990c. "Die Kleinsäuger von Tönchesberg 2," in *Rheingeschichte zwischen Mosel und Maas, DEUQUA-Führer 1*. Edited by W. Schirmer. Hannover: Deutsche Quartärvereinigung.
- VAN KOLFSCHOTEN, T., AND W. ROEBROEKS, Editors. 1985. *Maastricht-Belvédère: Stratigraphy, palaeoenvironment, and archaeology of the Middle and Late Pleistocene deposits*. Mededelingen Rijks Geologische Dienst 39 (= *Analecta Praehistorica Leidensia* 18).
- VAN KOLFSCHOTEN, T., AND E. TURNER. n.d. "Early Middle Pleistocene mammalian faunas from Kärlich and Miesenheim I and their biostratigraphical implications." *Proceedings of the SEQS Cromer Symposium* 1990. In press.
- VAN NEER, W. 1986. La fauna saaliennne du site paléolithique moyen de Mesvin IV (Hainaut, Belgique). *Bulletin de l'Association Française pour l'Etude Quaternaire*, suppl., 26:103-11.
- VEIL, S. 1982. Der späteszeitliche Fundplatz Andernach, Martinsberg. *Germania* 60:391-424.
- VERMEERSCH, P. 1991. TL dating of Magdalenian sites at Orp, Belgium. *Notae Praehistoricae* 10:27-29.
- VÉRTÉS, L., ET AL. 1964. *Tata: Eine mittelpaläolithische Traverthinsiedlung in Ungarn*. Budapest: Akadémiai Kiadó. [js]

- VLČEK, E. 1969. *Neandertaler der Tschechoslowakei*. Praha: Academia. [js]
- VON KOENIGSWALD, W. 1991. Exoten in der Grosssäuger-Fauna des letzten Interglazials von Mitteleuropa. *Eiszeitalter und Gegenwart* 41:70-84.
- VON KOENIGSWALD, W., AND T. VAN KOLFSCHOTEN. n.d. "The *Mimomys-Arvicola* boundary and the enamel thickness quotient (SDQ) of *Arvicola* as stratigraphic markers in the Middle Pleistocene." *Proceedings of the SEQS Cromer Symposium* 1990. In press.
- WAECHTER, J. D'A, M. H. NEWCOMER, AND B. W. CONWAY. 1970. Swanscombe 1970. *Proceedings of the Royal Anthropological Institute*, pp. 43-64.
- WAGNER, E. 1984. Ein Jagdplatz des *Homo erectus* im mittelpleistozänen Travertin in Stuttgart-Bad Cannstatt. *Germania* 62:229-67.
- . 1990. Ökonomie und Ökologie in den altpaläolithischen Travertinfundstellen von Bad Cannstatt. *Fundberichte aus Baden-Württemberg* 15:1-15.
- WERNERT, P. 1957. *Stratigraphie paléontologique et préhistorique des sédiments quaternaires d'Alsace*. Achenheim. Mémoires de la Service Carte Géologique Alsace Lorraine 14.
- WEST, R. C. 1977. *Pleistocene geology and biology, with especial reference to the British Isles*. London and New York: Longman.
- WETZEL, R., AND G. BOSINSKI. Editors. 1969. *Die Bocksteinschmiede im Lonetal (Gemarkung Rammingen, Kr. Ulm)*. Stuttgart: Müller and Gräff.
- WHALLON, R. 1989. "Elements of cultural change in the later Palaeolithic," in *The human revolution: Behavioural and biological perspectives on the origin of modern humans*, vol. 1. Edited by P. Mellars and C. Stringer, pp. 433-54. Edinburgh: Edinburgh University Press.
- WILSON, A. C., AND R. L. CANN. 1992. The recent African genesis of humans. *Scientific American* 266(4):68-73. [kj]
- WOBST, H. M. 1989. The origination of *Homo sapiens*, or The invention, control, and manipulation of modern human nature. Paper prepared for Wenner-Gren Foundation International Symposium 108, "Critical Approaches in Archeology: Material Life, Meanings, and Power," Cascais, Portugal, March. [kj]
- . 1990. "Afterword: Minitime and megaspaces in the Palaeolithic at 18 K and otherwise," in *The world at 18,000 BP*, vol. 2, *Low latitudes*. Edited by C. Gamble and O. Soffer, pp. 322-34. London: Unwin Hyman.
- WOILLARD, G. 1978. Grande Pile peat bog: A continuous pollen record for the last 140,000 years. *Quaternary Research* 9:1-21. [csc]
- WYMER, J. J. 1983. The Lower Palaeolithic site at Hoxne. *Proceedings of the Suffolk Institute of Archaeology and History* 35:169-89.
- . 1988. Palaeolithic archaeology and the British Quaternary sequence. *Quaternary Science Reviews* 7:79-98.
- ZAGWIJN, W. H. 1973. Pollen analytic studies of Holsteinian and Saalian beds in the northern Netherlands. *Mededelingen Rijks Geologische Dienst* 24:139-56.
- . 1985. An outline of the Quaternary stratigraphy of the Netherlands. *Geologie en Mijnbouw* 64:17-24.
- . 1989. Vegetation and climate during the warmer intervals in the Late Pleistocene of Western and Central Europe. *Quaternary International* 3:4:57-67.
- . 1991a. *Interglacials*. (Inaugural Lecture, Free University of Amsterdam.) Amsterdam.
- . 1991b. Book review. *Geologie en Mijnbouw* 70:213.
- ZAGWIJN, W. H., AND J. W. CHR. DOPPERT. 1978. Upper Cenozoic of the southern North Sea basin: Palaeoclimatic and palaeogeographic evolution. *Geologie en Mijnbouw* 57:577-88.

## Institutions

The Indian Anthropological Association is soliciting donations from concerned professionals and philanthropic institutions to relieve a chronic shortfall in funding that has limited publication of its journal, *Indian Anthropologist*. Cheques or bank drafts payable to the Indian An-

thropological Association, mailed to D. K. Bhattacharya, Managing Editor, IAA, Department of Anthropology, University of Delhi, Delhi 110 007, India, will be gratefully acknowledged.

## Prizes

The UCLA Institute of Archaeology announces an endowment to its publications unit in memory of Jo Anne Stolaroff Cotsen to support the publication of outstanding research and scholarship. Archaeologists are invited to request information on how to submit a manuscript for consideration as the next Cotsen Prize imprint. The inaugural volume is *Landscape Archaeology as Long-term History: Northern Keos in the Cycladic Islands*, by J. F. Cherry, J. L. Davis, and E. Mantzourani. Write: UCLA Institute of Archaeology Publications, 405 Hilgard Ave., Los Angeles, Calif. 90024-1520, U.S.A.

The International Women's Anthropology Conference announces the Eleanor B. Leacock Award, a prize of U.S.\$2,000 for the article published (or in press) in the

past five years that best advances a particular theme in the legacy of her work. That legacy covers a wide range of subjects, all subsumed by her life-long interest as a Marxist and feminist anthropologist in radical redress of the inequities in social power created by class-stratified societies and in the building of more egalitarian forms of life. The topic selected for the first award is contemporary forms of potentially transformative collective action among Third World and minority populations. Persons who think their work might qualify for the award are asked to submit six copies of it to The Eleanor Leacock Award, c/o Wenner-Gren Foundation for Anthropological Research, 220 Fifth Ave., New York, N.Y. 10001-7780, U.S.A., by May 1, 1993.