PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

African and Asian Perspectives on the Origins of Modern Humans

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African and Asian perspectives on the origins of modern humans

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SUMMARY

The ways in which the cultural evidence – in its chronological context – can be used to imply behavioural patterning and to identify possible causes of change are discussed. Improved reliability in dating methods, suites of dates from different regional localities, and new, firmly dated fossil hominids from crucial regions such as northeast Africa, the Levant, India and China, are essential for clarification of the origin and spread of the modern genepool. Hominid ancestry in Africa is reviewed, as well as the claims for an independent origin in Asia. The cultural differences and changes within Africa, West and South Asia and the Far East in the later Middle and early Upper Pleistocene are examined and compared, and some behavioural implications are suggested, taking account of the evolutionary frameworks suggested by the 'multiregional evolution' and 'Noah's Ark' hypotheses of human evolution. A possible explanation is proposed for the cultural differences between Africa, West Asia and India on the one hand, and southeast Asia and the Far East on the other. The apparent hiatus between the appearance of the first anatomically modern humans, *ca.* 100 ka ago, and the appearance of the Upper Palaeolithic and other contemporaneous technological and behavioural changes around 40 ka ago, is discussed. It is suggested that the anatomical changes occurred first, and that neurological changes permitted the development of fully syntactic language some 50 ka later. The intellectual and behavioural revolution, best demonstrated by the 'Upper Palaeolithic' of Eurasia, seems to have been dependent on this linguistic development – within the modern genepool – and triggered the rapid migration of human populations throughout the Old World

1. INTRODUCTION

The main thrust of this paper is the way the cultural evidence in its chronological context may be seen to imply behavioural patterning and to discuss the possible causes and effects of the transition from Middle to Upper Palaeolithic technology that followed the appearance of anatomically modern humans and the disappearance of all other archaic hominid populations. Possible models for understanding this transition can be no better than the data on which they are based and it must be readily apparent that it is absolutely essential to have more complete fossil remains in contexts dated by several proven and accepted methods, in situations where there is no question of the archaeological associations, and where evidence of prehistoric use of space is preserved. Within the straitjacket of the limited data at present available, therefore, the cultural evidence in context and its possible behavioural implications will be discussed.

There is now no doubt that the hominid lineage evolved initially in Africa and the record of evolutionary change from *Australopithecus* to *Homo habilis* to *Homo erectus* grades is clear although the ramifications of speciation events that gave rise to this are still open to much debate. The oldest *H. erectus* fossils from Africa date to between 1.8 and 1.6 Ma. The first stone artifacts intentionally shaped to a recurring pattern, the Oldowan tradition, are found with *Homo habilis* fossils between 2.4 and 2.0 Ma in East Africa. By 1.4 Ma or more the Oldowan tradition had been supplemented by a tradition, the Acheulian Techno-complex, characterized by large bifaces: handaxes and cleavers. These are not (although some may still disagree) distinct and separate tool-kits made by morphologically different populations but are variable components of the technological products of a single hominid grade: *Homo erectus*. In some occurrences the dominant tool is the biface, in others the (now Developed) Oldowan, core/chopper and flake tools predominate, sometimes to the exclusion of bifaces entirely. However, the great majority of Lower Palaeolithic assemblages in Africa, the Near East and India with which I am familiar combine varying percentages of both Acheulian and Oldowan components (Clark 1975; Gowlett 1988; Jayaswal 1982). It is important to recognize the extent of this variability in composition in the African Lower Palaeolithic when seeking to explain those artifact assemblages in Europe and eastern Asia where the Acheulian biface component appears to be missing. There is much speculation but, as yet, no testable explanation as to why this should be so. Climate and environment may have

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dictated the use of one preferred technology over another for the exploitation of particular resources. Different social and economic organization or mobility with limited and intermittent interaction between otherwise isolated communities could be another factor and, in the earlier Pleistocene, biologically distinct populations have also been invoked to explain the technological differences which will be discussed again later in this paper.

The spread of *Homo erectus* into tropical and subtropical Asia took place around 1.0 Ma; even as early as 1.2 Ma on the evidence of the micro-fauna from 'Ubeidiya, the earliest well-researched and dated stone tool locality outside Africa. *Homo erectus* spread through the Asian tropics into southeast Asia – represented by the classic fossils from Java – and to the subtropics and temperate regions of the Far East, as evidenced by the Pekin Man fossils from China. No acceptable stone artifacts are as yet known to be associated with Java Man but with Pekin Man at Zhoukoudian and other sites, a long cultural record is present that is technically similar to the African Developed Oldowan (Wei Qi 1988).

In Africa, by about 0.5 Ma, *Homo erectus* had been replaced by fossils showing more advanced characteristics grouped within a grade known as early or archaic *Homo sapiens* and showing a considerable amount of morphological variability combining archaic and modern features. These makers of the Acheulian and Developed Oldowan techno-complex in Africa had by this time spread from the believed original homeland in the dry tropical savannas into almost all ecological niches in the continent other than evergreen tropical forest. The earliest hominid fossils in Europe are generally assigned to this archaic grade (Stringer 1989) and are associated with both Acheulian and Oldowan-type tool-kits. Archaic *Homo sapiens* fossils are known from the Levant (Zuttiyeh) (Vandermeersch 1989), India (Hathnora) (de Lumley & Sonakia 1985), southeast Asia (Ngandong and Sambung-machan) (Rightmire 1990, pp. 34–52), and China (Dali, Maba, Jinnushan, Xujiayao, Yunxian) (Wu Rukang & Olsen 1985, pp. 79–165). Do these derive from this later expansion out of Africa into Europe and the Levant? Or are they the outcome of autochthanous biological evolution from the original *Homo erectus* populations in eastern Asia, as is generally thought to be the case?

All these fossils are poorly dated, but faunal associations suggest a later Middle Pleistocene or earlier later Pleistocene context: 0.5–0.2 Ma is considered approximate and is also suggested by the artifacts, where these are present. At Zuttiyeh, the stone industry is an evolved Acheulian (Jabrudian); at Hathnora it is also a typical later Acheulian. In China, where artifacts are associated, they are of the core/chopper and flake tradition. The Acheulian biface has disappeared and nowhere in eastern Asia is there any evidence of the specialized core techniques or the standardization of form and flaking pattern found with the Acheulian in Africa, West Asia and Europe. A variable heavy-duty pick component is present at some Chinese sites in the south and centre of the country but these almost never resemble Acheulian bifaces, rather are they comparable to the sub-Saharan Sangoan tradition from Africa with which they are most likely contemporary.

2. INDEPENDENT HOMINID ORIGINS IN ASIA

At this point the claim for a separate origin for the hominid lineage in Asia must be briefly considered. This is mainly supported by some Chinese palaeontologists and archaeologists and is based on the possibility that the late Neogene hominoids, exemplified by the fossils from the Yuanmou Basin (Banguo Basin), did not become extinct without leaving descendants. The upper part of the long Yuanmou fluvio-lacustrine sequence yielded two hominid incisor teeth (one *in situ*), a tibia from another site and what are believed to be a small number of intentionally flaked stone artifacts (Wen 1978). The incisors were first thought to be Australopithecine on the basis of palaeomagnetic dating suggesting an age of between 1.67 and 1.87 Ma (Chen *et al.* 1977). Later palaeomagnetic sampling, however, suggested a Bruhnes epoch age of 0.73 Ma or later. Resampling (Qian 1985) confirmed that a reversed polarity exists above the incisor-bearing sediments, putting the whole of the long Yuanmou sequence between 0.73 and 3.40 Ma. The associated stone pieces (Wen 1978) are, in my opinion, very doubtful artifacts. They are abraded with no unquestionable evidence of artificial fracture and they and the fossils are in secondary context. Clearly, further interdisciplinary field research and more precise dating are essential but, in any case, the age of the incisor-bearing strata puts them in the range of *Homo erectus* in Asia. The Java fossils may date between 0.9 and less than 0.7 Ma but there are, as has been said, no certain stone artifacts associated with them (Bartstra 1982). The Zhoukoudian (Choukoutien) Cave *Homo erectus* fossils date between ~0.7 and 0.24 Ma ago on latest estimates and the long and deep deposits in this cave preserve irrefutable evidence of sporadic occupation by hominids. The core/chopper and flake tool assemblages are technically comparable to the Developed Oldowan of Africa. Lantian (Gongwangling) is probably the oldest evidence for *Homo erectus* in China and is dated to between 1.2 and 0.8 Ma. Again, it is in secondary context but with a small number of stone artifacts (Wu & Olsen 1985, pp. 148–150) from adjacent localities. Other fluvial sediments with artifacts (e.g. Xihoudu) in China are not sufficiently well dated to be considered here.

In northern Pakistan there have been recent claims for stone artifacts in conglomerates of the Upper Siwalik Group that may be more than 2.0 Ma. The palaeomagnetic dating is convincing and so are the three flaked stone pieces I have seen (Dennell & Rendell 1988; Rendell *et al.* 1989, pp. 96–126). Tectonic folding and compression can, however, produce simulated artifacts and those forces have been at work in the Soan incline where the specimens were found. In peninsular India to my knowledge the earliest stone artifact assemblages belong to a later, not an earlier Acheulian (Misra 1989; Jayaswal 1982) and in our survey of the Middle Son Valley in 1980–82, we found no sediments older than Middle Pleistocene (Clark & Williams 1990). However, reconsideration is necessary if a possible artifact from below a tephra at Bori in Maharastra, dated to 1.4 Ma is confirmed by further finds (Korisettar *et al*. 1989). In this case an earlier movement into south Asia before 1.0 Ma will have to be considered.

Mention should be made here also of a claim for an age of 1.5–2.0 Ma for a core/chopper assemblage from a terrace of the Lena River in Siberia. Even more significant, however, is the very recent discovery of a hominoid mandible from Dmanisi, an open site in south Georgia, associated with a Villafranchian fauna suggesting an age of 1.6 Ma.

Admittedly, there has not been nearly so much detailed interdisciplinary survey for fossil hominoids and associated cultural and faunal remains in eastern and southern Asia as there has been in Africa, and often the sites are without fauna, but the surveys carried out have produced no evidence for an Australopithecine grade nor for *Homo habilis*. The *Sivapithecus* hominoids becoming extinct shortly after 7.0 Ma appear to have left no Australopithecine or *Homo habilis* descendants and at present it must be accepted that the first hominid in eastern and southern Asia, *Homo erectus*, moved into eastern Asia around 1.2–1.0 Ma, or a little earlier, from an origin in Africa, bringing with him the inherited technological skills for tool manufacture in stone and other raw materials.

3. LATE MIDDLE PLEISTOCENE AND EARLY LATER PLEISTOCENE HOMINIDS AND THEIR STONE TOOL ASSEMBLAGES IN AFRICA

It is now necessary to review the situation in Africa that led up to the appearance of anatomically modern humans 200 ka or more years ago, and the innovative technologies of the Middle Palaeolithic–Middle Stone Age. At about the same time (200 ka) a crucial change took place wherever the Acheulian biface tradition was found. This was the disappearance of the large biface cutting tools from assemblages that had always included an important flake tool component, little distinguishable from the Mousterian. There can be little doubt that in Africa the Middle Palaeolithic–Middle Stone Age is directly derived from the terminal Acheulian, both north and south of the Sahara.

Assemblages of small bifaces and Middle Palaeolithic flake technology: Fauresmith in South Africa (Volman 1984); Lake Langano (Chavaillon 1979) in the Ethiopian Rift Valley; Akka (Rodrigue 1987) and other Moroccan spring sites and the Dakhla Oasis spring sites in Egypt (Schild & Wendorf 1977) can be seen as transitional assemblages, like the Jabrudian or Mugharan Traditions in the Levant (Bar-Yosef 1988) and other such occurrences in the Caucasus (Adamenko & Gladiline 1989) and Crimea (Kolossov 1988). The disappearance of bifaces represents, it is suggested, a very significant behavioural–technological change and I believe it is due to the major technological invention of hafting with the greater efficiency which that gives to tool-use. These flake tools were lighter, more economical in raw material and could be easily resharpened or replaced. It is, therefore, likely to be in the time range of the late Acheulian and the contemporary later Archaic populations of Africa and western Asia that the ancestral stock of modern humans will be found. The degree of regional variability shown by the early modern human fossils implies that the speciation event that triggered the human revolution may have been completed some considerable time before 100 ka ago.

Others have discussed the fossil and cultural evidence in its chronological and palaeoenvironmental context as it relates to the modern genotype in the African continent and the technical innovations that can be recognised in the time range of 100 to 50 ka ago and immediately precedes and anticipates the upper Palaeolithic. I would like to discuss these and their behavioural implications more generally here. The South African evidence from Klasies River Mouth Caves (Deacon & Geleijinse 1988; Deacon 1989, this symposium) and Border Cave (Beaumont *et al*. 1978) shows that the Middle Stone Age began in the Last Interglacial (oxygen-isotope Stage 5e) and that the Middle Stone Age–Later Stone Age transition dates between 35 and 30 ka before present (BP) (Deacon 1989). This is supported by the long sequences in Umhlatuzana Rock Shelter (Kaplan 1990), Boomplaas (Deacon 1979) and Nelson Bay Caves (Klein 1972) and other sites (Volman 1984) although the dating needs to be more precise. The anatomically modern human fossils from Klasies River Mouth (Rightmire & Deacon 1991) have a minimum age of 90 ka ago and those from Border Cave are of comparable age.

The most significant innovation in the Middle Stone Age tool assemblages is the basic blade technology and the blade tradition or facies that characterises the Howieson's Poort Industry which probably dates between 60000 and 75000 years ago.

In East Africa, the Middle Stone Age is at least 100 ka old and, if dates from Ethiopia are confirmed, the beginning could be twice that age (Clark 1988). This is in accord with the variable fossil evidence. Some fossil crania are robust but fully modern (Omo I and Ngalaba) whereas other fossils (Omo II, Lake Eyasi, Singa, DireDawa and Bodo: this last now dated to 260 ka although confirmation is needed) show varying amounts of archaic and modern traits (Bräuer 1989; Stringer & Andrews 1988). The East African Middle Stone Age also shows early emphasis on the use of blades, especially in the Horn where obsidian and flint are the materials used (Brandt & Gresham 1989). It can be demonstrated (figure 2) that blade technology grew out of the Levallois Point and Nubian core forms, as has already been shown so well in the Negev and other Levantine sites (Marks 1977; Volkman 1983). Especially important is an occurrence comparable to that of the Howieson's Poort which is stratified in the Mumba Rockshelter in the Lake Eyasi Rift. Named the Mumba Industry, it comprises backed flakes and blades, including trapezes and short, stubby but usually well made bifacial and unifacial points. At Mumba the Middle Stone Age (Kisele Industry) that lies below is dated to *ca.* 100–130 ka ago and the Mumba Industry to between about 30 ka BP by radiocarbon, and 65 ka by Uranium series (Mehlman 1991).

In North Africa, the evidence from the Maghreb is strongly suggestive of an origin for the modern hominid fossils from Dar-es-Soltan, Tamara and other sites (Debénath *et al.* 1986), in the archaic lineage represented by Ternifine, Salé and Jebel Irhoud (Hublin 1985). There is general agreement that none of these later Pleistocene African fossils can be classified as 'Neanderthal' but that they are representative of the first anatomically modern peoples in that part of the continent. They, in turn, are direct ancestors of the Mechta-Afalou race (Arambourg *et al.* 1934) which, by 20 ka BP was widely spread in northern Africa.

The earliest Middle Palaeolithic in North Africa is Mousterian, usually with the Levallois technique and other regional variations (Balout 1955, pp. 269–335; Van Peer 1991). This was succeeded in the northwest and Sahara, relatively quickly it would seem, by an evolved Middle Palaeolithic known as the Aterian Industrial Complex (Tixier 1967) of which the greater part if not the whole is older than 40 ka BP and beyond the range of radiocarbon dating. On the evidence from the eastern Sahara sites of Bir Tarfawi, the Middle Palaeolithic sequence associated with five lacustrine episodes appears to date between 160 and 70 ka ago: the last occurrence has been named Aterian (Wendorf *et al.* 1990). The Aterian is spread throughout the Maghreb and the whole of the Sahara up to the Nile Valley (Tillet 1983, pp. 191–265). It is absent from the northeast and in Cyrenaica the contemporary industry is a Levallois–Mousterian (McBurney 1967, pp. 105–134). This is dated between more than 46 and 40 ka BP, when it is succeeded by a true Upper Palaeolithic blade industry: the Dabban (McBurney 1967, pp. 135–184). Below the Levallois–Mousterian in the warm episode of the Last Interglacial (perhaps oxygen-isotope Stage 5e) the artifact assemblage is a blade industry (pre-Aurignacian). This could be as old as 80–60 ka and resembles the Amudian Facies of the Mugharan Tradition in the Levant, with which it is believed to be contemporary. It should be noted here that the Acheuleo–Jabrudian in Israel, Syria and Lebanon is essentially non-Levallois whereas, if the chronology is correct, that in the Negev and northern and eastern Africa generally, the Middle Palaeolithic, is Levallois-based with emphasis on the production of Levallois points, where the raw material permits. I believe this has significance in view of the demonstrated derivation of blade technology from the Levallois point core as shown at Boker Tachtit between 47 and 38 ka BP (Marks 1977, pp. 61–80).

There can, therefore, be no doubt that the anatomically modern fossils with no Neanderthal traits, in South, East and North Africa, are associated with Middle Stone Age–Middle Palaeolithic industries and that they are as old as, or older than, those in western Asia. They are contemporary with the Neanderthal fossils and Mousterian industries of Europe and the Levant and they show very considerable variation, probably due to broad, regional, behavioural adaptation to ecological diversity that induced the emergence of specialized technologies (Van Peer 1991). These need to be briefly reviewed as they emphasise the ability of these populations to develop regional identities which are nowhere in evidence in the Lower Palaeolithic (Acheulian) or with the chopper/flake traditions of the Lower and Middle Pleistocene.

The extent of this regional variability can, for brevity, best be demonstrated on a map (figure 1) to show some of the characteristic regional assemblages which can be considered as ecologically adapted toolkits. In the hornfels, quartzite regions of southern Africa, in the obsidian, flint areas of the Horn, and where flint and silcrete were used in northern Africa, there is an early emphasis on blade production, from at least as early as 100 ka ago. Facies such as the Pre-Aurignacian, Mumba and Howieson's Poort industries emphasize the importance of hafting and this becomes abundantly clear in the tanged point component of the Aterian. Tixier (1967) defines the Aterian as a Mousterian facies of Levallois debitage, often multi-bladed with many facetted striking platforms, with a larger proportion of end-scrapers, often on blades, than any other Mousterian facies. An important part of the tool-kit, sometimes as much as a quarter, is composed of pieces with a bifacial tang located proximally. This tang is irrefutable evidence for mounting the stone working parts of a tool in some kind of handle or shaft. The small segments and trapezes of the Howieson's Poort and Mumba facies can only have been used efficiently if mounted. There are other indications of hafting of Mousterian pieces especially from the Levant (Shea 1989) and it is likely that, by the end of the Middle Palaeolithic, the simple composite tool was a regular piece of equipment for modern humans and Neanderthals alike. Certainly, although there are facies changes, all Middle Palaeolithic industries are part of a broad, technological entity.

4. CLIMATIC CHANGE AND ENVIRONMENTAL IMPACT ON LATER PLEISTOCENE HUMAN POPULATIONS (figure 2)

The impact of climatic change on human and animal population distribution in Africa was significant especially in relation to the Sahara. Most of the evidence comes from the later Pleistocene and the Holocene but it is not unreasonable to extrapolate cautiously from this for earlier episodes. Effects were not as dramatic as in high latitudes, but in the tropics and sub-tropics were still profoundly significant. For example, during the time of the Last Glacial maximum, the tropics were 5–8°C cooler, tropical evergreen forest retreated to a few refugia and its place was taken by wood- and grassland and montane vegetation descended 1000 m or more below its present altitudinal range. It was at such a time, probably in the Penultimate Glacial, that

Figure 1. Middle Palaeolithic–Middle Stone Age regional variants in Africa.

the Congo Basin was first permanently occupied by humans (Hamilton 1976; Clark 1980). The crucial region that controls movements of animals and humans between North and South Africa is the Sahara. Evidence is well preserved there for both more intensive desertification and also more humid periods when streams flowed, lakes filled and much of the desert was replaced by a Sudanic tree or grassland highly favoured for occupation by the large Ethiopian fauna and by humans (Clark 1989).

Clearly, when the Sahara was green it was occupied and, when aridification set in, animal and human populations moved out to the peripheries and to montane refugia. When the desert became hyperarid it was virtually unoccupied by man or beast. It is this climatic rhythm of more humid to more arid habitats that had, I believe, a major effect on interaction and exchange between northern and southern Africa and on movements and migrations within and outside the continent. The First was the Miocene ape migration to Eurasia; the next of which we have record is that of *Homo erectus* into Eurasia around one million or more years ago. I stress this to emphasize that, if modern humans evolved in Africa and moved out after 200 ka as the DNA data suggest (Stoneking & Cann 1989), then this is a repetition of a pattern and not the first migratory movement of such magnitude.

5. THREE HYPOTHETICAL SCENARIOS FOR AFRICAN AND WEST ASIAN INTERACTION

Figure 3 presents three hypothetical scenarios to show possible movements and interaction between North African and West Asian populations in response to climatic and environmental changes between the late Middle Pleistocene and the early last glacial.

Figure 3*a*: If the Uranium series dates for the mound-springs and 'radar rivers' in the eastern Sahara are reliable, the makers of the late Acheulian industries occupied the desert during the humid oxygen-isotope Stage 7, around 245–190 ka ago (Wendorf *et al.* 1990). The desertification of the Sahara during the penultimate glacial that followed triggered, it is suggested, a northward movement out of the desert into the Mediterranean littoral and eastward into the Nile valley; a movement that, it can be conjectured, turned the North African littoral into an Interaction Zone and, following the onset of the last interglacial (isotope Stage 5), once again permitted population expansion and movement into the

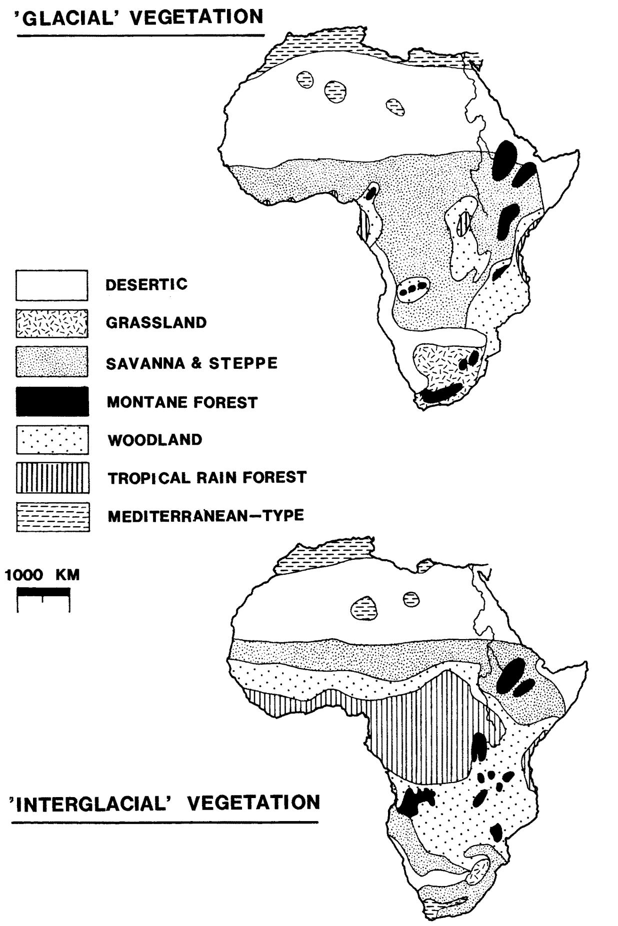

Figure 2. Hypothetical vegetation patterns for Africa under glacial and interglacial climates. (After *The historical atlas of Africa*. Longman's (1985).)

desert and over the Isthmus of Suez to and from the Levant; and perhaps also movement by some narrow sea-crossings into the Arabian peninsula and western Europe when sea levels were lower by 100 m or more during the maximum of a glacial.

Figure 3*b*: With the rapid onset of the warmer last interglacial, between *ca.* 125 and 74 ka ago, sea levels rose and the available space in the coastal plain became more restricted. Population densities are also likely to have increased following readaptation to new habitats, including the earliest use of sea-foods, the grinding of plant foods and innovations in technology. This last resulted in the disappearance of bifaces and experimentation with both early blade and more refined prepared core technologies in conjunction with the invention of hafting which permitted the production of simple, but more efficient, composite tools.

Figure 3*c*: The evidence from the Levant suggests that the first anatomically modern humans were present there about 90–100 ka ago and that they probably came from Africa. The northern African human populations associated with the Middle Palaeolithic, early Upper and Epi-Palaeolithic belong to the Mechta–Afalou race (described first from Epi-Palaeolithic sites in eastern Algeria) that, as has been said, had its roots in the ancient *Homo erectus* population of northwest Africa. The closest parallels to the Mechta–Afalou physical type were found to be with the Cro-Magnon fossils of western Europe. The early modern human fossils from Qafzeh and Skhul have been described as 'Proto-Cro-Magnons'. The relationship between the Levant and North Africa was clearly a close one at this time.

6. THE EXPANSION INTO ASIA

Looking at a simplified vegetation map of the Old World (figure 4) it is apparent that montane regions have tended to be significant barriers to north–south movement and interaction while, at the same time, favouring movement from west to east and vice versa along the steppe and savanna corridors. The central Asian deserts were probably similar filters north and south as was the Sahara. Of course, considerable zonal changes in vegetation must be projected under glacial and interglacial conditions and the elevation of the Himalayas and the Thibetan plateau. The evergreen forest was an effective barrier to the eastward extension of the Acheulian, even though much of the Far

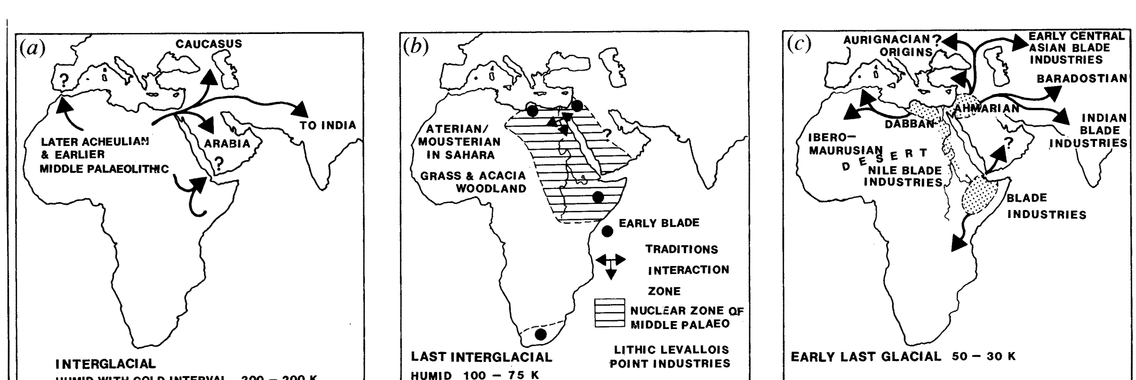

Figure 3. Hypothetical scenarios to show possible movements and interaction between northern Africa and western Asia. (*a*) Initial spread of later Acheulian and early Middle Palaeolithic from Africa to Eurasia under interglacial conditions, 300–200 ka ago. (*b*) To show early blade traditions in Africa and the Levant; the 'Nuclear Region' with heavy emphasis on Levallois point production and the 'Interaction Zone' between northeast Africa and the Levant during the humid period of the last interglacial, 100–75 ka ago. (*c*) The spread of Upper Palaeolithic blade industries from northeast Africa and the Levant during the cold and dry climates of the last glacial, 50–30 ka ago.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

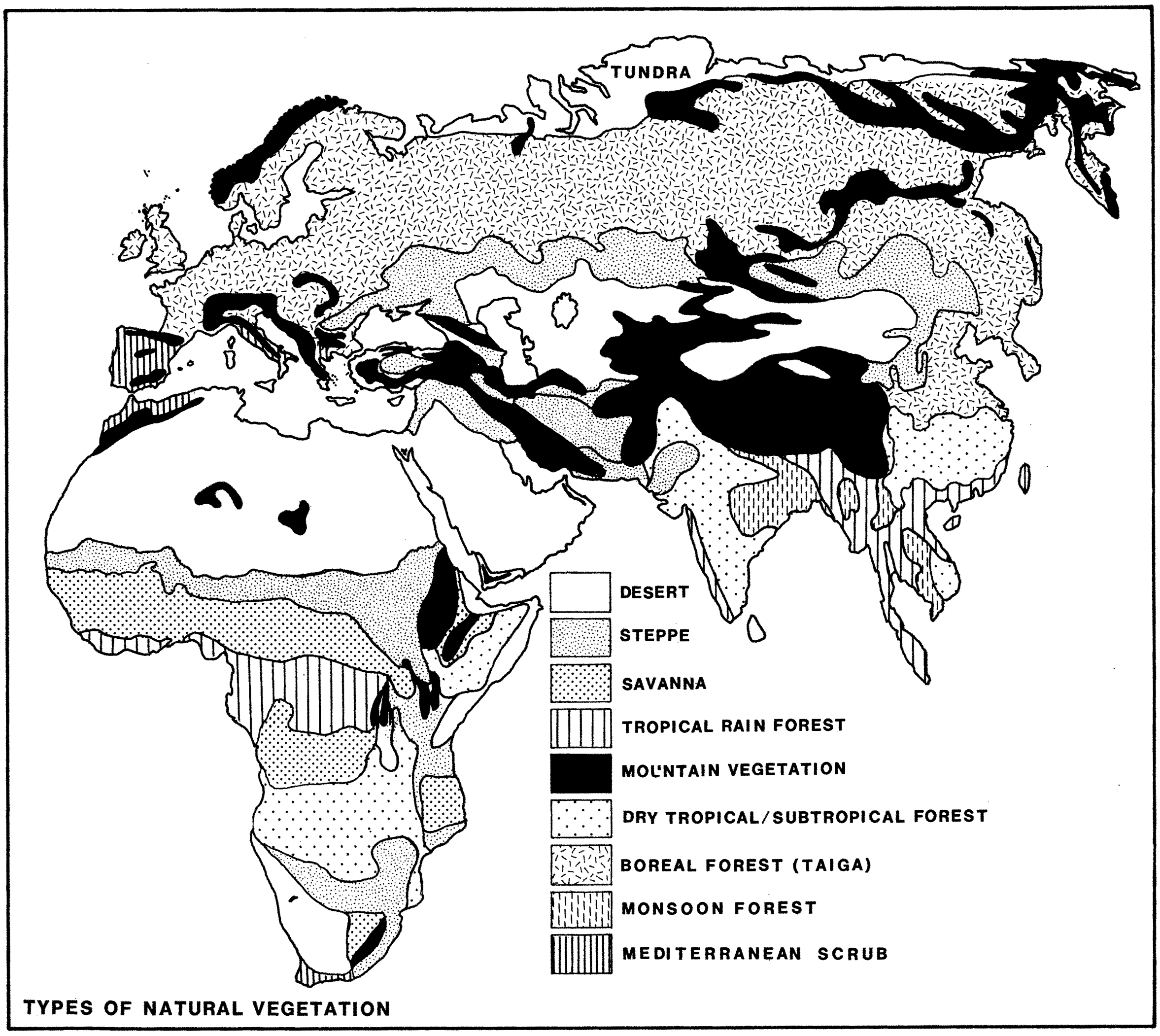

Figure 4. Simplified vegetation map of the Old World. (After *The Times concise atlas of the world.* Times Books (1974).)

East may have seen a much greater extension of the dry tropical and sub-tropical forest (Prell & Kutzbach 1987).

The Levantine evidence underscores the significance of the contemporary co-habitation of the Levant by early modern humans and Neanderthals and their stone industries. There do not seem to be any major technological differences between the modern and Neanderthal Middle Palaeolithic tool-kits except in regard to the emphasis on the use of the Levallois method in the southern Levant and more on the Quina tradition in the north (Bar–Yosef 1988). That the earliest Upper Palaeolithic blade tradition – the Ahmarian (*ca.* 37 ka BP) – in the Levant evolved from the southern Mousterian with Levallois point technology, seems clear, as also that it is the earliest Upper Palaeolithic in the Levant (Gilead 1991). It is comparable to and broadly contemporary with the Dabban in Cyrenaica (*ca.* 40 ka BP). Comparable antecedents can be seen in the 'Levallois–Idfuan' and Nazlet Khater industries along the Upper Nile (Vermeersch *et al.* 1990; Van Peer 1991). As at present, therefore, the evidence once again suggests that northern Africa and the Levant could be considered as a single 'culture area' (figure 3), albeit with much regional variability, the material products of which were made by anatomically modern humans (see figure 3*b*).

7. THE MIDDLE AND EARLY UPPER PALAEOLITHIC IN THE MIDDLE EAST

The Lower Palaeolithic dichotomy in stone tool traditions, well seen in Europe (Wymer 1982; Svoboda 1989; Howell & Arsebük 1989), and Africa (Kleindienst 1961; Clark 1975; Gowlett 1988) continues eastwards. The Acheulian biface tradition is present in Arabia and the Indian peninsula and even in Nepal, but the Indian assemblages are closest to the African pattern with both biface and core/chopper traditions being represented in a single assemblage but without the Levallois method. The Acheulian biface does not occur anywhere in or eastward of the tropical forest zone first encountered in northeast India (Lubine *et al.* 1985).

To the north of Arabia in the Crimea (Kolossov 1988), Georgia and Azerbaijan (Golovanova *et al.* 1990; Adamenko & Gladiline 1990) only the late or terminal Acheulian appears to have penetrated and the basal assemblage in the cave deposits in these regions might equally well be considered as transitional to Middle Palaeolithic; they are dated to the later part of the Last Interglacial. The same prondnik-type of bifacial knife occurs in the Crimea as it does at the eastern Sahara mound spring sites.

The Middle Palaeolithic in the Middle East (Iraq and Iran) is best known for the long sequence in Shanidar Cave (Solecki 1971) with its clear association with Neanderthal hominids; and from Warwasi (Dibble & Holdaway 1990). The artifact assemblages are from cave and open sites and, because they differ in artifact composition, it has been suggested that they represent seasonal patterning. The assemblages resemble Typical Mousterian but the Levallois method is rarely used. Points, side-scrapers, denticulates and borers are the most usual tool types and these assemblages show resemblances to both the northern Mousterian of the Levant and that from Central Asia. The earliest Middle Palaeolithic is thought to date from 80–100 ka and to continue to 40 ka. The environment was cold and dry with two more humid episodes between 80 and 62 ka and 56 and 42 ka; it was a desertic steppe with some forest in refugia. The Baradostian – the succeeding earlier Upper Palaeolithic industry known mostly from the Zagros sites in Iran and Iraq – is one of the earliest recorded, if the dates are correct (38–33 ka BP) and is clearly contemporary with the Ahmarian in the Levant. It is a blade-based technology with some micro-blades, the dominant tool types being burins, scrapers on flakes (some carinated), delicate points (Font Yves) and small, retouched bladelets with rare choppers, picks and grindstones. It follows directly on the Mousterian in the rockshelters and caves, suggesting that its appearance was abrupt. A derivation from the local Mousterian is not ruled out, however (Smith 1986). Regional specialization is very apparent. The steep scrapers of the Baradostian find parallels in the Levantine Aurignacian and with the Upper Palaeolithic industries in the Caucasus and Transcaucasia. In Central Asia and Afghanistan, however, Upper Palaeolithic prismatic blade technology seems to have made only a later appearance (Smith 1986).

8. THE INDIAN PENINSULA

In northeastern Pakistan, Acheulian handaxes have been dated between 730 and 400 ka by palaeomagnetism (Rendell *et al.* 1989). The late Acheulian is known from many open sites (Misra 1989) and also from caves (Misra 1985). The transition from Acheulian to Middle Palaeolithic in India took place sometime not less than 100 ka, and appears to follow the pattern observed in Africa and Europe where the bifaces disappear and the flake tool component takes over (Clark & Williams 1990). In general the Middle Palaeolithic in peninsular India is a flake-based technology with only a modified form of the Levallois method and, especially where quartzites were used, characterized by a lack of regular retouch. Only where cherts and other homogeneous materials were used is there evidence for regular retouching. Thermoluminescence and Uranium-series dates from Rajasthan range from 150–100 ka while radiocarbon dates indicate ages between 40 and 10 ka BP. The former are likely to be more correct. The climate shows a change from humid at the beginning to cold and dry with open vegetation and much grassland later.

The time of the introduction of Upper Palaeolithic blade technology into India is, as yet, unknown and such assemblages as have been dated range in age between *ca.* 26 and 10 ka BP. However, large blades in secondary and abraded context occur stratified in gravels at the base of the early Upper Pleistocene Baghor Formation in the Son Valley and are likely to be older. The Upper Palaeolithic is a blade and bladelet techno-complex dominated by backed blades and with lower percentages of scrapers in regionally varied contexts. Blade tools are reminescent of those of the Ahmarian in the Levant and this relationship is reinforced in terminal Pleistocene contexts in both India and Iraqi Kurdistan (see figure 3*c*).

9. CENTRAL ASIA

In cave and palaeosol sites in the loess in Central Asia (figure 5) in Uzbekistan (Islamov 1990) and Tadjikistan (Ranov & Davis 1979; Davis *et al.* 1980) the Acheulian biface facies of the Lower Palaeolithic is unknown and the assemblages are characterised by core-choppers and flake tools not infrequently with steep retouch; Levallois typology is not present. Heavier duty forms are rare and in no way resemble an Acheulian biface. The age – on palaeomagnetic evidence – appears to be between 250 and 130 ka (Davis *et al.* 1980). All are associated with episodes of warmer, more humid, though nevertheless dry climate supporting a forest–steppe vegetation.

The succeeding Middle Palaeolithic in Central Asia can be seen as a derivative of the Lower Palaeolithic Industry, as elsewhere, and is characterized by retouched scrapers and points, but this retouching may be the outcome of resharpening and related to

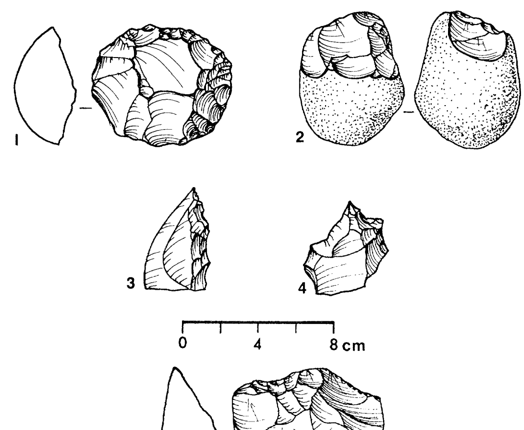

Figure 5. Core/chopper and flake tools from Lakuti I (nos. 1–4) and Karata (no. 5) sites in the loess in Kazakstan, Central Asia. (After Davis *et al.* 1980.)

raw material procurement and availability (Dibble 1988). The little that is known of the Lower Palaeolithic in Iran and Iraqi Kurdistan is comparable and probably dates to not less than 100 ka, indicating that the assemblages are similar to those in Central Asia (Smith 1986, pp. 14–17) but at Barda Balka (Braidwood & Howe 1960) a few poorly made handaxes are associated with the core/choppers and flake tool components. It seems likely that the distribution of bifaces in the more tropical south and of the core/chopper and flake tool tradition in the north has a basis in climatic and environmental differences.

10. NORTHERN ASIA

Research during the last decade has produced evidence of what is considered to be Lower Palaeolithic occupation in southern and western Siberia (Dolitsky 1985) but there is no general agreement as to the age of these assemblages, although even claims of 70 ka ('Makarovo Horizon') have been put forward. However, because some of the assemblages are surface finds, there is room for doubt. Similar problems arise in the dating of the Middle Palaeolithic except for cave sites in the Altai (Ust-'Kanskaya: Strashnaya and Denisova Caves) which are clear evidence for a stratified Mousterian, although claims for a Levallois component of the assemblages seem unproven (Larichev *et al.* 1987). The three sites are dated between 40 ka and 20 ka BP and are, therefore, late for a Middle Palaeolithic. At Denisova, although blades are absent from the assemblages, it is claimed that in each layer except one, Upper Palaeolithic and Mousterian types of artifact occur together. In sites west of Lake Baikal, the 'Makarovo Horizon', thought to date more probably to more than 40 ka BP, comprises cores and choppers, flakes and blades, 'micro-flaking' and prismatic cores and combines Middle and Upper Palaeolithic technology. It is said to be contemporary with the Mousterian in the Altai (Larichev *et al.* 1988; 1990, pp. 354). Such assemblages have led to claims for a direct transition of the Siberian Upper Palaeolithic from the regional Mousterian. Early Upper Palaeolithic prismatic blade technology is found at three sites west of Lake Baikal and is dated to between 32 and 28 ka BP. East of the Lake, four other sites are ascribed to the early Upper Palaeolithic and two have been dated between 35 and 26 ka BP and provide evidence of dwelling foundations and hearths (Larichev *et al.* 1990, p. 365). Russian investigators claim that true Upper Palaeolithic assemblages exist (Igetey Ravine I: Ust'-Kova) that predate (25–28 ka BP) the 'classic' Siberian Upper Palaeolithic (Mal'ta and Bur'et) which is dated to 20–21 ka BP, and a strong case for regional continuity has been made. Notwithstanding, in view of the traits shared with some of the south Russian sites, especially in the art and bone and ivory working, it is difficult not to see a connection that could imply an eastward and northward movement of the first modern human populations around 22 ka BP.

Given the severity of the climatic oscillations during the Glacial maximum, population movements might be expected but the direct antecedents of the classic Upper Palaeolithic remain uncertain. Is it, as some researchers claim, an autochthonous development out of the local Middle Palaeolithic, or is it intrusive? These assemblages in the Lake Baikal region described as early Upper Palaeolithic, that combine Middle and Upper Palaeolithic technological features, might also be seen as a comparable regional response to ecological change by technological innovation or by interaction as are those blade/flake industries such as the Châtelperronian, Uluzzian, Szeletian, Howieson's Poort, Amudian and other industries that may be the final expression of the Mousterian rather than the beginning of the Upper Palaeolithic (Mellars 1989).

11. EASTERN ASIA

In the tropical forest habitats of mainland southeast Asia, the chopper/chopping tool tradition, as it has been called by Movius (1948), is completely dominant but very poorly dated. Most of the assemblages are of late Pleistocene or later age although there is a claim that needs to be substantiated for a date of 0.8–0.6 Ma (Pope *et al.* 1986). From the Island of Java, the oldest artifacts that are not proven to be of late Pleistocene age are, perhaps, the small flake tools, surface finds from a fluvial context at Sangiran (von Koenigswald 1978) and, on the evidence from China, would not be inappropriate examples of the stone tools that could have been made by Java Man.

In China the core and flake tool facies is everywhere dominant and is well documented by numerous investigators (Ikawa-Smith 1978; Aigner 1978*a*, *b*; Pei Wenzhong & Zhang Senshui 1985; Jia Lanpo 1980). Here, in late Middle and early later Pleistocene contexts (not less than 100 ka) a heavy duty component is sometimes added to the core/flake traditional artefacts, as at Dingcun and Baisur (Huang Weiwen, 1987). These also occur in South Korea (e.g. at Chongokni (Bae 1988)) but their presence most likely has a functional explanation, as does the African Sangoan which this Far Eastern tool component resembles.

The core/chopper and flake tradition of southeast and East Asia is part of the very extensive technocomplex that stretched from Africa and western Eurasia to the Far East and is not an independent autochthonous development unrelated to the other parts of the Old World. If reflects the choice of the hominid populations that this was the preferred stone equipment in the forest and steppe environments of those regions from Central Asia eastwards to the Far East. The longest stratigraphic record covering the late Middle and Upper Pleistocene in the Far East comes from Locality 1 at Zhoukoudian (Pei & Zhang 1985) but this is supplemented by other, less extensive, sequences dated by fauna, palaeomagnetic, U-series and radiocarbon methods (Wei Qi 1988). Work by a joint Chinese–U.S. team in the Nihewan Basin in northern China has produced sealed activity sites with much fauna dated by palaeomagnetism to around 1.0 million years ago. This is a flake and core/chopper industry that exhibits modification but only minimal

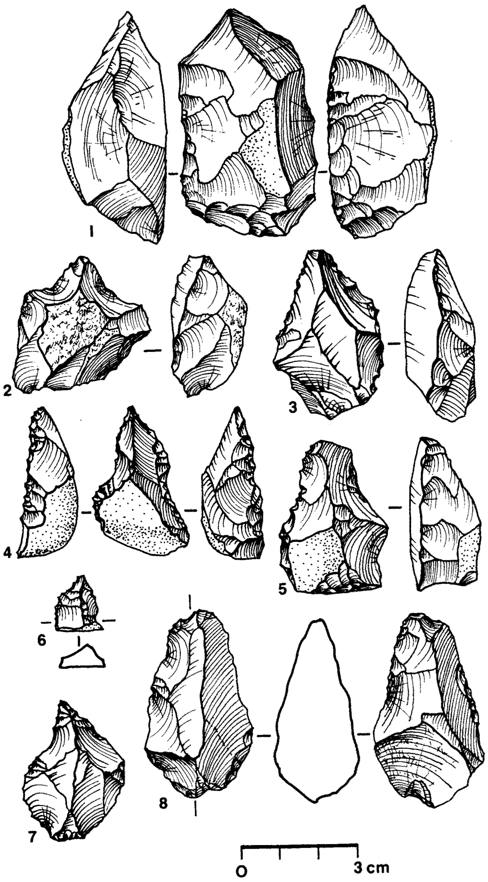

Figure 6. 'Middle Palaeolithic' core/chopper and Light Duty modified and retouched flake tools from Xujiuyao (Hsu-chia-yao), Yangkao County, Shanxi Province. (After Jia & Wei 1976.)

retouch. It is closely comparable to the assemblages from Zhoukoudian where flakes predominate but there, unlike the Nihewan sites, bipolar flaking is well in evidence (Schick *et al.* 1991). This tradition continues up to the coming of the Upper Palaeolithic micro-blade industries that appear to have spread into northern China between 30 and 20 ka BP. There is very little change in technology and artifact types from bottom to top at Zhoukoudian but rare, retouched racloirs and borers, or stubby points, occur with the later assemblages and increasing use was being made of finer-grained raw materials. This is well seen both at cave sites (e.g. Hsiao-nan-hai (Aigner 1978*b*, pp. 167–172) and the Upper Cave at Zhoukoudian (Aigner 1978*b*, pp. 186–192)) and at open air sites such as Xujiayo (Jia & Wei 1976) (figure 6) and Ban Jing in the Nihewan (Xie Fei, personal communication) that date from *ca.* 100 ka or later. The industries remain technologically unspecialized, even where the heavy duty point tools and picks are present and it is apparent that there was no necessity for retouching and resharpening of artifacts and that the supply of raw materials was adequate for what they were used on, as they show very little evidence of heavy usage. The great majority of flakes show little or no modification and, even when this is present, it consists usually of simple micro-chipping of an edge due to use. Such a long unspecialized stone industry suggests that the materials on which the tools were used were mostly soft, not hard and resistant. It has been suggested since the 1930s that in the Far East the tools of Palaeolithic hominids may have been made of bamboo. A strong case can be made out for the likelihood that the technology of the forest and steppe populations in the late Middle and later Pleistocene was based on the use of bamboo, wood and their by-products. If this was so, it can best explain the unspecialized, almost opportunistic, nature of the stone industries, the uses of which would have been confined to the basic needs of chopping, sawing, splitting and scraping these raw materials.

A recent study (1991) of montane foragers and marginal cultivators in southern Yunnan in a mixed conifer and broad-leafed, open forest habitat, shows that bamboo and wood still provide virtually all their material needs today with the exception of the addition of a short iron machete. Experiments with flaked stone tools (chopper and flakes) made on the spot and comparable to those from Zhoukoudian and other Chinese sites, showed that they were fully adequate for carrying out all the tasks necessary for preparing the many pieces of equipment made by these people from bamboo. Studies of use-wear and phytoliths on the edges of these tools are proceeding.

If, as we believe will be demonstrated, the main raw materials and food sources for which stone tools were needed by Pleistocene populations in southeast and East Asia northwards to the 'Bamboo Line', were obtained from plants, this would explain the persistence of the unspecialized stone industries: a tradition that later spread to Australasia.

In the Far East, this techno-complex is found in the time range of *Homo erectus*, archaic *Homo sapiens* fossils (Dali, Xujiayao (Wu & Olsen 1985), Yunxian (Li & Etler 1992) and Jinnuishan (LüZune 1990)) and with some later Pleistocene modern human fossils. Because no major changes can be seen in the technological base, this has been used to support a claim for regional continuity between the *Homo erectus* and anatomically modern populations. If the early modern fossils from China (e.g. Salawusu, Liuchiang, Laipin (Wu & Olsen 1985)) were more precisely dated and their morphology better known, it would strengthen this model. However, the latest report on the 'Old Man' from the Upper Cave at Zhoukoudian shows it to be late in time and not to be Mongoloid (Kamminga & Wright 1988). Whereas in Africa and western Europe, the abrupt transition from Middle to Upper Pleistocene is marked by major technological changes, this does not seem to have been the case in China. If this can be seen as an argument for regional evolution and continuity in the human population, it might equally be seen as a highly successful behavioural and technological adaptation of anatomically modern populations moving from the west some 40 ka ago, bringing with them such Upper Palaeolithic traits as ornamentation and bone tools (e.g. Upper Cave, Zhoukoudian). The association of fully modern fossils with the core/flake tradition in Australia and the lack of fossil connections linking the southeast Asian evolved *Homo erectus* with modern Australian remains inadequately

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

demonstrate that either model is tenable. However, when considered in relation to the molecular and cultural evidence respectively, especially the art, the 'Noah's Ark' model appears at the present time to be the most likely.

12. BEHAVIOURAL IMPLICATIONS OF THE MIDDLE PALAEOLITHIC–MIDDLE STONE AGE

This review of the artifact assemblages of Africa and Asia and their place in space and time has demonstrated the ancient dichotomy present in Lower Palaeolithic technology that, most probably, under climatic and environmental restraints, dictated the emphasis on one or other of these great technocomplexes. Whatever the explanation, it is clear that, when the choice has been made, the technology successfully fulfilled the need for survival. The transition and continuity between the Lower and Middle Palaeolithic appears clear, especially in the west and south, though in eastern Asia, while the continuity is clear, any significant transition is not easily seen or dated.

The climatic fluctuations in northern Africa and sequential drastic environmental changes in the Sahara and the Levant due to the effects of the continental glacial advance, initiated technological and attendant behavioural changes manifest in the transition from Acheulian to Middle Palaeolithic. The Middle Palaeolithic in the southern Levant and northeast Africa have much in common as exemplified in the early experimentation with blade technology during the Last Interglacial and later the development of the true Upper Palaeolithic blade technology more than 40 ka. The DNA evidence (Stoneking and Cann 1989) and the associated fossils of anatomically modern humans show that these technological changes are most likely to have been associated with the modern genotype and not with Neanderthals. The review of the Middle Palaeolithic–Upper Palaeolithic cultural evidence from central and eastern Asia is unfortunately ambiguous, though associated fossils with the Middle Palaeolithic are described as 'Neanderthal'. There are claims for both regional continuity and catastrophic replacement of technological traditions for explaining the replacement of Middle by Upper Palaeolithic technology. More chronological precision is essential, however. Modern humans were in Israel around 100 ka ago. Why, if they possessed the same intellectual and physiological capabilities as ourselves, did not the behavioural changes of the 'Cultural Revolution' manifest themselves at the same time? They did not, and early modern and Neanderthal tool-kits show no very significant differences in the Levant for some 50 ka when, first, the Ahmarian blade tradition made its appearance followed, some millennia later, by the Aurignacian. The hiatus seems unexplainable on the cultural and fossil evidence alone.

The technological and organisational complexity of the Upper Palaeolithic–Later Stone Age, always associated with the modern genotype, is sharply contrasted with that of the Middle Palaeolithic – Middle Stone Age. Much has been written about the richness of Upper Palaeolithic culture and there is no need to repeat it here. The evidence for the beginnings of a broader perception of the nature of their world is, however, hinted at in the Middle Palaeolithic but is remarkably limited and unconvincing where symbolic behaviour is concerned (Chase & Dibble 1987; Chase 1991). Early moderns and Neanderthals buried their dead (Qafzeh, Kebara) (Smirnov 1989). There is some slight suggestion also, from associated grave goods, of a possible belief in an afterlife. Use of pigment (Wreschner 1980) might, perhaps, be seen as a means of symbolic expression but there is no evidence for ritual behaviour now that the skull and context of the Monte Circeo Neanderthals have been reinvestigated. Similarly, the caches of bear skulls in caves in the Alps must be eliminated. There is also little or no use of bone for equipment although, in the tropics, hardwood took the place of bone, even in the Later Stone Age. There is minimal evidence for ornamentation, although a few rare examples do exist in both Europe and Africa. Art, with the possible exception of notched bones, and incised ostrich eggshells in southern Africa, does not exist. The bone 'flute' from Haua Fteah is now seen as more likely to be the result of hyaena chewing than of human modification (Davidson 1991). Evidence for dwelling structures comes from French Châtelperronian contexts, from southern Russia and from Morocco.

Unless it be the diversity in the Middle Palaeolithic–Middle Stone Age tool traditions in Africa, implying ecologically adapted specialisations, little difference in behaviour can be seen between the technologies of the Neanderthals and those of early moderns. The Howieson's Poort industries and related occurrences in Africa do seem to anticipate the Later Stone Age blade traditions but they may not be all that different in age and grade from the Châtelperronian and similar industries in Europe which were, at one time, thought to be the earliest Upper Palaeolithic but are now seen as more likely to represent a terminal stage of the Middle Palaeolithic and are regarded as attempts by the last Neanderthals to adjust their technology and behaviour to those of the first modern peoples that they encountered (Mellars 1989, this symposium). This interpretation is, no doubt, strengthened by the Neanderthal burial in a Châtelperronian level at St Cesaire.

Anatomically modern humans like ourselves are expected to have possessed the same potential for intellectual ability as does our own kind. Their technology and behaviour, therefore, should be very different from that of the Neanderthals who, although possessing considerable ability to survive inimical environments, nevertheless became extinct. Thus, the fact that the technology and behaviour of the first modern humans in Africa and the Levant do not appear to be all that different from those of the Neanderthals, poses a major problem. It should, however, not necessarily be assumed that these similar tool-kits were used in the same way by the two groups, and some tool forms may have been used very differently by moderns and Neanderthals occupying similar habitats. Therein lies the importance of the Middle Stone Age regional variability in technology and the Strategies for resource procurement for which they were adapted. If the chronology is correct, there were some 50 ka between the time when the first moderns appeared in the Levant and the time when Upper Palaeolithic technology, symbolic behaviour and social organization spread so rapidly throughout the world. What was going on behaviourally, intellectually and technologically during that time? Until more of the hard data – excavated localities, fossil and cultural evidence in well-dated environmental contexts – are available it is possible only to speculate. More basic data from key areas and key sites are essential. I see every reason to accept that anatomically modern humans evolved in Africa at the time suggested by the molecular record (Stoneking & Cann 1989) but that they had not yet acquired the unique intellectual abilities that made possible the complex social organisation and symbolic behaviour of the Upper Palaeolithic populations. The catalyst that made the Upper Palaeolithic possible was, I have believed for a long while, the development of a full language system like our own, which opens up a new world of ever-broadening horizons and opportunities, the ability to convey specific information, to distinguish between past, present and future, to think abstractly, to use symbolism and, in short, to be psychologically similar to ourselves (Clark 1970: 146–7; Cavalli-Sforza *et al.* 1989, 1991; Mellars 1989, 1991; Davidson 1991). The threshold must be in that time range when Middle Palaeolithic technology was replaced by the Upper Palaeolithic, the cultural complexity of which is seen in the circumstantial evidence of the activity areas or settlements and the proliferation of technological variability and in elaborate artistic expression.

Whether the ability to speak is a physical or neurological phenomenon, or both, is for the anatomists and linguists to decide. The hyoid bones of *H. erectus* and other archaic hominids are not available for comparison but a Neanderthal hyoid bone, similar to our own, does not necessarily imply that Neanderthals could talk, though it does imply that they had the anatomic ability to do so. Broca's area can be identified even on crania assigned to *H. habilis* and, while this is related to the ability to speak, it is unclear what degree of vocal communication was represented. Emotional vocalizations, gesturing and posturing of chimpanzees have enabled them to develop an efficient proto-culture that could have some analogous relationship to the communication system and behaviour of *H. habilis*, the maker of the Oldowan stone tools. The culture of *H. erectus* is certainly more elaborate but it does not appear to this author to have needed any *complex* communication system and the ability to make even 'refined' stone tools can be mastered by observation, experiment and practice with minimal vocal instruction. Bickerton (1990) suggests that the neural structure of the brain could have allowed early hominids to extract from their perceptions a 'secondary representation' that improved the efficiency of their use of the environment. His contention is that 'primitive language' would have had a vocabulary of words signifying meaning but lacking the grammatical elements of syntax. He sees the jump from 'primitive' language to syntactic language as rapid and considers that it emerged as a single genetic event. If the first anatomically modern humans evolving in Africa already had a syntactic language system, why do we not see this most significant development reflected in the cultural evidence associated with the early modern fossils, which we do not? If, however, full language developed only later and suddeny between 40 and 50 ka ago, this would account for the lag in the appearance of the cultural revolution represented by the Upper Palaeolithic traditions and the very rapid spread of modern humans throughout the world from 40 ka BP onwards. If Africa, as the preponderance of the evidence now suggests, was the home of anatomically modern humans – the continent, moreover, where these modern traits made their appearance early in the Middle Pleistocene – it would seem that this evolutionary event need not have been accompanied by the ability to speak syntactically, as we do. This may well have been a later development for which modern humans were pre-adapted. Whether this event also took place in Africa, or elsewhere, remains to be shown but, if there were two genetic events and not one, this would explain the undifferentiated nature of Middle palaeolithic stone technology associated with the first anatomically modern humans in North Africa and the Levant and the experimentation with new technologies represented by the Pre-Aurignacian, the Amudian, the Howieson's Poort and similar technological manifestations in South and East Africa and Equatoria. It might also be connected with the division of Caucasoids and Mongoloids on the genetic tree.

It is of interest that the early modern fossils from eastern Asia and Europe are closer morphologically to each other than are the modern fossils from eastern Asia to the antecedent hominid fossils of the region. This suggests the migration hypothesis, though some gene flow between seems to be observable (Stringer 1990).

The first humans to enter Australia around 40–60 ka (Roberts *et al.* 1990) were anatomically fully modern and carried with them a tool-kit that resembled that which had been in use in China since the days of *Homo erectus*. If, however, there is no compelling evidence for the direct descendancy of the modern Mongoloid and Australoid populations of eastern Asia and Australasia from the then existing archaic genepool in the East, it is equally possible that modern humans pushing eastwards were quick to readapt their technology and behaviour to that best suited for exploiting the resources of the new regions into which they moved.

13. CONCLUSIONS

To summarize: the palaeontological and archaeological evidence points to an early emergence of anatomically modern humans – the 'African Eve' – associated with regionally and ecologically specialized tool-kits that were evolving in Africa from around 200 ka ago. By 100 ka ago, modern groups had spread into western Asia where they lived for some 50 ka contemporaneously with Neanderthals. Although it is to be expected that behavioural adaptations of modern humans and Neanderthals grew increasingly different, this does not appear to be reflected in the cultural associations, though meaningful variation may, perhaps, be obscured by the too-generalized level of the approach we are using. Some time subsequent to the move into the Levant and possibly further afield, the modern human genotype developed a syntactic language system that, by 40 ka ago, had revolutionized social organization, communication and symbolic relationships, leading to this genotype's rapidly replacing, as they moved out in EuroAsia – without receiving from them any significant genetic input – the archaic human races they encountered in their population of the world.

REFERENCES

Adamenko, O.M. & Gladiline, V.N. 1989 Korolevo: un des plus anciens habitats Acheuléens et Moustériens de Transcarpatie Soviétique. *Anthropologie* **93**(4), 689–712.

Aigner, J.S. 1978*a* Pleistocene Faunal and Cultural Stations in South China. In *Early Palaeolithic in South-East Asia* (ed. F. Ikawa Smith), pp. 129–160. The Hague: Mouton.

Aigner, J.S. 1978*b* Important archaeological remains from North China. In *Early Palaeolithic in South-East Asia* (ed. F. Ikawa Smith), pp. 163–232. The Hague: Mouton.

Arambourg, C., Boule, M., Vallois, H. & Verneau, R. 1934 Les Grottes paléolithiques des Beni Ségoval (Algérie). *Archs Inst. Paléont. hum.* **13**.

Bae, Kidong 1988 The significance of the Chongokni Stone Industry in the tradition of the Palaeolithic cultures of East Asia. Ph.D thesis, University of California, Berkeley.

Balout, L. 1955 *Préhistoire de l'Afrique du Nord*. Paris: Arts et Métiers Graphiques.

Bartstra, G.J. 1982 *Homo erectus*: the search for his artifacts. *Curr. Anthrop.* **23**, 318–320.

Bar-Yosef, O. 1988 Le Paléolithique d'Israel. *Anthropologie* **92**, 769–795.

Beaumont, P.B., de Villiers, H. & Vogel, J.C. 1978 Modern man in sub-Saharan Africa prior to 49,000 BP: A review and evaluation with particular reference to Border Cave. *S. Afr. J. Sci.* **74**, 409–419.

Bickerton, D. 1990 *Language and species*. University of Chicago Press.

Braidwood, R.J. & Howe, B. 1960 Prehistoric investigations in Iraqi Kurdistan. In *Studies in ancient oriental civilisation*, vol. 31. Chicago University Press.

Brandt, S.A. & Gresham, T.H. 1989 L'Age de la Pierre en Somalie. *Anthropologie*, **94**(3), 459–482.

Brauer, G. 1989 The evolution of Modern humans: a comparison of the African and non-African evidence. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 123–154. Edinburgh University Press.

Chase, P.G. 1991 Symbols and Palaeolithic artifacts: style, standardization and the imposition of arbitrary form. *J. anthrop. Archaeol.* **10**, 193–214.

Chase, P.G. & Dibble, H.L. 1987 Middle Palaeolithic symbolism: a review of current evidence and interpretations. *J. anthrop. Archaeol.* **6**, 263–296.

Chavaillon, J. 1979 Un site Acheuléen près du Lac Langano (Ethiopie) *Abbay Documents pour servir à l'histoire de la civilisation ethiopienne* **10**, pp. 57–74. Paris: CNRS.

Chen Guoliang, Li Suling & Lin Jinlu 1977 Discussion of the age of *Homo erectus* yuanmouensis and the event of early Matuyama. *Scient. Geol. Sinica* **1**, 34–43.

Clark, J.D. 1975 A comparison of the Late Acheulian Industries of Africa and the Middle East. In *After the Australopithecines* (ed. K. W. Butzer & G. Ll. Isaac), pp. 604–659. The Hague: Mouton.

Clark, J.D. 1980 Early human occupation of African savanna environments. In *Human ecology in savanna environments* (ed. D. R. Harris), pp. 41–72. London: Academic Press, 41–72.

Clark, J.D. 1988 The Middle Stone Age of East Africa and the beginnings of regional identity. *J. World Prehis.* **2**(3), 235–303.

Clark, J.D. 1989 The origins and spread of modern humans: a broad perspective on the African evidence. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 565–588. Edinburgh University Press.

Clark, J.D. & Williams, M.A.J. 1990 Prehistoric ecology, resource strategies and culture change in the Son Valley, Northern Madhya Pradash, Central India. *Man Environ.* **15**(1), 13–24.

Davidson, I. 1991 The archaeology of language origins: a review. *Antiquity* **65**, 39–48.

Davis, R.S., Ranov, V.A. & Dodonov, A.E. 1980 Early Man in Soviet Central Asia. *Scient. Am.* **243**, 130–137.

Deacon, H.J. 1979 Excavations at Boomplaas Cave: a sequence through the Upper Pleistocene and Holocene in South Africa. *World Archaeol.* **10**, 241–257.

Deacon, H.J. 1989 Late Pleistocene Palaeoecology and Archaeology in the Southern Cape, South Africa. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 547–564. Edinburgh University Press.

Deacon, H.J. & Geleijnse, V.B. 1988 The stratigraphy and sedimentology of the Main Site sequence, Klasies River, South Africa. *S. Afr. archaeol. Bull.* **43**, 5–14.

Debénath, A., Raynal, J.-P., Roche, J., Texier, J.-P. & Ferembach, D. 1986 Stratigraphie, habitat, typologie et devenir de l'Atérien Marocain: Données récentes. *Anthropologie* **90**(2), 233–246.

Dennell, R.W. & Rendell, H.M. 1988 Late Pliocene artifacts from northern Pakistan. *Curr. Anthrop.* **29**(3), 495–498.

Dibble, H.L. 1988 The interpretation of Middle Palaeolithic scraper reduction patterns. In *L'Homme de Néandertal*, vol. 4 (*La technique*) (ed. L. Binford & J-Ph. Rigaud), pp. 49–58. Liège: ERAUL.

Dibble, H. & Holdaway, S. 1990 Le Paléolithique moyen de l'Abris sous roche de Warwasi et ses relations avec le Moustèrien du Zagros et du Levant. *Anthropologie* **94**(4), 619–642.

Dolitsky, A.B. 1985 Siberian Palaeolithic archaeology: approaches and analytic methods. *Curr. Anthrop.* **26**(3), 361–378.

Gilead, I. 1991 The Upper Palaeolithic period in the Levant. *J. World Prehist.* **5**(2), 105–154.

Golovanova, L.V., Levkovskaya, G.M. & Barychinikov, G.F. 1990 Le nouveau site Moustérien en Grotte de Matouzka, Caucase septentrional (Résultats des Fouilles de 1985–1987). *Anthropologie* **94**(4): 739–762.

Gowlett, J.A.J. 1988 A case of Developed Oldowan in the Acheulian. *World Archaeol.* **20**, 13–26.

Hamilton, A. 1976 The significance of patterns of distribution shown by forest plants and animals in tropical Africa for the reconstruction of Upper Pleistocene palaeoenvironments: a review. In *Palaeoecology of Africa, 1972–1974,* vol. 19. (ed. E. M. van Zinderen Bakker), pp. 63–97). Cape Town: Balkema.

Howell, F.C. & Arsebök, G. 1989 *Yarimburgaz Cave, 1988*: Report on the investigations in the Cave of Yarimburgaz (Marmora, Turkey). Report to the National Geographical Society, Washington.

Huang Weiwen 1987 Bifaces in China. *Acta anthrop. Sinica* **6**(1), 61–68.

Hublin, J.-J. 1985 Human fossils from North African Middle Pleistocene and the origin of *Homo sapiens*. In *Ancestors: the hard evidence* (ed. E. Delson), pp. 238–288. New York: Alan Liss.

Ikawa Smith, F. 1978 *Early Palaeolithic in South and East Asia*. The Hague: Mouton.

Islamov, Y.I. 1990 Sel'oungour, un nouveau site du Paléolithique inférieur en Asie centrale. *Anthropologie* **94**(4), 675–688.

Jayaswal, V. 1982 *Chopper-chopping component of the Palaeolithic in India*. Delhi: Agam Kala Prakashan.

Jia Lanpo 1980 *Early Man in China*. Beijing: Foreign Language Press.

Jia Lanpo & Wei Qi 1976 A Palaeolithic site at Hsu-chia-yao in Yangkao County, Shansi Province. *Acta archaeol. Sinica* **2**, 97–114.

Kamminga, J. & Wright, R.V.S. 1988 The Upper Cave of Zhoukoudian and the origins of the Mongoloids. *J. hum. evol.* **17**(8), 739–767.

Kaplan, J. 1990 The Umhlatuzana Rockshelter sequence: 100,000 years of Stone Age history. *Natal Mus. J. Human.* **2**, 1–94.

Klein, R.G. 1972 Preliminary report on the July through September, 1970 excavation at Nelson Bay Cave, Plettenberg Bay (Cape Province, South Africa). *Palaeoecol. Africa* **6**, 177–208.

Kleindienst, M.R. 1961 Variability within the Late Acheulian Assemblage in Eastern Africa. *S. Afr. archaeol. Bull.* **16**(62), 35–52.

Kolossov, I.G. 1988 Les débuts du Paléolithique en Crimée. *Anthropologie* **92**(3), 809–838.

Korisettar, R., Mishra, S., Rajaguru, S.N., Gogte, V.D., Ganjoo, R.K., Venkatesan, T.R., Tandon, S.K., Somayajulu, B.L.K. & Kale, V.S. 1989 Age of the Bori volcanic ash and Lower Palaeolithic culture of the Kukdi Valley, Moharashtra. *Bull. Deccan Coll. Res. Inst.* **47**, 135–137.

Larichev, V., Khol'ushkin, U. & Laricheva, I. 1987 Lower and Middle Palaeolithic of Northern Asia: achievements, problems and perspectives. *J. World Prehist.* **1**(4), 415–464.

Larichev, V., Khol'ush kin, U. & Laricheva, I. 1988 The Upper Palaeolithic of Northern Asia: achievements, problems and perspectives I. Western Siberia. *J. World Prehist.* **2**(4), 359–396.

Larichev, V., Khol'ushkin, U. & Laricheva, I. 1990 The Upper Palaeolithic of Northern Asia: achievements, problems and perspectives II. Central and Eastern Siberia. *J. World Prehist.* **4**(3), 347–385.

Li Tianyuan & Etler, D.A. 1992 New Middle Pleistocene hominid crania from Yunxian, Hubei Province, The People's Republic of China. *Nature, Lond.* (In the Press.)

Lubine, V.P., Tcherniachovski, A.G., Barychnikov, G.F., Levkovskaia, G.M. & Selivanova, N.B. 1985 La Grotte de Koudaro I: (Résultats de recherches pluridisciplinaires). *Anthropologie* **89**(2), 159–180.

de Lumley, H. & Sonakia, A. 1985 Contexte stratigraphique et archéologique de l'Homme de la Namada, Hatnora, Madhya Pradesh, Inde. *Anthropologie* **89**, 3–12.

Lü Zun-E. 1990 La Découverte de l'Homme fossile de Jing-niu-shen: Première Etude. *Anthropologie* **94**(4), 899–902.

Marks, A.E. 1977 The Upper Palaeolithic sites of Boker Tachtit and Boker: A preliminary report. In *The prehistory and palaeoenvironments in the central Negev, Israel*, vol. 2 (ed. A. E. Marks). Southern Methodist University Press.

McBurney, C.B.M. 1967 *The Haua Fteah (Cyrenaica) and the Stone Age of the Southeast Mediterranean*. Cambridge University Press.

Mehlman, M.J. 1989 Later Quarternary archaeological sequences in northern Tanzania. Ph.D. Thesis, University of Illinois.

Mehlman, M.J. 1991 Context for the emergence of Modern man in Eastern Africa: Some new Tanzanian evidence. In *Cultural beginnings: approaches to understanding early hominid lifeways in the African savanna* (ed. J. D. Clark), pp. 177–196. Mainz: Römisch-Germanisches Zentralmuseum.

Mellars, P. 1989 Major issues in the emergence of modern humans. *Curr. Anthrop.* **30**(3), 349–385.

Mellars, P. 1991 Cognitive changes and the emergence of modern humans in Europe. *Cambr. archaeol. J.* **1**(i), 63–76.

Misra, V.K. 1985 The Acheulian succession at Bhimbetka, central India. In *Recent advances in Indo-Pacific Prehistory* (ed. V. N. Misra & P. Bellwood), pp. 35–48. Oxford and New Delhi: IBH.

Misra, V.N. 1989 Stone Age India: an ecological perspective. *Man Environ.* **14**(1), 17–64.

Movius, H.L. 1948 The Lower Palaeolithic cultures of southern and eastern Asia. *Trans. Am. phil. Soc.* **38**(4), 329–420.

Pei Wenzhong & Zhang Senshui 1985 A study of the lithic artifacts of *Sinanthropus*. *Palaeontol. Sinica* **12**, 1–277.

Pope, G., Barr, S., MacDonald, A. & Nakabanlang, S. 1986 Earliest Radiometrically dated artifacts from Southeast Asia. *Curr. Anthrop.* **27**, 275–279.

Prell, W.L. & Kutzbach, J.E. 1987 Monsoon variability over the past 150,000 years. *J. geophys. Res.* **92**(D.7) 8411–8425.

Qian Fang 1985 On the age of "Yuanmou Man": A discussion with Liu Tung-Sheng *et al.* *Acta anthrop. Sinica* **4**(4), 324–331.

Ranov, V.A. & Davis, R.S. 1979 Towards a new outline of the Soviet Central Asian Palaeolithic. *Curr. Anthrop.* **20**(2), 249–270.

Rendell, H.M., Dennell, R.W. & Halim, M.A. 1989 *Pleistocene and palaeolithic investigations in the Soan Valley, Northern Pakistan*. Oxford: BAR International Series, **544**.

Rightmire, G.P. 1990 *The evolution of Home erectus*. Cambridge University Press.

Rightmire, G.P. & Deacon, H.J. 1991 Comparative studies of Late Pleistocene human remains from Klasies River Mouth, South Africa. *J. hum. Evol.* **20**, 131–156.

Roberts, R.G., Jones, R. & Smith, M.A. 1990 Thermoluminescence dating of a 50,000 year old human occupation site in northern Australia. *Nature, Lond.* **345**, 153–156.

Rodrigue, A. 1987 Nouveaux éléments sur le Moustérien du Maroc: La station d'Akka (Maroc Saharien). *Anthropologie* **91**, 483–496.

Schick, K.D., Toth, N., Qi, Wei, Clark, J.D. & Etler, D. 1991 Archaeological perspectives in the Nihewan Basin, China. *J. hum. Evol.* **21**(1), 13–26.

Schild, R. & Wendorf, F. 1977 *The prehistory of Dakhla Oasis and adjacent desert*. Warsaw: Polska Academia Nauk.

Shea, J.T. 1989 A functional study of the lithic industries associated with hominid fossils in the Kebara and Qafzeh Caves, Israel. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 611–625. Edinburgh University Press.

Smirnov, Y. 1989 Intentional human burial: Middle Palaeolithic (Last Glaciation) Beginnings. *J. World Prehist.* **3**(2), 199–233.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Smith, P.E.L. 1986 *Palaeolithic archaeology in Iran*. University Museum, University of Pennsylvania.

Solecki, R.S. 1971 *Shanidar: the first flower people*. New York: Alfred A. Knopf.

Stoneking, M. & Cann, R. 1989 African origins of Human Mitochondrial DNA. In *The human revolution* (ed. P. Mellars and C. Stringer), pp. 17–30. Edinburgh University Press.

Stringer, C.B. 1989 The origin of early modern humans: A comparison of the European and non-European evidence. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 232–244. Edinburgh University Press.

Stringer, C.B. 1990 The emergence of modern humans. *Scient. Am.* **263**(6), 98–104.

Stringer, C.B. & Andrews, P. 1988 Genetic and fossil evidence for the origin of modern humans. *Science, Wash.* **239**, 1263–1268.

Svoboda, J. 1989 Middle Pleistocene adaptations in Europe. *J. World Prehist.* **3**(1), 33–70.

Tillet, T. 1983 *Le Paléolithique du Bassin Tchadien septentrional (Niger-Tchad)*. Paris: CNRS.

Tixier, J. 1967 Procédés d'analyse et questions de terminologie concernant l'étude des ensembles industriels du Paléolithique récent et de l'Epipaléolithique dans l'Afrique du nordouest. In *Background to evolution in Africa* (ed. W. W. Bishop & J. D. Clark), pp. 771–812. University of Chicago Press.

Vandermeersch, B. 1989 The evolution of Modern humans: recent evidence from south-west Asia. In *The human revolution* (ed. P. Mellars & C. Stringer), pp. 155–164. Edinburgh University Press.

Van Peer, P. 1991 Interassemblage variability and Levallois styles: The case of the Northern African Middle Palaeolithic. *J. anthrop. Archaeol.* **10**, 107–151.

Vermeersch, P.M., Paulissen, E. & Van Peer, P. 1990 Le Paléolithique de la Vallée du Nil égyptien. *Anthropologie* **94**, 435–458.

Volkman, P. 1983 Boker Tachtit core reconstruction. In *The Prehistory and Palaeoenvironments in the central Negev, Israel*, vol. 3 (ed. A. E. Marks), pp. 129–190. Methodist University Press.

Volman, T.P. 1984 Early prehistory of southern Africa. In *Southern African prehistory and palaeoenvironments* (ed. R. G. Klein), pp. 169–220. Rotterdam: Balkema.

von Koenigswald, G.H.R. 1978 Lithic industries of *Pithecanthropus erectus* of Java. In *Early Palaeolithic in Southeast Asia* (ed. F. Ikawa Smith), pp. 23–27. The Hague: Mouton.

Wei Qi 1988 Le cadre stratigraphique, géochronologique et biostratigraphique des sites les plus anciens connus en Chine. *Anthropologie* **92**(3), 931–938.

Wen Benheng 1978 Palaeolithic artifacts found in the Yuanmou Basin, Yunnan. In *Gurenlei Lunwanji* (Collected papers of palaeoanthropology) (ed. Institute of Vertebrate Palaeontology and Palaeoanthropology), pp. 126–133. Academia Sinica. Beijing: Science Press.

Wendorf, F., Close, A.E., Schild, R., Gautier, A., Schwarcz, H.P., Miller, G.H., Kowalski, K. Krolik, H., Bluszcz, A., Robbins, D. & Grün, R. 1990 Le dernier interglaciaire dans le Sahara Oriental. *Anthropologie* **94**, 361–391.

Wreschner, E. 1980 Red ochre and human evolution: A case for discussion. *Curr. Anthrop.* **21**, 631–644.

Wu Rukang & Olsen, J.W. 1985 *Palaeoanthropology and palaeolithic archaeology in the People's Republic of China*. Orlando: Academic Press.

Wymer, J. 1982 *The Palaeolithic Age*. London: Croom Helm.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES