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The Middle Stone Age of East Africa and the Beginnings of Regional Identity

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The history of research into the Middle Stone Age of East Africa and the present state of knowledge of this time period is examined for the region as a whole, with special reference to paleoenvironments. The known MSA sites and occurrences are discussed region by region and attempts are made to fit them into a more precise chronological framework and to assess their cultural affinities. The conclusion is reached that the Middle Stone Age lasted for some 150,000 years but considerably more systematic and in-depth research is needed into this time period, which is now perceived as of great significance since it appears to span the time of the evolution of anatomically Modern humans in the continent, perhaps in East Africa.

KEY WORDS: Middle Stone Age; Sangoan/Lupemban; long chronology; Archaic *Homo sapiens*; Modern *H. sapiens*.

> . . . when we eventually find the skulls of the makers of the African Mousterian they will prove to be of non-*Homo sapiens* type, although probably not of Neanderthal type, but merely an allied race of *Homo rhodesiensis.* The partial exception . . . of the Stillbay culture group is therefore explicable on the grounds that *Homo sapiens* influence was already at work.
>
> (Leakey, 1931, p. 326)

> The other view is that the cradle of the Aurignacian races lies hidden somewhere in the Sahara area, probably in the south-east, and that an early wave of movement carried one branch of the stock via Somaliland and the Straits of Bab el-Mandeb into Arabia, and thence to some unknown secondary centre of distribution in Asia.
>
> (Leakey, 1931, p. 239)

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INTRODUCTION

"Middle Stone Age" (MSA) is the term introduced in 1929 (Goodwin and Van Riet Lowe, 1929, pp. 95–145) and that is in general use today in Africa south of the Sahara to describe the combination of recurring technological and typological characteristics that follow those of the Earlier Stone Age and precede the Later Stone Age in that part of the continent. It is an inadequately defined but still useful term which includes a variety of lithic industries that are also chronologically related. For most researchers, therefore, the term carries chronostratigraphic connotations, although because of the imprecision that still exists in this time range, the boundaries are by no means accurately defined. Middle Stone Age is used synonymously with "Middle Paleolithic", the term used in the remainder of the Old World where the comparable lithic traditions are found; this includes North Africa and the Sahara.

Although the chronology lacks precision, there is increasing evidence to show that the Middle Stone Age/Middle Paleolithic in Africa begins sometime between $\geqslant$200,000 and 100,000 years ago and comes to an end between 40,000 and 30,000 years ago. The close of the Middle Stone Age can be well seen in most parts of the continent with the change in the Later Stone Age, from a more generally flake-dominated technology to one based on a blade, often microblade/flake tradition. The beginning of the Middle Stone Age, however, is less easy to see and is, to a great extent, identified by changes in the lithic components of the industries, namely, by the disappearance of bifaces (handaxes and cleavers) of the Acheulean type and the appearance or, where this was already in existence during the Earlier Stone Age, the *refinement* of the Levallois method(s) of flake production. There are, however, almost as many exceptions as conformities to this rule and there are few, if any, localities where the transition is sharply defined, either technically or stratigraphically. In large parts of East, central, and southern Africa there are found what at one time were called "transitional industries" (Clark and Cole, 1957, p. xxxiii) which were placed in a "First Intermediate Period" between the Earlier and the Middle Stone Ages. This term is, however, not much used today and the two Industrial Complexes known as "Fauresmith" and "Sangoan" that were assigned to this transitional period have, as a result of more precise understanding of their stratigraphic position, been relegated, on the one hand (Fauresmith), to a terminal Acheulean stage, dated at Rooidam (South Africa) to 174,000 B.P. $\pm$ 20,000 years by uranium series (Szabo and Butzer, 1979), and on the other hand (Sangoan), sometimes to the end of the Acheulean and sometimes to the beginning of the Middle Stone Age (Isaac, 1982, pp. 245–247). Fauresmith-type industries have been described from South and East Africa; other such assemblages from various parts of the continent, e.g., Ethiopia (Clark, 1945a) and Morocco (Acheulean 8) (Biberson, 1961, pp. 331–396), are comparable. The Sangoan is more generally associated with what today are higher-rainfall and/or more closed-vegetation environments but the extent to which this was the case when these assemblages were being made still remains to be clearly demonstrated and a pattern of savanna mosaic now seems more probable. The earliest MSA occurrences recognized in this review are those where Acheulean-type bifaces are no longer present and the prevailing technology combined the use of refined Levallois and disk core methods to produce thin flakes and points. Together with them is a flake/blade core component that may or may not also have made use of the Levallois forms of preparation. It is not necessary, of course, for all of these basic technological components to have been present at one and the same time and regional preferences, based in part on the raw materials employed, have resulted in a number of spatially adapted variants or facies.

In Europe, Middle Paleolithic assemblages that antedate the Last Glacial are commonly referred to as "Pre-Mousterian", whereas those in the same time range but with hand axes are named "Acheulean": the Light Duty components are virtually the same. In Africa, subdivisions of the Middle Stone Age are given regional names from type-sites or localities, but as in Europe and western Asia, the retouched flake tools show very little or no difference from those of the Light Duty component of the later Acheulean and this is clearly indicative of a continuity between them (Clark, 1982). Many of the retouched forms found with the Middle Stone Age were already present with the Acheulean, and the same is true of the technology, although in a less evolved form. In East Africa, besides refinement in prepared core techniques, the new elements are an increasing emphasis on the production of blades where raw material permits, in some places on various regionally distinct bifacial and unifacial "point" forms, the Heavy Duty core-ax or pick, and on the presence of what is generally referred to as an Upper Paleolithic/Later Stone Age component such as end-scrapers, borers of various kinds, burins, and backed forms. Assemblage variability is closely related to environment and to raw material, and the ways in which occurrences cluster to form industries can be seen to be determined by adaptation to regional ecological conditions by MSA populations occupying a remarkably varied range of habitats. This was, therefore, a time that saw the beginning of cultural identities and biological differentiation, with, also, the appearance of the first anatomically Modern humans from some, as yet unidentified, gene pool of archaic *Homo sapiens* somewhere in the African subcontinent (Stringer and Andrews, 1988). Some of the earliest fossil evidence for Modern humans comes from East Africa during the time period of the Middle Stone Age.

It is to be expected that the tool-kits of Modern humans would exhibit some significant refinement over those of archaic hominids. While this is true of Upper Paleolithic/Later Stone Age assemblages in general and, in particular, of the increased range of variability in space and time, it is not nearly so obvious in the initial stages that began in the Middle Stone Age. Such is also true of other "transitions", for example, in the change from hunting/gathering to agriculture, where at the beginning, little technological alteration is to be seen. The changes in MSA lithic technology are not so readily apparent and, when they are recognized, are likely to be more spatially restricted and to show no very clear-cut stylistic differences through time. This is, however, a time of several very important innovations, a more structured social organization that might be deduced from a pattern of regular transhumance and reoccupation of key localities and the hafting of stone working parts in traditional ways to form simple composite tools.

Space and Time Framework

There is no clearly defined area of the continent known as East Africa. The core area is more generally regarded as the countries of Kenya, Tanzania, and Uganda but the Horn (Ethiopia and Somalia) cannot be omitted, and at times, Zambia and Malawi have also been included, although for the purpose of this review, the two latter countries have been omitted as, except in the north, their prehistoric connections appear to have been more with southern Africa. That part of the southern Sudan to the west of the territorial boundary with Ethiopia has, however, been included since geographically it forms part of this wider East African region.

The Middle Stone Age belongs to the end of the Middle and earlier part of the Later Pleistocene. That is to say, it makes its appearance during the period of aridity at the end of the Acheulean [the equivalent of the Penultimate (Riss) Glaciation in Europe] and continues throughout the time of the Last Interglacial and into the early Last Glacial. In the Olduvai Gorge, the Masek Beds date between 400,000 and 600,000 B.P. and contain advanced Acheulean assemblages. They were laid down at the top of the Beds I–IV sequence, at a time when oxygen-isotope analysis indicates that the climate was drier than today. The extensive deposits of wind-worked tuffs from the Masek Beds through the Ndutu and Naisiusiu Beds to the present are also indicative of drier conditions (Cerling *et al.*, 1977).

Since the deep-sea core evidence (Shackleton and Opdyke, 1973) shows that these climatic fluctuations were world wide events, chronological evidence from other parts of the African continent, as well as from East Africa, can be used to help date the beginning and end of the Middle Stone Age.

This evidence now indicates that these events are synchronous in both Africa and Eurasia, and recent thermoluminescence dates from Europe (Valladas *et al.*, 1986; Mellars, 1986) and western Asia (Valladas *et al.*, 1988) show that the Middle Paleolithic there belongs in the same time period.

The most reliable dating evidence from Africa is radiometric and isotopic. The later Acheulean at Isimila in central Tanzania is dated by uranium series to ca. 260,000 B.P. (Howell *et al.*, 1972), and at Kapthurin in the Baringo Basin in northern Kenya the youngest K/Ar age for a late Acheulean is 230,000 B.P. (Leakey *et al.*, 1969). In the eastern Sahara, the period of aridity between the final Acheulean of the mound springs and the early Middle Paleolithic is attested by the lowered water table, deflation, and dune migration (Wendorf and Schild, 1980). The late Acheulean in the Bir Tarfawi basin is dated, on three samples, by uranium series to $\geqslant$350,000 B.P. (Wendorf *et al.*, 1988b). Recently, following the "radar rivers" research in the southern part of the Western Desert of Egypt, the late Acheulean there is dated to ca. 140,000–212,000 B.P. (McHugh *et al.*, 1988). In South Africa, evidence for the final Acheulean at Rooidam (see above) and the lithostratigraphic and sedimentological evidence from coastal and inland sites suggest that the Acheulean also ended there ca. 200,000 years ago.

The earliest Middle Stone Age assemblages date to ca. 200,000 B.P. and shortly before, so that there is no longer support for any significant hiatus or discontinuity between the end of the Earlier and the beginning of the Middle Stone Ages, other than in those parts of the continent where extreme desertic conditions resulted in temporary abandonment by the larger game animals and humans. At Kulkuletti and Gademotta in the Ethiopian Lakes section of the Rift Valley, the earliest Middle Stone Age assemblage occurs above a horizon with hand axes and below a tuff dated by K/Ar to 235,000 B.P. $\pm$ 5000 years (Wendorf *et al.*, 1988a). Later assemblages interstratified with further tuffs have dates of 181,000 $\pm$ 6000 and 149,000 B.P. $\pm$ 13,000 years (Wendorf *et al.*, 1988a). If these dates appear earlier than was at one time expected, it should be mentioned that the Middle Stone Age at the Malewa Gorge in Kenya is dated to 240,000 B.P. (Evernden and Curtis, 1965, p. 358). On the other hand, the date of ca. 400,000 B.P. for the "Pseudo-Stillbay" from the Kinangop plateau in Kenya (Evernden and Curtis, 1965, p. 358) must be too early if this occurrence is to be considered as belonging in the Middle Stone Age and may, rather, point to an association in some late Middle Pleistocene Acheulean context.

The later Pleistocene Kibish Formation in the Lower Omo Valley in southwest Ethiopia, produced from a single horizon, but different localities, two relatively complete human crania and a fragment of a third. The cultural association of these fossils is probably Middle Stone Age (see below) and a uranium-series date gives them an age of ca. 130,000 B.P. The Ngaloba Beds at the top of the geological sequence at Laetoli yielded a virtually complete cranium (LH 18) (Day *et al.*, 1980) in a context with MSA artifacts (Harris and Harris, 1981) and with an age—by association with a dated tuff and correlation with the same trachytic tuff at Olduvai Gorge—of between 120,000 and 130,000 B.P. (Hay, 1987).

Recent work by Mehlman (1987) in the Lake Eyasi Rift shows that the earliest Middle Stone Age there (Njarasa Industry), associated with a "Sangoan-type" pick or core-ax component, is most probably older than 130,000 years B.P. The main MSA assemblage from Bed VIB at the base of the Mumba Cave sequence is dated by two uranium-series determinations of 109,486 and 131,710 B.P., an age not inconsistent with the C-14 determinations above. The Eyasi Beds with the Njarasa Industry outcropping on the lake plain have been shown (Mehlman, 1987) to antedate the Mumba Beds and a calculated age of ca. 173,000 B.P. is proposed for the top of these beds. At Olduvai Gorge, the earliest Middle Stone Age yet found occurs in the upper part of the Ndutu Beds, estimated to be ca. 50,000 B.P., while the lower part of the beds is thought, on faunal evidence, to have an age of ca. 200,000 B.P. (Hay, 1987, pp. 146–159). Attempts to date, by the obsidian hydration method (Michels *et al.*, 1983), Phases 1 and 2 of the MSA from Prospect Farm in the Kenya Rift were unsuccessful. However, the lower part of Phase 3 (Horizon 2) is dated to between 119,000 and 106,000 B.P., while Phase 4 (Horizon 1) dates between 46,700 and 53,600 B.P., which, on averaging seven dates, gives an age of 50,184 B.P. From Porc Epic Cave, Dire Dawa in eastern Ethiopia, obsidian hydration dates of ca. 61,000 B.P., and ca. 78,000 B.P. from the MSA occupation are probably underestimates (Clark *et al.*, 1984a, pp. 64–68).

Elsewhere in Africa, the beginning of the Middle Paleolithic/Middle Stone Age has much the same early date. Besides those mentioned above are new uranium-series dates from the Ouljian Beach in Atlantic Morocco of ca. 140,000 and 120,000 B.P. (Hoang *et al.*, 1978), in association with which Middle Paleolithic artifacts are found. The lowest stratigraphic unit at the cave of Haua Fteah, Cyrenaica, containing the Pre-Aurignacian Industry is, on faunal evidence and correlation with the deep-sea core isotope Stage 5, dated to 127,000–75,000 B.P. (Klein and Scott, 1986), which would place the blade-dominated Pre-Aurignacian assemblage there as early Middle Paleolithic. Radiocarbon dates from the Middle Paleolithic (Mousterian and Aterian) in northern Africa are unreliable and should all probably be treated as infinite ages beyond or at the lower limit of the method. Recently a new series of dates for the Aterian in the eastern Sahara (Wendorf *et al.*, 1988b) shows that this industry is $\geqslant$ 100,000 B.P. At Bir Tarfawi there is evidence for five or six lacustrine epochs associated with the Middle Paleolithic and the use of a range of dating techniques indicates that the beginning of the

Middle Paleolithic there may date to 160,000 B.P., while the later occurrences date to 140,000–120,000 B.P. and a date of ca. 70,000 B.P. is given for the last lacustrine episode.

The end of the Middle Stone Age in East Africa is not well dated but indications are that it occurred at much the same time as in other parts of the continent, namely, between 40,000 and 30,000 years ago. It was present ⩾40,000 B.P. at the site of Midhishi 2 in northern Somalia (Brandt and Brook, 1984) and possibly ⩾ 70,000 B.P. on a recent TL result (S. A. Brandt, personal communication). Radiocarbon dates of ⩾ 30,000 B.P. and possibly ca. 65,000 B.P. by uranium series on bone from Bed V at Mumba Shelter are associated with a specialized late MSA industry (Mehlman, 1987, p. 141). From Bed III an industry that combines an evolved MSA and bladelet technology, known as the Naseran Industry, is dated to 26,900 B.P. ± 760 years, and the same industry from the type-site is dated to ca. 23,000 B.P. These, as well as other "transitional" industries (e.g., the Tshangulan Industry in Zimbabwe) recall what used to be referred to as "Magosian" industries and placed in a "Second Intermediate Period." Although the Magosian from the type-site has been shown to be a mixed assemblage, there is no doubt that the Naseran, Tshangulan, and other such entities are valid industries that postdate the MSA proper but continue to retain certain inherited traits that presumably remained especially advantageous in the tropical savanna habitat.

In the Lake Nakuru basin a late MSA assemblage (GrJil1) occurs in sediments that, on correlation with a dated core from Lake Elmenteita, are ⩾30,000 years old (Merrick, 1975, p. 232). At Lukenya Hill, a microlithic industry was present by at least 21,000 B.P. and overlay an undiagnostic, non-Middle Stone Age occurrence (Miller, 1979). In southern Africa, the Middle Stone Age comes to an end shortly before 32,000 B.P. (Deacon, 1987). In the Ituri, in northeast Zaire, a microlithic industry in quartz is already present by 41,000 B.P. (Van Noten, 1977).

OUTLINE HISTORY OF MSA RESEARCH IN EAST AFRICA

Research So Far Undertaken

The first systematic prehistoric research in East Africa was begun by E. J. Wayland, Director of the Geological Survey of Uganda, in 1920 (Van Riet Lowe, 1952, p. 3). He developed a threefold glacio-pluvial hypothesis for the later sedimentary history of that country. In 1926, L. S. B. Leakey's East African Archaeological Expedition in the basins of Lakes Naivasha and Nakuru in the Eastern (Kenyan) Rift (Leakey, 1931) described "Kenyan

Mousterian" and "Kenyan Stillbay" assemblages from stratified, fine-grained sediments in the Malewa Gorge. These were made mostly from obsidian and he later (Leakey, 1936) likened them to "Middle Stone Age" assemblages from South Africa. At the same time, the Swedish paleogeographer Eric Nilsson (1932) was working in the same area and on the East African high mountains. He placed the sequence he identified in a pluvial/interpluvial framework and recovered cultural assemblages similar to those found by Leakey. This framework was developed by Leakey (1931, p. 78), who considered his "Mousterian" assemblages to be evolved from a locally recognized industry (Nanyukian), comparable to a Fauresmith and so to a late Acheulean. In 1932 his excavations at Apis Rock (now Nasera), in the eastern Serengeti in Tanzania, yielded a stratified sequence of "Proto-Stillbay" and "Stillbay" in the lower part of the cave sequence (Leakey, 1936, pp. 63–66).

Leakey also found, in sediments on top of the Kinangop Plateau overlooking Lake Naivasha, an assemblage of small, unifacially and bifacially worked points in obsidian which he described as "Pseudo-Stillbay" (Leakey, 1936, pp. 49–56) and he believed this to date to a time not long after, or contemporary with, the end of the Acheulean. From the same swamp clays on the Kinangop, Leakey (1936, pp. 54–55) also recovered at one site (Cartwright's Farm) a small assemblage of blades and blade tools. Retouched forms include blades with blunted backs, burins, and scrapers, presumably end-scrapers. As this is the locality from which Evernden and Curtis obtained their sample (KA 1089) (1965, p. 363) that gave an age for the Pseudo-Stillbay, this is also presumably the estimated age for the "Basal Aurignacian."

In 1934 for 18 months, T. P. O'Brien (1939) undertook a survey of sites on the west side of the Lake Victoria Basin in Uganda, in particular at localities in the southwest at Nsongezi, where he found another sequence with some significant differences from those in the Kenya Rift. In 1945, Leakey and Owen (1945) published the results of their fieldwork in the Winam Gulf area on the northeast side of Lake Victoria and found a sequence similar to that reported by O'Brien. The only other work of significance on the Middle Stone Age was by Kohl-Larsen's expedition to the Lake Eyasi Rift that resulted in the discovery of fragmentary remains of two, perhaps three, archaic *Homo sapiens* individuals with artifacts described as "Levalloisian" and the excavation of a long, stratified sequence in the Mumba Rockshelter (Kohl-Larsen, 1943).

By the 1960s, research interests had concentrated on the search for early hominids and culture at Olduvai Gorge and other Plio-Pleistocene localities in the East African Rift System from northern Tanzania to Ethiopia. At the same time, the British Institute in Eastern Africa concentrated on the investigation of Later Stone Age and Iron Age sites to document the change from hunting and gathering to pastoralism and, later, to cultivation in northern

Kenya and the Kenya Highlands. The Middle Stone Age received far less attention, probably because associated faunal remains were scarce and also were thought to be of existing species and there was no reliable method by which to date these sites which, at that period, were thought to be contemporary with the European Upper Paleolithic. Again, at that time, there was no indication that Modern humans might have evolved during the time the MSA was the dominant technological mode; in short, this seemed to be a period without much intrinsic interest.

Ethiopia and Somalia (Clark, 1954) contributed little more to understanding the Middle Stone Age other than to extend knowledge of the distribution in time and space of the open savanna grassland variants into both the high plateaus and the Rift and to show that points—bifacial, unifacial, and Levallois—were advanced forms there. In 1929 de Manfred and Teilhard de Chardin (Teilhard de Chardin, 1930) and, again, in 1933 Breuil and co-workers (1951) excavated the cave of Porc Epic near Dire Dawa that yielded a typical Middle Stone Age assemblage together with a fragmentary human mandible. Blanc (1938) reported on the recovery of certain MSA forms from Moggio in the Ethiopian Rift and Leakey analyzed assemblages excavated from a stratified cave sequence ca. 5 km away at Gorgora at the north end of Lake Tana (Moysey, 1943; Leakey, 1943). No Middle Stone Age sites are recorded from western Ethiopia. Only in the southwest are small assemblages recorded, from a rockshelter at Yavello (Clark, 1945b) and on an exposed surface at Gotera (Chavaillon and Chavaillon, 1985).

In the Sudan, on the upper reaches of the Blue Nile south of its junction with the White Nile at Khartoum, was found in 1924 at Singa a fossil skull lacking the face, which was initially described as "Proto-Bushman" (Wells, 1951). From the same horizon, at Abu Hagar, some 30 km upriver from Singa, the fossiliferous horizon had associated an indeterminate industry but with some MSA affinities (Lacaille, 1951). More recently, a reexcavation by Ziegert (1981) has suggested that the industry may have been as early as a late Acheulean.

It was not until the late 1960s and 1970s that the Middle Stone Age began to take on new interest, with the work of Glen Cole (1967) at Nsongezi in Uganda in 1962 and 1964; the work of H. V. Merrick (1975) at Prolonged Drift in the Lake Nakuru Basin and at Lukenya Hill east of Nairobi in 1969 and 1971; that of M. J. Mehlman (1977, 1979) at Naseru in 1975–1976, to the Lake Eyasi Basin at Mumba Rockshelter in 1977; and that of Barbara Anthony (1972, 1978) at Prospect Farm overlooking Lake Elmenteita on the slopes of Eburru volcano in 1963. In 1972, Wendorf and Schild (1974) excavated important quarry and living sites at Gademotta and Kulkuletti on an extinct volcano in the Ethiopian Lakes section of the Rift; the writer and his team (Clark and Williams, 1978; Kurashina, 1978) excavated in 1974 and 1975 another quarry and workshop site at Koné at the southwestern end of the Afar Rift and reexcavated at Porc Epic (Clark and Williams, 1978; Clark *et al.*, 1984a); and in 1979–1980, McBrearty (1986) reexamined and excavated the site of Muguruk in the Winam Gulf area of Western Kenya, first reported by Leakey and Owen (1945), and a new site with fauna at Songhor (McBrearty, 1981). These were all systematically excavated, stratified assemblages in primary or near-primary contexts, the analysis of which is the main evidence showing the composition and variability present in the East African Middle Stone Age. More recently still, systematic research has begun on the prehistory of Somalia and the first radiocarbon dates are now beginning to appear (Brandt and Brock, 1984).

Nomenclature and Terminology

In recent years much less attention has been paid to nomenclature and terminology than in the past, and since reliable dating methods have become available to prehistorians in Africa, the emphasis has shifted to identifying and understanding the behavioral patterns that can be inferred from the artifact assemblages in an undisturbed context. Many of the terms used have never been adequately defined, have little or no validity now, or have already, by consensus, been dropped. Such, for example, is the term "Stillbay" adopted on the basis of selected surface collections from sand dunes in the southwestern Cape Province of South Africa. Investigators now prefer to continue to use the general term Middle Stone Age, which carries no specific connotation, or else, for localized sequences, to adopt local names defining the chronostratigraphic boundaries and artifact composition of each entity recognized. For the present, therefore, MSA occurrences in Ethiopia, Somalia, and the three East African countries are not more specifically differentiated and further research is necessary before any more meaningful divisions can be imposed. The occurrences within the Lake Victoria Basin, however, are sufficiently different that distinctive terms are necessary, especially since the associations there appear to be more particularly with the Zaire Basin and Equatoria rather than with the East African savannas. The term "Tumbian," used initially by Leakey and Owen (1945), was discarded in 1947 because the initial Tumbian assemblages from Bas Congo were mixed surface collections. This was replaced by "Sangoan," which itself was from surface finds at Sango Bay on the west side of the lake (Wayland, 1923). The term "Lupemban" for stratified assemblages in southwestern Zaire and northeastern Angola was proposed by Belgian and other workers in the Congo Basin (Breuil, 1944). Sealed, post-Acheulean assemblages from Nsongezi (Cole, 1967), the

Winam Gulf (McBrearty, 1986), and northeastern Angola (Clark, 1963) contain from the beginning the "crude" Sangoan core-ax, other Heavy Duty tools, and rare Lupemban foliates. Later, the core-axes became more refined and there were many more lanceolates. The continuum exhibited by this tradition on both sides of the basin is in general terms referred to here as "Sangoan-Lupemban," but where local sequences warrant this, a more specific local term is employed (McBrearty, 1988).

ENVIRONMENT AND HABITAT

Physiography (Figs. 1–4)

As defined in this review, the East African region consists of a high inland plateau area, dominated by some of the highest mountains in the continent, bounded, except in the southern part of Tanzania, by a narrow coastal plain 15–65 km in width, which leads up, sometimes gradually but more usually by steep, impressive escarpments, to the plateau. Cutting through this part of the elevated interior plateau of sub-Saharan Africa is the Great Rift Valley. The funnel-shaped northern section, in Ethiopia, known as the Afar Rift, is an arid, low-lying desert steppe, in the north some 120 m below sea level, and the coastline bounding the southern part of the Red Sea and the Gulf of Aden is one of the hottest parts of the world. In the southwest as the Rift narrows, the land rises to the Ethiopian lakes—some freshwater, some brackish—and continues southwesterly to Lake Turkana, 365 m above sea level. The major part of Ethiopia consists of two elevated and deeply dissected high plateaus separated by the Rift. These plateaus are composed of basalt lavas overlying sandstones and shales and attain average elevations of 2300–2450 m, with high mountain ranges on the northern plateau reaching 4300 m. The South-East Plateau is highest on its western and northern sides and falls away to drier, more low-lying, bush-covered country in Somalia. The plateau highlands are a mixture of high grassland savanna with evergreen forest on the mountains and tropical evergreen forest in the southwest. Rainfall is highest in the west, reaching 2400 mm, and decreases steadily eastward. The South-East Plateau receives ca. 1800 mm in the west but only 890–380 mm in the lower eastern parts and the littoral zone in Somalia 250 mm or less, supporting only an aromatic steppe vegetation. In Ethiopia the northern plateau is everywhere separated from the low-lying surrounding regions by steep escarpments which have long kept its population in near-isolation and encouraged the development of its unique civilization. On the west and north, this plateau is bounded by the lowlands of the southern and eastern Sudan, fed and drained by the Blue Nile coming from Lake Tana, the

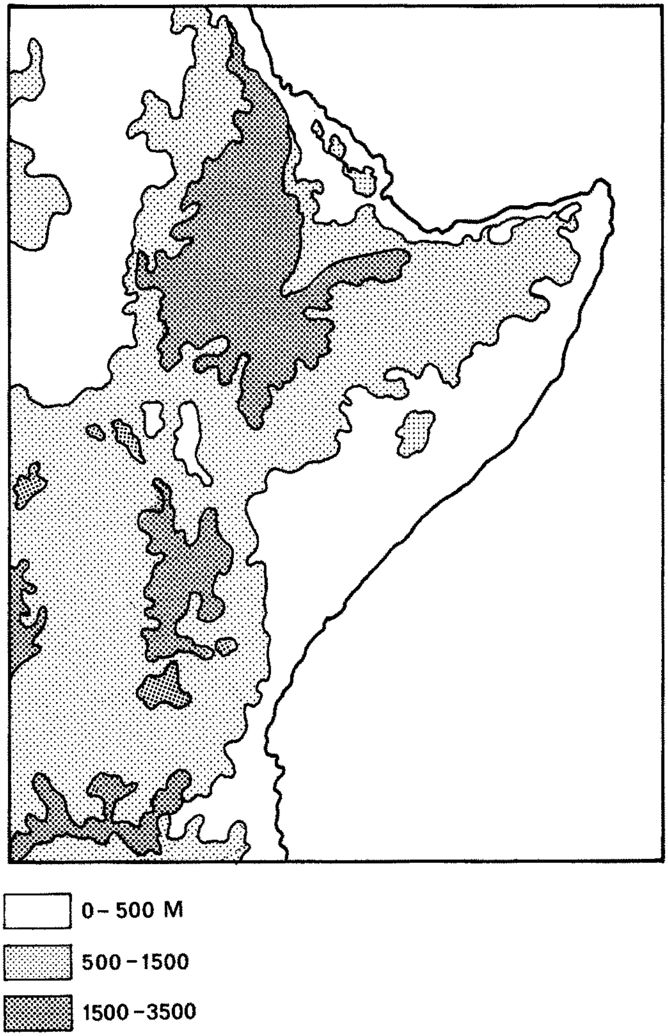

Fig. 1. Simplified topography (after Clark, 1967, Base Map 1).

White Nile from Lake Victoria, and their tributaries. Much of this comprises gray cracking clay plains that are annually flooded. Rainfall in the west is between 400 and 800 mm and, in the north, decreases rapidly from 800 mm near the base of the Ethiopian Escarpment to 200 mm and less further north. Today the vegetation is tropical woodland and grass steppe, and while the high plateau regions and more low-lying savanna woodlands support agriculturalists, the drier parts are the home of nomadic cattle and camel pastoralists.

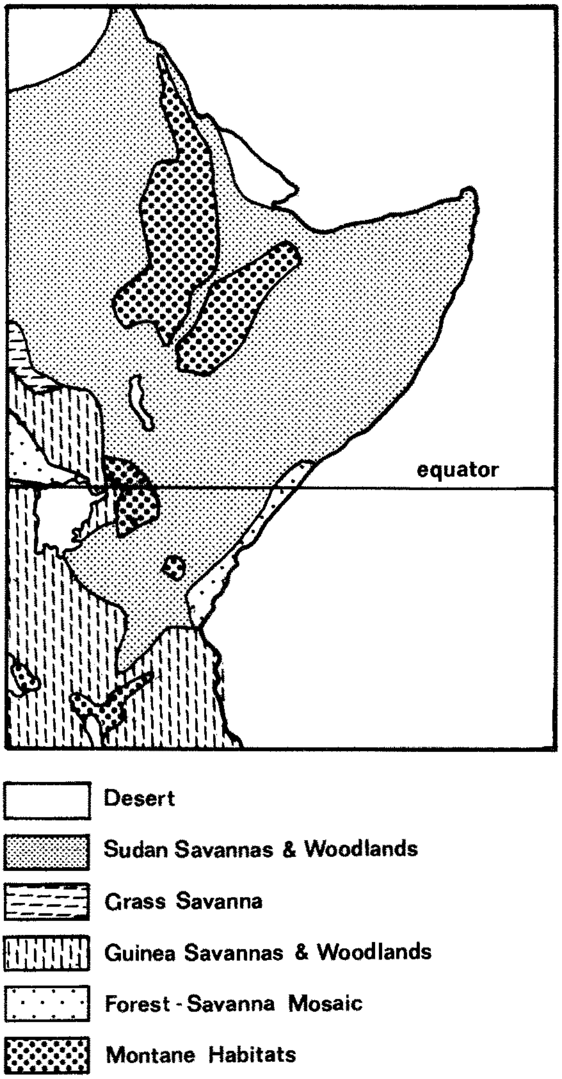

Fig. 2. Simplified vegetation zones (after Dorst and Dandelot, 1970, p. 150).

South of Ethiopia and Somalia lies the core of the East African region, drained, on the one hand, by rivers to the Indian Ocean but also by others flowing to large internal lake basins, the greatest of which is Lake Victoria. Dominating this region of undulating plains and plateaus are some of the highest, snow-covered mountains on the continent, which show evidence, as

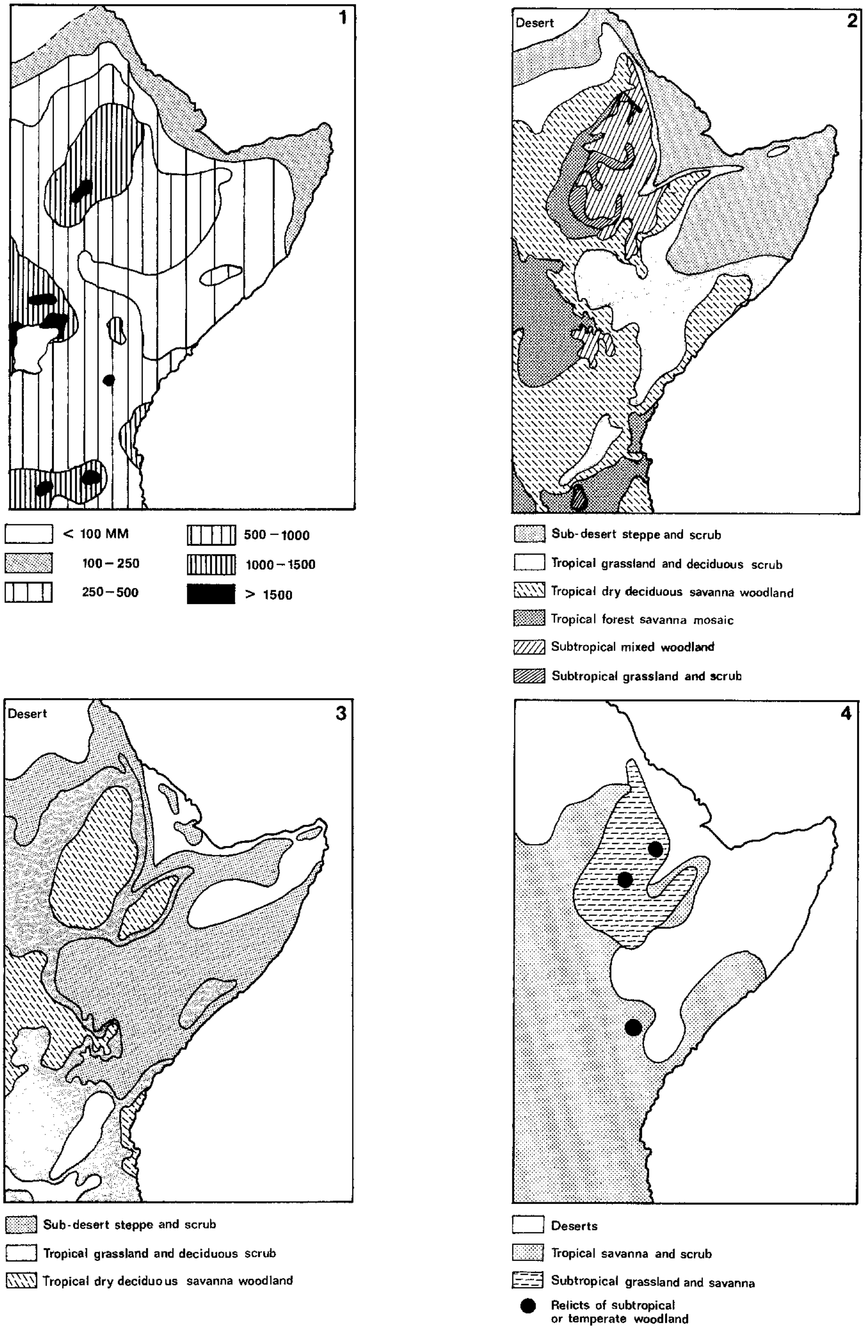

Fig. 3. Maps showing hypothetical vegetation changes under conditions of decreased rainfall and lowered temperature. (1) Present average annual rainfall (after Fitzgerald, 1961, p. 35). (2) Hypothetical vegetation with rainfall as today but temperature 5°C lower (after Clark, 1967, Base Map 8). (3) Hypothetical vegetation with rainfall 50% less than present but temperature as today (after Clark, 1967, Base Map 10). (4) Probable vegetation at the Last Glacial Maximum (18,000 B.P.) (after Butzer, 1978).

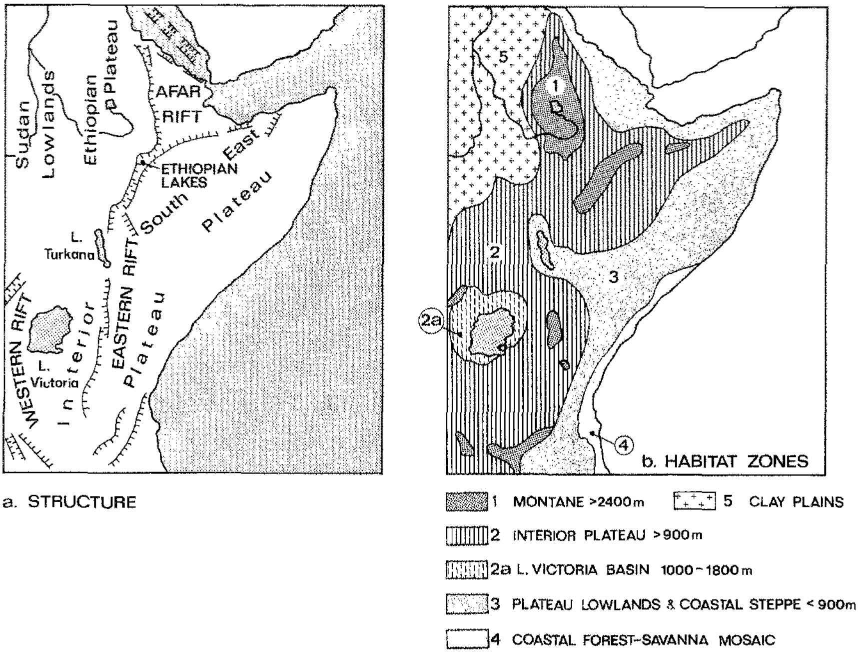

Fig. 4. (a) Structure (after *Oxford Regional Economic Atlas of Africa*, 1965, pp. 48–49). (b) Habitat zones identified for this review.

do those in Ethiopia, of three earlier periods of more extensive glaciation. Leaving the coastal plain, the eastern part of the plateau rises gradually from ca. 240 to ca. 1000 m and supports a semiarid to arid steppe that becomes more desertlike in its extension northward into northern Kenya. South of Lake Turkana, the Rift divides into an eastern and a western zone, each bounded by ridges or high country and containing a series of deep lakes. The Western Rift separates East Africa from the central Equatorial region of the Congo Basin, while the Eastern Rift divides the interior plateau of East Africa into two parts, a narrower, eastern part and an extensive western part comprising the central plateau proper and the lower country of the Lake Victoria basin, some 1130 m high. The underlying geology comprises ancient metamorphosed Basement Complex rocks with, superimposed, sandstones and lavas. The lake basins, especially within and adjacent to the Rift, hold deep sedimentary sequences and datable volcanic rocks that preserve the record of Tertiary and Quaternary climatic fluctuations. Rainfall is heaviest in the west, especially in the Victoria Basin, often > 1000 mm, and again, at the coast itself from the monsoon, but it is as low as 550–650 mm in the Masai steppe and eastern rift area of Tanzania. The vegetation is a mosaic of tropical woodlands, grasslands, and thicket, with a belt of desert steppe separating the southern highlands of Ethiopia from the East African highlands. The higher ranges and mountains support evergreen montane forest and temperate grassland and, in the western parts of the Victoria Basin, patches of tropical, moist forest.

Most rain falls during the passage of the Inter-Tropical Convergence Zone (ITCZ), which is a low-pressure zone where the northeast and southeast trade winds of the two hemispheres meet. The ITCZ moves south of the Equator in January and north of it, following the path of the sun, in July so that there are often two rainy seasons near the Equator but only one further to the north and south. The month of April is usually wet over East Africa, but by June, the ITCZ has moved north so that the rainy period in Ethiopia is from July to September. In November the rains start to move southward, and by mid-November, the 5- to 5.5-month rainy season begins in much of Tanzania. However, this pattern undergoes considerable diversification due to altitude and large water bodies. The heaviest rain falls in the west and along the Tanzania and south Kenya coast, with much less rain falling in the north and southeast. The heavy rain west and north of the Lake Victoria Basin is due largely to the existence of that water body.

Fauna

The whole of the region with which we are concerned was home to the full range of large, medium, and small mammalian species of the Ethiopian faunal zone, although the large herbivores were more common in the better-watered regions where the grazing was better. In the steppe and desert, drier-loving species, especially gazelle, proliferated, and it is clear that at one or more times in the past, a corridor of migration opened down the central parts of the inland plateau, allowing movement of mammalian and avifauna between the northeast and the southwest arid areas (Winterbottom, 1967) as relict populations attest in this corridor today. These episodes of dry climate were also in general periods of lowered temperature and at some such times in the past Palearctic forms, such as the Walia ibex and the Semien fox, penetrated to the Ethiopian high plateaus.

Paleoenvironments (Fig. 3)

It is clear that in the past there have been significant changes in the distribution and composition of the vegetation zones coincident with the climatic fluctuations between glacial and interglacial conditions in the high latitudes. Whereas during the Interglacials, conditions would appear to have been in general similar to those of the present-day interglacial episode, there is no doubt that, during the Glacials, temperatures in tropical Africa were lowered, sometimes as much as 7–10°C (Butzer, 1978; Hamilton, 1976, 1982; Van Zinderen Bakker, 1976). This resulted in significant readjustment of vegetation zones. Higher-altitude vegetation descended some 1000 m below its present limits, and since the climate in general was also drier, this resulted in a significant extension of the desertic and semiarid steppe. At the height of the Last Glacial, the tropical lowland forest in the Congo Basin and West Africa was restricted to a few refuge zones and woodland and grassland are thought to have replaced it. These woodlands appear to be relatively tolerant of climatic fluctuations and, for example, from the height of the Last Glacial, the *Brachystegia-Julbernardia* woodlands that cover so much of the southern part of East Africa and south-central Africa, were not displaced (Livingstone, 1971).

The environmental setting in which the makers of the Middle Stone Age industries occupied the high plains, savanna, and steppe country of East Africa is, therefore, determined in large part by worldwide climatic fluctuations modified in places, by local physiographic features. If the available dates are reliable—and the general agreement between those from other parts of the continent and those from East Africa suggests that they are—then the earliest MSA made its appearance in oxygen-isotope Stage 6 (195,000–128,000 B.P.), that is, during the latter part of the Penultimate Glaciation north of the Mediterranean. MSA populations began to assume broad, regional identities during the time of the Last Interglacial (oxygen-isotope Stage 5, 128,000–75,000 B.P.) and to produce tool-kits in part, at least, ecologically determined which, during the long dry period of lowered temperature during the earlier part of the Last Glaciation (oxygen-isotope Stages 4 and 3, 75,000–32,000 B.P.), began to show that the continuity was more with local antecedent occurrences than with contemporary assemblages in other regions. Such a pattern was, no doubt, induced by sparse populations living in relative isolation and adopting more specialized strategies with which to exploit the local plant and animal resources. While this is likely to have been the pattern in more favorable habitats, the changes that adverse climatic events must have brought about in those parts that were only marginally exploitable when conditions were favorable (as during isotope Stage 5) would have been likely to lead to demographic readjustment, and abandonment of some regions, and the seasonal reuse of others and, so, to ensuring interaction with adjacent populations. The early Last Glacial period in East Africa, as in North Africa, is likely to have been one of movement and interaction that stimulated the development, through experiment, of more efficient subsistence strategies in changing and deteriorating habitats. The less harsh surroundings of tropical and subtropical Africa might have been, therefore, the milieu in which the Modern genotype could have evolved.

Some evidence is available for the later Pleistocene climate of northern Somalia. Two uranium-series dates from speleothems from Hayla Cave in the northeast (250,900 ± 23,900 and 260,400 B.P. ± 26,600 years) suggest that the later Middle Pleistocene climate there, during the earlier part of oxygen-isotope Stage 7, was more humid than at present (Brandt and Brook, 1984). A Gulf of Aden core shows the climate of the Last Interglacial to have been warm and humid, with cooler conditions during isotope Stage 5d (115,000–105,000 B.P.) (Van Campo *et al.*, 1982). Other speleothem and spring tufa deposits from the north, 116,000–113,000 and 89,000–86,000 B.P. (Brandt and Gresham, 1988) confirm a more equable and evenly dispersed precipitation during isotope Stages 5e and 5a. The initial stages of the Last Glacial (isotope Stage 4c, ca. 72,000–58,000 B.P.) are characterized by a major period of aridity, on the evidence of the Gulf of Aden core (Van Campo *et al.*, 1982).

In the Afar Rift, eolian sands accumulated during the Middle Pleistocene. These are found stratigraphically overlying the Plio-Pleistocene lacustrine sediments, underlie those of the late Pleistocene lake transgression, and are indicative of a period of aridity presumably during the later part of the Middle Pleistocene. Since, however, mammalian fossils are found interstratified in some levels, some moister episodes must also have occurred (Gasse *et al.*, 1980, p. 378). A 50-m core from Lake Abhé shows the climatic history of that basin and can be matched by a similar history from other basins in the central Afar (e.g., Asal). A period of high lake level ended about 70,000 B.P. and was followed by a time of aridity when the lake dried up (isotope Stage 4). The lake rose again between 60,000 and 50,000 B.P. and remained high until 20,000 B.P., when it again fell but did not dry up. During the time of the earlier lake the climate was humid, the rainfall irregular, and the lake water fresh. The climate of the later lake was also humid and tropical but the water was more alkaline. The terminal phase was one of cold temperatures (Gasse *et al.*, 1980, pp. 380–384). Evidence from the Ethiopian Lakes region before 30,000 B.P. is enigmatic or missing, although there are indications of a high lake in the Zwai-Shala basin during the time of MSA activity at Gademotta (Gasse *et al.*, 1980).

In East Africa proper, well-dated evidence for climatic and vegetational changes begins only 40,000–30,000 years B.P. Prior to that time scattered and isolated data exist but, apart from those from the Plio-Pleistocene localities in the Rift, are inadequately dated. This is so especially for the Middle and early Late Pleistocene. Lake Victoria was, in general, low during the Last Glaciation and grasses proliferated at the expense of forest species. It is estimated that, during the major worldwide episodes of lowered temperature, the montane forests on the East African high mountains descended some

1000 m lower than their present limit (Hamilton, 1982, p. 211). Evidences exist for three earlier periods of expanded glaciation on Mounts Ruwenzori, Kilimanjaro, and Kenya, the most recent of which is equated with Würm III of the Last Glaciation. The next oldest (Rwimi Glaciation) on Ruwenzori is thought to be about 100,000 B.P. and the oldest and most extensive (Katabarua Glaciation) is appreciably older still. These were also times of drier climate on the East African mountains and it is estimated that rainfall may have been reduced by 29% (Livingstone, 1980, pp. 343–345).

Although there is little doubt that significant changes in climate—in rainfall, temperature, evaporation rates, and humidity—took place during the time the MSA was being made, it is not yet possible to reconstruct MSA paleoclimates and environments in detail for any of the main regions of East Africa. This must entail the recovery and analysis of long cores from selected lake basins. Until then little more is possible than the general indication that, at times of lowered temperatures and glaciation in high latitudes, the climate of large parts of East Africa would have been cooler and drier and that, during interglacial stages, rainfall, humidity, and temperature would have increased, producing conditions similar to those of the present day.

Habitat Zones (Fig. 4b)

For the purposes of this review and the description of the Middle Stone Age that follows, East African environments can be considered under five very generalized biotic regions or habitat zones.

(1) The highest plateaus of Ethiopia (1950–3000 m) and the high ranges and mountains of Kenya, Uganda, and Tanzania, where the predominant vegetation types are montane grassland and *Acacia* woodland, with evergreen montane forest on the higher parts.

(2) The interior plateau proper, with elevations between 1370 and 370 m, supporting moist and deciduous woodland of the *Brachystegia-Julbernardia* and *Isoberlinia* type in the higher-rainfall areas and drier *Acacia* and *Commiphora* woodland steppe with thicket in the drier and lower more easterly parts. In the Lake Victoria Basin are isolated patches of tropical mixed forest. Although today the biota, other than that resulting from somewhat higher rainfall, are not greatly different from that in other higher-altitude parts of the interior plateau, the Middle Stone Age occurrences within the basin of Lake Victoria, as also those in the Lake Kivu Basin, are sufficiently distinct from those in other parts of East Africa to warrant their being considered here within a separate sub-Zone—2A.

(3) The low-lying, mostly below 200 m, steppe and desert zone of the Red Sea and Gulf of Aden and the Indian Ocean coastal region from the Kenya border northwards. Included also are the arid northern parts of the Somali Plateau.
(4) The Indian Ocean coastal zone of Kenya and Tanzania, which supports tropical moist forest and savanna mosaic.
(5) The cracking gray clay Gezira plains of the south and eastern Sudan, supporting dry grassland and woodland steppe, some of it annually flooded.

In particular, Zones 1 and 2 have major subdivisions, based usually on altitudinal variability, that provide a mosaic of microhabitats with seasonally important resources and would have been optimal foraging environments for hunter/gatherers. In each of the five zones it is in the ecotone where most of the activity is believed to have taken place, and in the seasonal movements within and out of the arid zones, this is just as likely to have been important in the later Pleistocene as it is today.

A review of what is currently known of the Middle Stone Age occurrences and industries in each of these zones follows, although it needs to be emphasized that the number of occurrences is sparse in the extreme and that any comparisons that can be made should be treated with caution and as being no more than suggestions for future avenues of investigation.

The Atlas of African Prehistory (Clark, 1967) lists Middle Stone Age occurrences under various industrial terms current at that time—*Sangoan, Lupemban, Levalloisian, Stillbay,* and *Undifferentiated MSA*. Many of those shown for East Africa and the Horn consist of surface finds which, technologically, can be referred to one or other of the MSA traditions mentioned above. However, little is known concerning them so that, with few exceptions, they are not made use of further in this review, other than to include some in the map. The number of sites in each country is recorded in Table I. However, only those sites and occurrences, listed in Table II, that

Table I. Number of MSA Sites by Country in East Africa[a]

	Sangoan	Sangoan/ Lupemban	Levalloisian	Stillbay	Undifferentiated MSA	Total
Ethiopia	—	—	5	16	9	30
Somalia	—	—	13	22	12	47
Kenya	5 (+8)	6 (+3)	—	5 (+7)	—	34
Uganda	6	3	—	7	3	19
Tanzania	3 (+3)	13	—	2	5	26
Sudan	2	1	—	—	1	4
Total	27	26	18	59	30	160

[a]Figures in parentheses are shown in the *Atlas of African Prehistory* (Clark, 1967) as of "uncertain" allocation.

Fig. 5. Location of sites referred to in this review.

contribute to a closer understanding of the nature of MSA traditions in East Africa are discussed (Fig. 5).

Because of the uncertainty attaching to the chronology of the Middle Stone Age and the very few dates available at present, the various occurrences and industries can be only relatively ordered. Assuming that the available dates are reliable, the Middle Stone Age industries can be divided into an

Table II. The Main Middle Stone Age Sites and Occurrences in Greater East Africa[a]

Country	Sangoan/Lupemban and inferred earlier MSA	MSA of uncertain age	Inferred later MSA	Associated hominid fossil
Ethiopia/Somalia	Gademotta (3) Kulkuletti (3) Melka Kunturé (1) Hargeisa, lower (3) Jesomma, lower (3) Omo (Kibish Frm.) Member 1 (3)	Gorgora (1) Modjo (3) Gadeb (1) Yavello (2) Koné (3) Garoe (3) Bur Yassin (3) Jesomma, upper (3) Hargeisa, upper (2) Ala Kanasa (3)	Midhishi (3) Aladi Springs (3) Porc Epic (3) Gotera (2)	Dire Dawa (3) Omo 1 and 2 (2)
Kenya	Muguruk (Ojolla Ind.) (2A) Malewa Gorge (2) Kinangop ("Pseudo-Stillbay," "Basal Aurignacian") (1) Prospect Farm (Phases 1–3) (2)	Songhor (2A) Muguruk (Pundo Makwar Ind.) (2A) Lukenya Hill (2)	Prolonged Drift (2) Prospect Farm (Phase 4) (2) Enkapune ya Muto (1)	Kanjera (2)
Uganda	Nsongezi (N & O Horizons) Sangoan (2A) Sango Hills, Galula, & Kabinda Sangoan (2A)	Orichinga Valley (upper silts) (2A)		
Tanzania	Mumba Cave (Bed VIB) (2) L. Eyasi (Njarasa Ind.) (2) Nyara R (Sangoan) (2) Tendaguru (Sangoan) (4) Isimila (Sangoan) (2) Ndutu Beds, lower (2) Laetoli (Ngaloba Beds) (2)	Loiyangalani (2)	Ndutu Beds, upper (2) Nyara River (2) Galula (2) Nasera (2) Mumba Cave (Bed V) (2)	Laetoli Hominid 18 (Ngaloba Beds) (2) Mumba Cave (2) Lake Eyasi crania (2)
Sudan	Singa (5) Abu Hugar, lower (5) Khor Abu Anga, upper (5)	Abu Hugar, upper (5)		Singa (5)

[a] Numbers in parentheses after names indicate the phytogeographic habitat zone.

earlier and a later group but with other occurrences forming a third group that cannot be placed in either of the first two. Table II shows how these Middle Stone Age occurrences have been ordered for the purpose of this review, the zones in which they occur being shown in parentheses after each name. The arbitrary division of the MSA occurrences into "earlier," "later," and "unclassified" has been made on the following basis: those for which there are radiometric or isotopic dates of $\geqslant$ 100,000 B.P. or which are, on stratigraphic and/or faunal evidence, "early," have been placed in the earlier category. Occurrences with associated dates of < 100,000 B.P. or which stratigraphic and/or faunal evidence indicates to belong more probably in the later part of the MSA time range have been so placed. Where no associated chronological evidence exists, occurrences have been listed as "of uncertain age" (or as unclassified). It is necessary to appreciate that, in the present state of knowledge, any chronological ordering of the MSA has no solid foundation in reliable data and is attempted here only as an indication that certain of these occurrences *appear* to be early for one reason or another, just as others *appear* to be late. Only further systematic work on the MSA will show whether or not this ordering has any validity.

THE MIDDLE STONE AGE OF EASTERN AFRICA

Raw Materials in the Middle Stone Age

With the exception of obsidian, which in some instances was brought > 100 km from the nearest known source, most raw materials used for stone tool manufacture are located within a short distance or had to be brought not more than 50 km from a known source. What materials were used depended upon the solid geology. Where Basement Complex rocks predominate, the material was usually quartz and quartzite. In the Horn and northern Kenya where the Jurassic System is widely distributed, cherts from the limestones and shales were more commonly used as well as local sources of indurated shale. The regions of volcanic rocks, basaltic and rhyolitic lavas, trachytes, phonolites, and other lavas were used, particularly for large artifacts, while quartz and chert—often in the form of erratics from stream channels served for the manufacture of Light Duty equipment. Of special interest are the obsidians associated with the volcanics in the Rift or on the adjacent plateau in Kenya and northern Tanzania, since these sources are all known (Merrick and Brown, 1984) and their utilization by prehistoric groups provides evidence for long-distance movement, even in the Middle Stone Age.

The Middle Stone Age in the Horn

The Ethiopian Rift (Lakes Region and the Afar)

Anderlee. Anderlee, a site in the arid central Afar Rift, is reported to yield picklike forms resembling those of the Sangoan but these have yet to be described in detail and illustrated (Kalb *et al.*, 1982). As, however, the later Pleistocene conglomerates and gravels that everywhere overlie the earlier Pleistocene sediments in the Rift were the source of material for the manufacture of many crude, picklike artifacts that have every appearance of being late, perhaps Iron Age, for this writer the age and affinities of the Anderlee assemblage remain uncertain and so it is not dealt with here.

Gademotta and Kulkuletti (Zone 3) (Wendorf and Schild, 1974). The earliest dated MSA is found at these two sites in the Ethiopian lakes section of the Rift Valley, on the slopes of the old volcano overlooking Lake Zwai, where obsidian flows made these localities important sources of raw material (Figs. 6a–g). The dates of 140,000, 180,000, and 230,000 B.P. indicate a position in the late Middle Pleistocene in oxygen-isotope Stages 7 and 6, times, respectively, of warm climate with cold oscillations and cold climate with warm oscillations. These dates suggest also that the MSA there lasted some 90,000 years or more. During this period seven paleosols had time to form on the alluvial mantles of volcanic ash on the slopes of the volcano.

The earliest MSA (ETH-72-8B) occurred on a horizon overlying one with small bifaces. This occurrence is typically MSA with Levallois technique, well-developed and retouched unifacial and bifacial points, and side-scrapers of various kinds. Blades represent a small but important component in view of the increased "bladiness" of later occurrences. This site is considered by the excavators to have been a base camp that was probably of a single but longish occupation, judging by the number of retouched artifacts present. All these occurrences appear to have been workshop sites as indicated by the piles of debitage and manufacturing debris with trimming flakes and retouched tool fragments broken in the course of manufacture. The actual quarry sites do not appear to be represented here but there are some for pitchstone at Koné (see below) and they are likely to have been similar to these and to those still in use today on the slopes of Chabbe volcano to the south, i.e., shallow, open workings with large quantities of primary debitage and flakes from the roughing out of large, biconical cores, not unlike proto-Levallois cores (Clark and Kurashina, 1981, p. 318).

The technology shows no very significant change from top to bottom of the sequence except for fluctuations in the percentages of Levallois cores and debitage and, more importantly, a steady increase through time in the blade component (40% at the end), the introduction of non-Levallois blade cores,

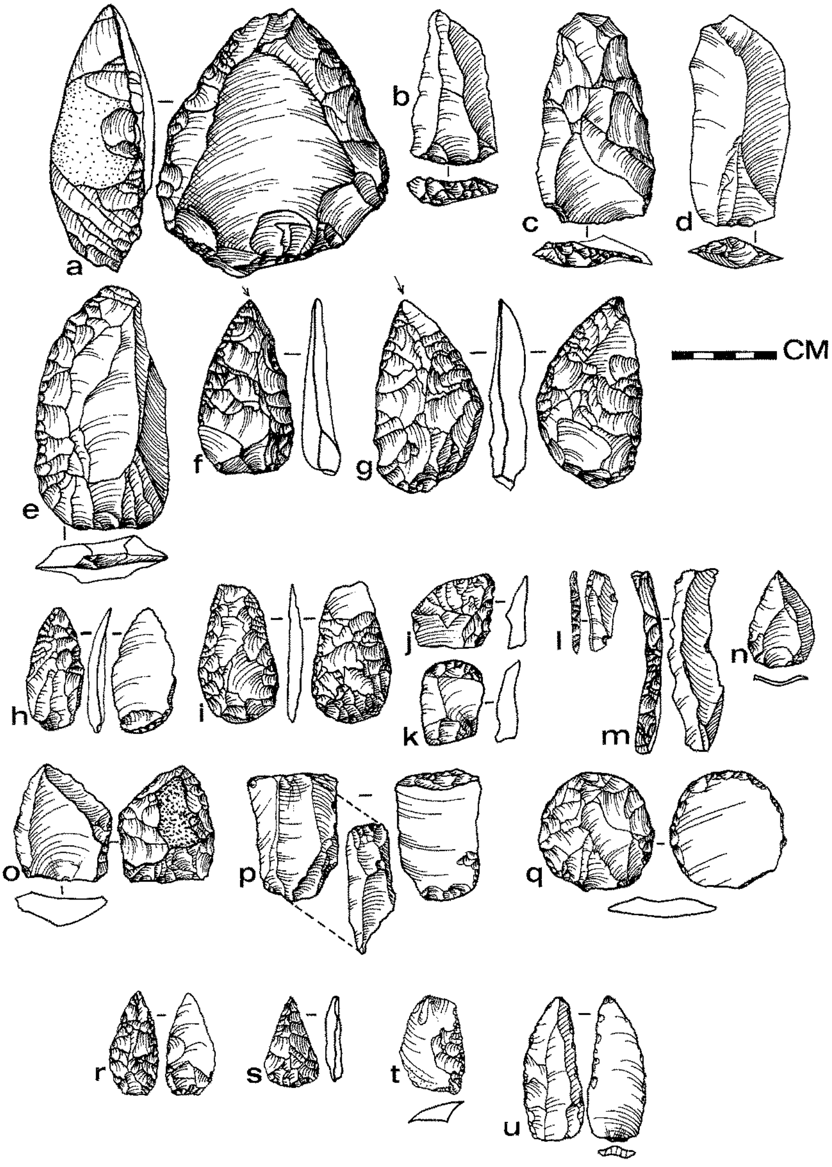

Fig. 6. Artifacts from sites in Ethiopia. (a–g) Gademotta and Kulkuletti: (a) Levallois core; (b, c) Levallois flakes; (d) Levallois blade; (e) convex side-scraper; (f) unifacial (Mousterian) point; (g) bifacial point with burin scar (a–f from ETH–72-1; g from ETH–72-8B). All obsidian (after Wendorf and Schild, 1974, pp. 189, 207, 212, 214, 219, 224). (h–q) Koné: (h) partibifacial point; (i) bifacial point with chisel end; (j) déjeté scraper; (k) end-scraper; (1, m) pseudobacked blades; (n) Levallois point; (o) Nubian core; (p) flake (sinew-frayer) core and refitting blade. All obsidian; from Locality 5 Extension (after Kurashina, 1978, pp. 418, 420, 422, 426, 429, 431). (q) Disk; obsidian, from Locality 1, Area A (after Clark and Williams, 1978, p. 29). (r–u) Porc Epic Cave, Dire Dawa, 1974 excavations: (4) partibifacial point, chert; (s) subtriangular, bifacial point, basalt; (t) inverse side-scraper, chert; (u) Levallois blade with use-wear, basalt (after Clark *et al.*, 1984a, pp. 51, 52, 53, 55).

and a corresponding decrease in Levallois preparation. A case can also be made for stylistic variation since points and side-scrapers covary through time and the authors (Wendorf and Schild, 1974, p. 156) suggest that if these retouched forms are all basically cutting tools, mainly knives, then the fluctuations may be indicative of a stylistic drift.

Koné (Zone 3) (Kurashina, 1978, pp. 314–445). This locality, in many ways very similar to Gademotta, is, as yet, undated (Figs. 6h–q). Situated at the southwest corner of the Afar Rift, the sites at Koné are located in the caldera of an old explosion crater on the slopes of this volcanic complex and, once again, are associated with paleosols (vertisols). The occurrences lie on old land surfaces and again are workshops, it would seem of one or two individuals, the obsidian and pitchstone having been collected from outcrops and flows on the higher slopes immediately to the north of the workshop areas and carried down to the sheltered floor of the caldera. The same workshop waste is found with piles of flaking debris, including trimming spalls and retouched points broken in manufacture, all collected and dumped, it is believed, to remove it from the living areas of these temporary camps. The Levallois method is well developed and particular interest attaches to the use of the "sinew-frayer" flake core and the Nubian core technique for making Levallois points; these make up some 4.2% of the assemblage (Fig. 7). Some of the Nubian cores must initially have been quite large, although most of those found are small and exhausted. Refitted flakes onto some 12 of these cores show well the reduction sequence and flaking techniques. From the lateral edges of large cores were struck bladelike flakes that appear at first glance to have been backed. This is, however, not in fact so and the "backing" is the remnant of the flaking that went into the preparation of the underside of a Levallois core and is, therefore, pseudobacking. Superficially some of these look like large backed blades and it is not impossible that they could have provided the prototype that led up to the backed-blade technology of later contexts. The blade component at the Koné sites is, however, always small (e.g., Locality 5 Extension, Area A: blades, 3.8%; long triangular flakes, 2.4%). Retouched forms comprise partibifacial and unifacial points, side-and end-scrapers, burins, borers, backed and truncated flakes, and thin, bifacially retouched disks that recall those from the later sites in the Kenya highlands (Prospect Farm) and at Lukenya Hill (see below).

Unfortunately, none of the Lake Zwai or Koné sites produced any fauna in direct association with the activity horizons. Another locality to note in the Rift yielding MSA artifacts is *Modjo* (Moggio), where characteristic points and Levallois flakes were found by Blanc (1938) and by our own team in 1974; these were derived from fine stream sediments.

Middle Awash (Zone 3). A small MSA assemblage was found in association with a hearth in stratified, later Pleistocene sands and silts at

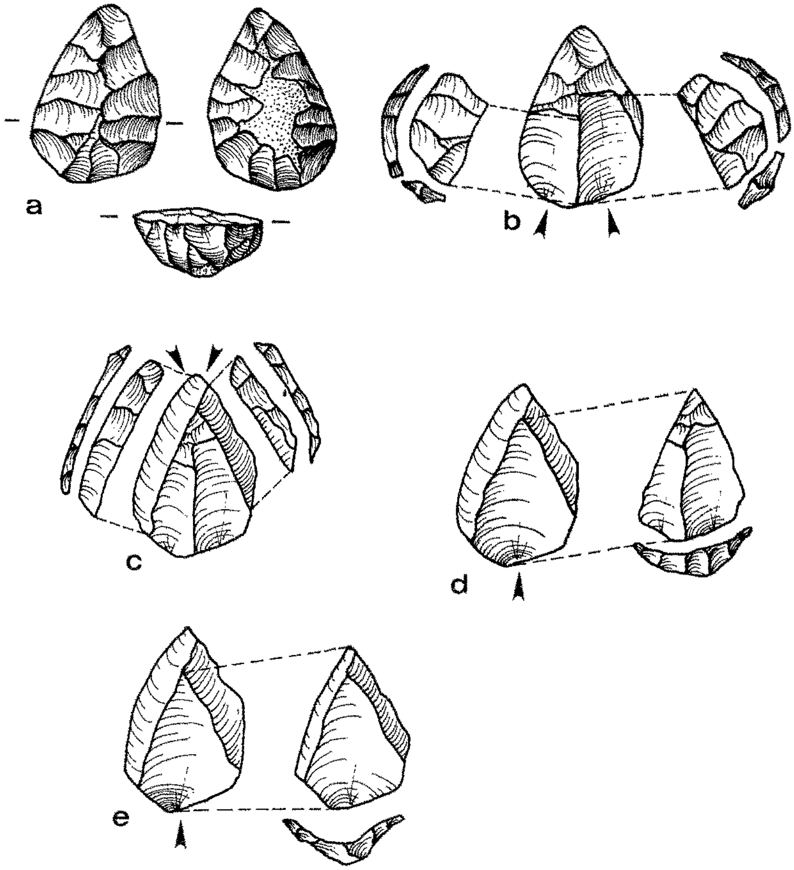

Fig. 7. Stages in the production of Levallois points and pseudobacked blades/flakes from Nubian cores at Koné. (a) Radial preparation of high-backed, subtriangular Levallois core; steep, near-vertical flaking on ventral face. (b) Removal of two flakes/blades from proximal end of core, each showing remains of radial preparation scars on dorsal face and pseudobacking. (c) Removal of two flakes/blades from distal end of core, each showing pseudobacking. (d) Removal of first-order Levallois point. (e) Removal of second-order Levallois point.

Ala Kanasa in the Middle Awash region of the Afar Rift (Clark *et al.*, 1984b). These sediments could be seen to overlie silts with horizons yielding artifacts that included advanced Acheulean forms of biface. The makers of this MSA assemblage used fine-grained rocks (chert, rhyolite, indurated shale, and obsidian), none of which was local and so must have been brought in. Artifacts included bifacial and unifacial points, side-scrapers, and a Levallois point. In connection with the prevalence of Levallois point production in the Horn and in view of the possibility of a land bridge or short water crossing to southwest Arabia at Bab-el Mandeb at times of lowered sea level during glacial maxima, it is of interest to note that Levallois flakes and points, together with their cores, have been reported recently from the Wadi 'Muggah in the region of Shabwa in South Yemen (Inizen and Ortlieb, 1987).

Porc Epic Cave, Dire Dawa (Zone 3) (Breuil et al., *1951; Clark* et al., *1984a).* At the southern end of the Afar Rift, on a precipitous cliff face near the base of the escarpment of the South-East Plateau, this cave occupies a commanding view over one of the main access routes between the plateau and the rift (Figs. 6r–u). Earlier excavations by Teilhard de Chardin (1930) and Breuil *et al.* (1951) were followed by others in 1974 and 1976 (Clark and Williamson, cited by Clark *et al.*, 1984a), although the results of the second of these are not yet available. Although larger, the shelter is in many ways comparable to that at Gorgora (see below) and is tentatively considered as another hunting camp. The MSA is contained within a breccia some 2.5 m deep and is sealed (except in the front part of the cave, which has suffered subsequent erosion) by a massive early Holocene dripstone dated to the seventh millennium B.C. The obsidian hydration dates obtained by Michels and Marean (Clark *et al.*, 1984a, Part II) suggest a minimum age for the Porc Epic occurrence of between 60,000 and 77,000 B.P. No significant changes could be detected in the technology and typology from top to bottom of the sequence. The artifacts were associated with much comminuted and often burned bone, together with fire fractured artifacts and rock from what appear to be hearths with red pigment. During the 1933 excavation by Teilhard de Chardin and Wernert, a fragmentary human mandible was found in the breccia and it is discussed below.

Most of the artifacts (80%) are made from chert from the local Jurassic limestones but obsidian and a fine-grained basalt were also used and obtained from a distance which, in the case of the obsidian, suggests ranging strategies extending 100 km or more west of Dire Dawa. Most of the 5146 artifacts are flaking waste (87.6%); the rest consist of retouched (4.0%) and modified/edge-damaged (8.3%) pieces. Of the retouched tools, 38% are points, nearly 30% are side-scrapers of various kinds, some 10% are burins, and there are smaller percentages of borers, composite tools, and backed forms. Of the modified edge-damaged pieces, nearly 20% are flakes and 17% blades, with 41% modified, broken flakes and blades, which could be a possible indication that these might have been intentionally snapped to facilitate hafting.

Especially interesting also is the way in which longer flakes and blades were selected for retouch and utilization (Clark *et al.*, 1984a, pp. 57–58). The technology is predominantly of Levallois type (42% of the cores are Levallois). Although present, the Levallois point is rare and atypical, which could be due to the size limitations imposed by the nodular chert from the local limestones. The overall size of the points (except for those in obsidian, which are usually smaller) is similar to that of such points from other sites in the Horn and it would seem that this was the optimum size—length ca. 5–10 cm.

Aladi Springs (Zone 3). Aladi is a mound spring locality situated between Mieso and Dire Dawa and near the foot of the escarpment of the South-East Plateau. The MSA occurrence is found under a sterile, gritty, brown clay (indicative of an arid phase) and in the top 10–20 cm of a calcareous layer of green, possibly lacustrine clay/loam seemingly deposited during a humid phase. All are sealed by a tufa with Late Stone Age microlithic artifacts dated to ca. 11,000 B.P. Since good sources of obsidian and chert occur not far away, the overall small size range of artifacts is hard to understand unless environmental conditions imposed a reliance on erratics as sources or the assemblage is, in fact, evolved and late (Clark and Williams, 1978). The size range of raw materials is obviously important and the impression of "lateness" given by diminutive Levallois cores can be misleading where no radiometric dating is available. This view is reinforced by the recent report of the discovery of MSA artifacts and cores in the Juba Gorge in southern Somalia where sources of good tabular chert exist and this is the material used to produce long Levallois points (C. A. Marean, personal communication) in a region where the use of small-sized erratics commonly imposed a size limit on artifacts.

Gotera (Zone 2). Gotera is an open site situated in Gemu-Gofa Province in the northeast of the salt lake Chew Bahir. In 1974, a late MSA assemblage was found here but the details are not available to me (Chavaillon and Chavaillon, 1985). The fauna (Geraads and Guillemot, 1985) is a small one, some 15 specimens only and all of extant forms, suggesting a situation in open savanna, perhaps on the edge of a temporary lake. Apart from reedbuck, gazelle, and an equid, the fauna came from small animals—rodents, hares, an insectivore, small carnivores, birds, and a snake. The absence of bone splinters and the articulated state of the bone suggest that this is not normal food waste. The age estimate is probably not more than 50,000 B.P.

The Ethiopian Plateau

Gorgora Rockshelter (Zone 1) (Moysey, 1943: Leakey, 1943). Situated near the north end of Lake Tana, this site provides about the only knowledge of the MSA in the northern part of the Ethiopian Plateau (Figs. 8a and b). It is a small shelter in a volcanic inselberg rising from the Plain of Gondar. The site is difficult of access but affords a superb view of the country below and so possibly formerly of game movements. As with Porc Epic Cave, it is likely to have been more advantageous as a hunting camp than as a seasonal

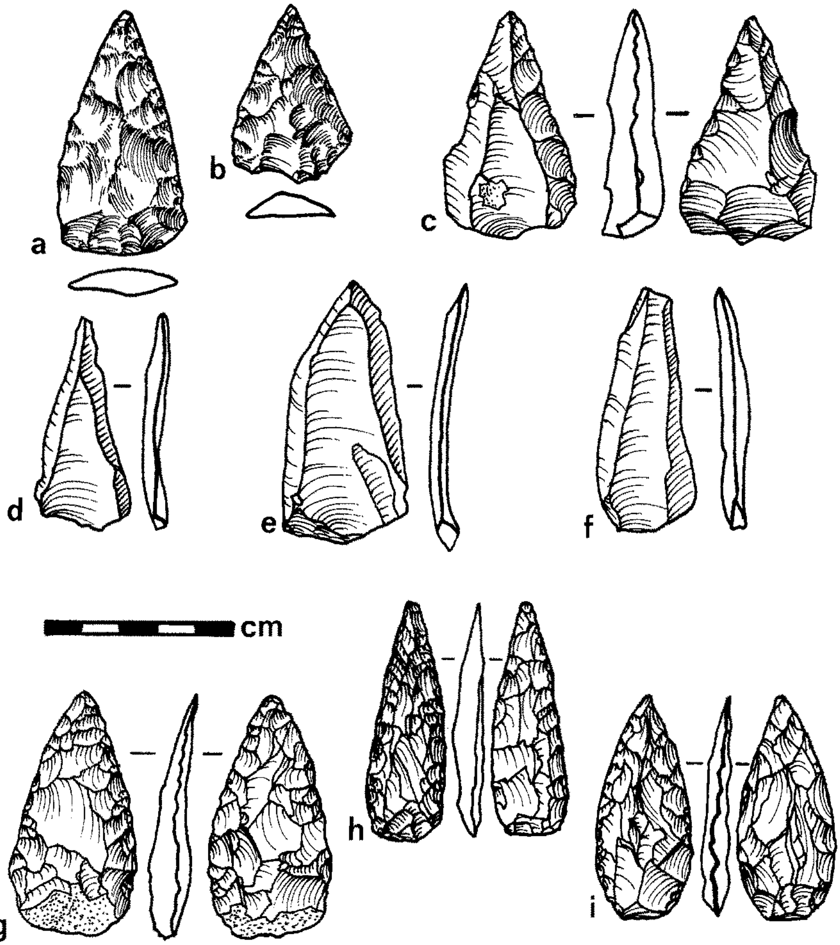

Fig. 8. Artifacts from sites in Ethiopia and Somalia. Gorgora Rockshelter, "Middle Stillbay" level: (a) partibifacial point, chert; (b) unifacial point, chert (after Leakey, 1943, Fig. 3). Midhishi 2 Cave, Somalia, Level 5: (c) Levallois core; (d, e) Levallois points; (f) Levallois blade (after Gresham, 1984, pp. 121, 165). Hargeisa, from red, sandy loam forming the upper part of the Upper Member of the Marodijeh Tug sediments: (g–i) bifacial points [J. D. Clark collection: (g, h) chert; (i) quartzite].

camp for a larger group. The area available for occupation was only some 5 × 2.5 m at the surface and was gradually more restricted with depth by the inward slope of the rock walls, the available surface finally pinching out at 2.75 m. Apart from the upper 1 m, the industry was MSA and occupation was continuous, as there were no sterile layers. The sediments containing the MSA comprised a gray volcanic ash with concretions (presumably carbonate) below the 2.75-m level. To what extent this "gray ash" derives from hearths is not known but at Porc Epic fire-altered artifacts were an important feature. When analyzed by Leakey, the Gorgora assemblage consisted of retouched tools and much debitage, suggesting that the artifacts were made in the shelter. There were 873 artifacts, of which 76% were waste flakes and 23% retouched tools and utilized pieces. Of the last two a surprising number (71%) were unifacial and bifacial points, the remaining specimens being Levallois cores, rare burins, backed flakes and crude scrapers. Red and gray pigment is present from the 2.5-m level upward. There is no way of knowing how much debitage may have been left at the shelter, but even so, the proportion of points suggests that this was a special-purpose camp, occupied sporadically over a longish period of time during which some 2.75 m of deposit accumulated. Leakey believed he could see a development in the industry to a climax at the 2-m level and a "degeneration" subsequently to the 1.25-m level.

The raw material is mostly chert, which must have been obtained from erratics since the nearest original source is some 130 km distant from this region of Trapp rocks. Points are, on an average, ca. 6 cm long and range from 4 to 10 cm. The waste flakes are dominated by those with multifaceted striking platforms. There are no Levallois points but a few blades are present. The points, both short and long, are markedly subtriangular and both unifacially and bifacially worked. The butt ends of some are thinned as if for hafting. The high percentage of special-purpose points also adds to the likelihood that this was a hunters' camp. Nothing is, however, said in the reports concerning fauna so that it must be concluded that none was preserved.

Melka Kunturé (Zone 1) (Hours, 1973; Chavaillon et al., *1979).* Melka Kunturé lies 50 km south of Addis Ababa on the Ethiopian plateau at ca. 2300-m altitude. Here there are some seven localities yielding MSA assemblages investigated by Bailloud (1965) and Hours (1973). The most important of these sites is Garba III, where an excavation revealed stratified layers of coarse sand and gravels resting on a succession of sands, clays, and tuffs; these comprised seven levels in all, numbered from the top downward. Level 7 was a "habitation floor" with Acheulean artifacts and fauna. The overlying sands and gravels contain the six upper artifact occurrences, each separated by a sterile deposit. This sequence appears to show the transition from a late Acheulean (Level 7), with hand axes and cleavers and a small number of side-scrapers and bifacial points in obsidian, to the overlying Level 6, where Acheulean bifaces are no longer present and there is an increase in the number of side-scraper and point forms; the industry is mostly on obsidian. The assemblages from the upper 5 levels are not large but are similar to that from Level 6 and all similarly include end-scrapers and burins.

This kind of occurrence is also found at other of the MSA localities at Melka Kunturé. In the overlying late Pleistocene tuff, what is considered to be evolved MSA is present only in the basal levels. The Levallois method, although present, appears to be rare at the Melka Kunturé localities, which gives cause for surprise since one of the main sources for obsidian is at Baltchitt, only some 10 km distant to the north.

Hours likens the biface assemblage from Level 7 at Garba III to a "Fauresmith," comparing it to that described from Gondar (Clark, 1945a), and sees the succeeding MSA as a "Stillbay"-type tradition evolved from this final Acheulean. Although the Melka Kunturé MSA occurs only in small assemblages, is in secondary context, and cannot yet be dated more precisely, the stratigraphic evidence strongly suggests that the occurrences from Garba III are early and emphasizes also the continuity with and derivation from the late Acheulean.

The South-East Plateau

Gadeb (Zone 1). It might have been expected that the MSA would have been well represented on the high plains of the South-East Plateau, and that this does not seem to be the case is probably due to the lack of survey rather than to a real absence. The only locality investigated to date is at Gadeb 8 in Arsi Province, where sparse MSA artifacts occur in the fluvial sediments of the 10-m terrace of the Webi Shebeli. They are made from local lavas and are of no particular note (Kurashina, 1978). However, at the height of the cold episodes synchronous with glacial conditions in the high latitudes, it is probable that the high plains would have been windy and unfavorable habitats and this may be the reason why it seems, on the basis of site distributions as presently known, that at such times the population was concentrated at lower altitudes.

Yavello (Zone 1). Yavello, in western Sidamo Province in the south-western part of the country, is another site where MSA artifacts have been found. These were discovered coming from some 1.75 m of red cave earth in a rockshelter (Clark, 1945b). The raw material was predominantly vein quartz but chert, silcrete, and quartzite were also used. The assemblage comprises discoid cores and flakes with faceted and plain platforms and also a few retouched, planoconvex side-scrapers, two bifacial points, and two possible burins. This small assemblage was associated with a fossil fauna that included bovid and pig together with numerous fractured bone fragments.

Midhishi (Zone 3). In northern Somalia, the later MSA is best seen at the site of Midhishi 2 in the Golis Range (Brandt and Brook, 1984; Gresham, 1984), where the MSA is contained within a carbonate-cemented brown silt (dated by C-14 and TL to > 42,000 B.P.); this rests on breccia and is overlain by a compact brown, sandy silt containing a mixed Middle and Later Stone Age component (Brandt, personal communication). The artifacts are made from chert, often tabular, and comprise points—unifacial and bifacial (18%), scrapers (86%), the largest group being side-scrapers, and a small percentage of other forms, notably denticulates (Figs. 8c–f). Cores are single and opposed platform, disk, and Levallois for flakes and Levallois points. Of the flakes, 25.4% were typed as Levallois points (Gresham, 1984, p. 164) produced from various kinds of Levallois cores, in particular the opposed-platform "Nubian" type of core, which is also, incidentally, present at Boker Tachtit (Marks, 1983, p. 37), with the earliest Upper Paleolithic in the Negev dated to $\geqslant$45,000 B.P. Levallois points (Gresham, 1984, p. 172) are almost twice as common as Levallois flakes and the same is the case with the cores from which they were struck, although there is a possibility that some of the opposed-platform cores were not prepared by the Levallois method, particularly in the upper levels. Whether or not this was so, these cores produced a significant number of blades as well as triangular flakes (Levallois points). Levallois points appear to be a characteristic of the MSA occurrences in the Horn, where the material is chert and available in relatively large sizes.

Hargeisa, Jesomma, and Garoe (Zone 3). The stratified, fluvial sequence on the plateau in northern Somalia at these sites, also undated and without fauna, is comparable to the succession at Melka Kunturé. The assemblage contained in the basal stream sediments at Hargeisa is an evolved Acheulean made from quartzite and chert exhibiting evidence, in the form of cores and flakes, of the Proto-Levallois technique (Figs. 8g–i). In the succeeding sediments (gravels and sands) are found early MSA artifacts ("Levalloisian") stratified below a characteristic MSA ("Stillbay"), with points, scrapers, and products of the Levallois and disk core techniques in the upper part of the sequence. These latter assemblages are almost invariably made from chert that occurs as bands in the Eocene limestones (Clark, 1954, pp. 160–225). This sequence is repeated at a number of other sites on the northern plateau (e.g., Clark, 1954, pp. 176, 191). The collections were mostly from the surface and were not excavated, nor, due to wartime conditions, were they the product of a systematic archaeological survey, but they do tend to show that the MSA was of long duration and is stratigraphically divisible into an earlier stage (Levalloisian), made more often on quartzite, and a later stage (Stillbay), where chert was the preferred material. The earlier stage contains notably fewer retouched points [Jesomma is the exception (Clark, 1954, Plate 14)], while the later stage is characterized by numbers of retouched points, scrapers, and other tools.

Bur Yassin (Zone 2). In the southern parts of Somalia, in eastern Ethiopia, and at the south end of the Afar Ridge, where the selected, usually siliceous, raw materials commonly occurred in the form of erratics, mostly of a small size, the later MSA assemblages are often of diminutive proportions like the Pontinian or Micro-Mousterian of Italy. Some of the assemblages from Bur Yassin (Bur Eibe) are of this kind, while others may belong with an evolved and later form of MSA (Clark, 1954, pp. 206–207).

In the Horn, therefore, MSA occurrences, derived from a late Acheulean ancestry, make an early appearance with a fully developed Levallois technology. In some localities (e.g., Midhishi and Gademotta) Levallois points are a significant form and, through time, give place to blade production. Retouched forms also show an emphasis on the production of points and, to a lesser extent, on *racloirs*. These trends might be seen as due, in part, to the availability of obsidian and cherts in sizes that gave freedom for experiment.

The Middle Stone Age in the Kenya Highlands (Figs. 9 and 10)

There are relatively few MSA occurrences known from Kenya and these are mostly either from the Naivasha/Nakuru region of the Kenya Rift, northwest of Nairobi, or from the Lake Victoria Basin, which has a tradition distinct from that found in the rest of the Kenya interior plateau.

The final or evolved Acheulean in the Highlands has been likened to the Fauresmith of South Africa and sites are located on the slopes of Mount Kenya (Leakey, 1932, pp. 38–39) and in the Kinangop Range (Zone 1) (Leakey, 1936, pp. 48–56) at a time, it has been suggested, of lowered rainfall and a shrinking of available water resources, a time that would be in the cold oxygen-isotope Stage 6. In the same swamplike beds on the Kinangop is found the "Pseudo-Stillbay" made on obsidian and characterized chiefly by diminutive, short triangular points and side-scrapers (Figs. 9j–l). The K/Ar date (Evernden and Curtis, 1965) of ca. 400,000 B.P. for this industry appears, however, too old to be acceptable, although it is possible that the diminutive nature of the obsidian assemblage may be conditioned by the size range of the available raw material and some of the sources in the Rift may not have been available in the late Middle Pleistocene. Typologically such an assemblage is not typical MSA but could equally well represent the Light Duty element of a late Lower Paleolithic occurrence, and this needs to be investigated further. By the time the Prospect Farm locality on the slopes of Mount Eburru was occupied, the obsidian sources there were readily available, and at Kariandusi in the Naivasha Rift, the earliest use of obsidian in East Africa is recorded with the Acheulean, dating there to probably 900,000 B.P. So, unless a local pebble-lag concentrate from agglomerates was preferred [analysis shows that the obsidian probably came from nine different source areas (Merrick and Brown, 1984)], it seems likely that the makers of the

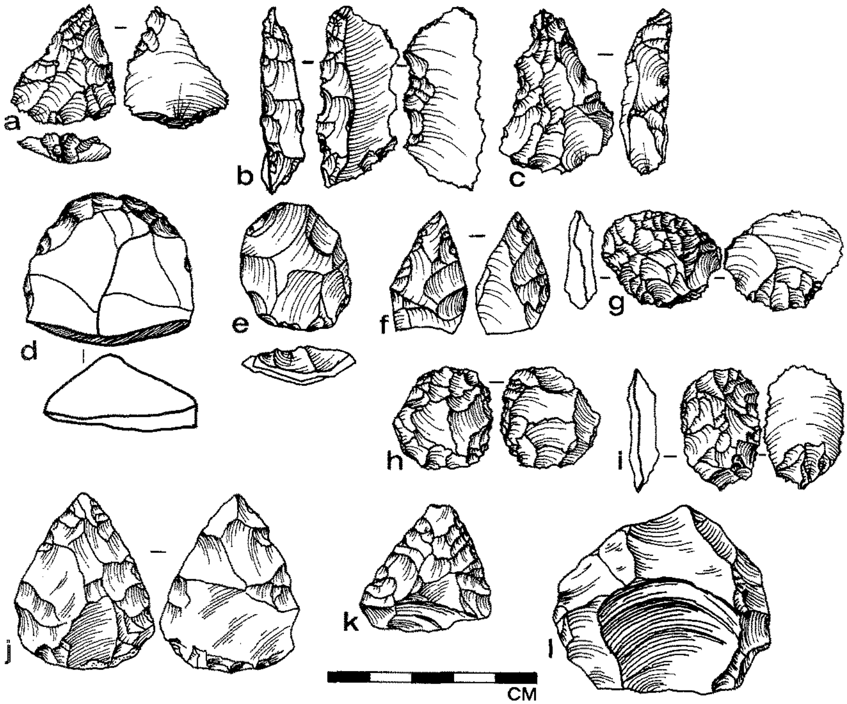

Fig. 9. Artifacts from the Eastern Rift and Kinangop Plateau, Kenya. Prospect Farm, Mt Eburru. (f–i) Phase 4: (f) bifacial point; (g–i) disks. Obsidian. (a–e) Phase 3: (a) unifacial point; (b) denticulate side-scraper; (c) convergent scraper; (d) end-scraper; (e) disk (after Anthony, 1978, pp. 338, 344, 348, 350, 356, 419, 447, 449). "Pseudo-Stillbay" from *Wetherall's Site*, Kinangop: (j) bifacial point; (k) unifacial point; (l) radially prepared core. Obsidian (after Leakey, 1936, p. 53).

Pseudo-Stillbay must have had good sources available to them, within 40 km of the site, in the Rift.

With the beginning of the MSA, obsidian replaced lava as the primary raw material used for artifacts in the central Kenya Rift Valley and it came from major sources within a radius of 50 km. Outside the Rift, the use of obsidian in the MSA falls off quickly; it is not known from Uganda and only rarely in the Lake Victoria Basin. From this time also there is good evidence for movement of obsidian beyond the 50-km radius, and at Lukenya Hill, the obsidian was brought from sources 65 and 135 km from the site. In western Kenya also, at Muguruk and Songhor, the obsidian has traveled 190 km from its source in the Rift (Merrick and Brown, 1984, pp. 140–142).

Prospect Farm (Zone 2). This is the main MSA site in the Rift and is situated on the slopes of Mount Eburru overlooking Lakes Elmenteita and Nakuru (Figs. 9a–i and 10g–q). Other MSA assemblages are known from the Malewa Gorge and the Little Gilgil River locations in the Lake Naivasha

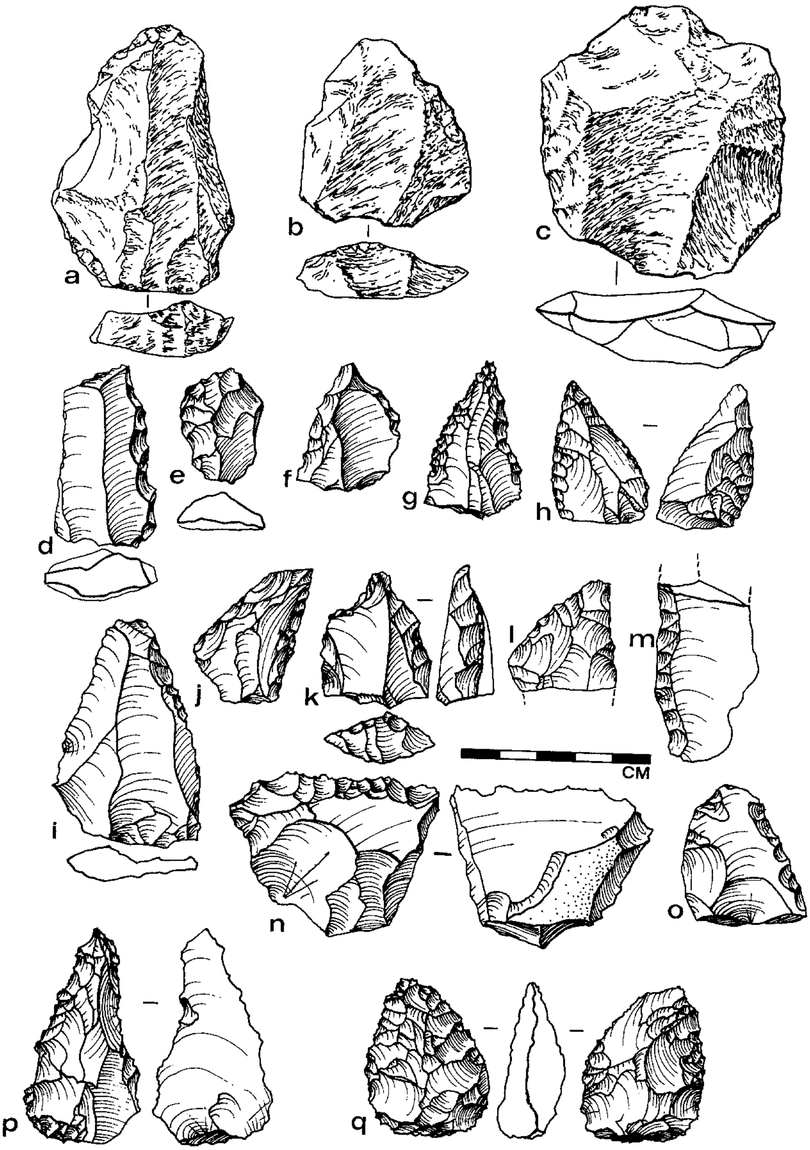

Fig. 10. Artifacts from Tanzania and Prospect Farm, Kenya. (a–c) Ndutu Beds, Olduvai Gorge, Tanzania: (a, b) Levallois flakes; (c) Levallois core (after Leakey *et al.*, 1976, p. 334). (d–f) Loiyangalani, Serengeti, Tanzania: (d) denticulate side-scraper; (e) end-scraper; (f) borer. Quartzite (after Bower and Gogan-Porter, 1981, pp. 12, 14, 23). (g–m) Prospect Farm, Phase 1: (g) unifacial point; (h) partibifacial point; (i) backed flake; (j) déjeté scraper; (k) borer; (l) convergent canted scraper; (m) inversely retouched, single side-scraper. (n–q) Prospect Farm, Phase 2: (n) transverse scraper; (o) convergent scraper; (p) convergent scraper; (q) bifacial point. All obsidian (after Anthony, 1978, pp. 89, 91, 103, 126, 132, 134, 151, 209, 215, 217, 221, 338, 344, 348, 350, 356, 419, 447, 449).

Basin, although these have not been described in any detail (Leakey, 1931, pp. 76–89). The assemblage from Malewa is associated with a K/Ar date of 220,000 B.P. (Evernden and Curtis, 1965) but this also needs to be accepted with caution. The artifacts are in obsidian, are typically MSA, and comprise points, disks, and other forms with a Levallois technology. The Prospect Farm locality suggests, as do Gademotta and Koné, that the MSA is of a long duration (Anthony, 1972, 1978) and the horizons appear to be a similar combination of workshop and temporary camping places for groups coming to exploit the obsidian source close by. The two localities excavated gave the same succession except that the second, which was carried down 14 m, penetrated the deeper and older horizons, exposing two further MSA occurrences. Under a horizon with an Eburran (Kenya Capsian) assemblage dated to ca. 10,000 B.P., and separated from this by 2.5 m of sterile deposit, were found four MSA horizons, separated one from the other, by varying thicknesses of sterile tuffs and pumice. At least two of these are associated with old soil horizons that again point to the elapse of a long period of time between the lowest and the uppermost MSA horizons. The lowest artifact occurrence, named Phase 1, was within a 10-cm-thick, heavily lateritized land surface that capped > 4 m of altered and weathered tuffs; the total thickness of these is not known and they might contain other earlier horizons.

Each of the four occurrences is known from large numbers of artifacts and retouched tools that are of one or more dominant forms. The top occurrence (Phase 4; Figs. 9f–i) is characterized by unifacial and bifacial discoids made from thin Levallois flakes and that are probably some form of knife. The next two occurrences (Phases 3 and 2; Figs. 9a–e and 10n–q) have a variety of retouched forms, in particular points. Artifacts from the lowest occurrence (Phase 1; Figs. 10g–m) show overall smaller dimensions than those above and the characteristic tool was a thick, pointed scraper. The Malewa Gorge sample seems to fit best with that from the upper MSA horizons (Phases 3 and 4) on account of the retouched discoids.

Merrick (1975, pp. 293–295), who analyzed metrically a sample of artifacts from each of the three uppermost horizons (Phases 4, 3, and 2) at Locality 1, also noted changes in typology and technology that may be considered stylistic, since there is covariance of certain tool forms, which suggests functional equivalence. Besides the discoids, single and double side-scrapers are the dominant forms in the uppermost occurrence and points are also a significant component. In those from the MSA horizons, Phases 2 and 3, casually retouched and miscellaneous modified pieces predominate; convergent scrapers and then single side-scrapers are the most common retouched forms in Phase 2. In the assemblage from Phase 3, the dominant retouched form is a simple side-scraper and convergent scrapers and points covary between Phase 1 and Phase 2. The technology shows little change except that core proportions in Phases 1 and 3 are generally similar and typically MSA, whereas in Phase 2 the cores are more usually single- and double-platform cores of Later Stone Age type. The sequence of tuffs, pumices, and old soil horizons in these important excavations, termed the Prospect Farm Formation, is the lateral equivalent of Formation A, Enderit Drift (see below).

"Prolonged Drift," Ementeita (GrJi11) (Zone 2) (Merrick, 1975, pp. 230–267). This MSA occurrence, on the lower reaches of the Enderit River in the Lake Nakuru Basin (ca. 1800 m), is stratified in the lower of two major cycles of sedimentation and beneath a major unconformity (the Makalia Ash). In the lowest of four fluviolacustrine sediments is some 5 m of bedded sands, gravels, and silts capped by a paleosol. The MSA artifacts occur throughout this deposit but were concentrated mostly in three horizons within a 5-m thickness of deposit. The upper two are thought to be fluvially concentrated but the lowest is probably a camping and workshop floor with artifacts in fresh condition. Laterally, artifacts and fossil bone were found eroding for a distance of > 30 m up- and downstream. The site was tested by means of a 3 × 5-m excavation and a series of test pits.

In all some 9634 artifacts were found, mostly in obsidian, with small quantities of chert and lava. Most of the pieces were debitage from the manufacture of tools at the site. Much of this debitage was small, with a number of bladelike forms and trimming flakes from the manufacture of bifacial points. The majority of tools was unifacial and bifacial points, mostly leafshaped, with a small number of bifacial "knives." Points were found in all stages of manufacture. Other tools comprise irregular side-scrapers and truncated blades with, in addition, a large number of modified/edge-damaged pieces. Associated with the artifacts were a large number (2704) of fragments of fossil bone, mostly from hippopotamus, *Equus*, and a number of medium-sized bovids; the bones were considerably fragmented. Also present was a fragment of a reed stem.

The occurrence is from the top part of the lower formation (A) at Enderit Drift and so is considered late MSA. Elsewhere, from lower in Formation A, there is other MSA material. Associated with Formation B from the lowest levels is a blade industry of Eburran type and there is a date of 12,300 B.P. ± 822 years and, on correlation with the Makalia Section, another date of 21,000 B.P. Very few MSA occurrences are known from the floor of the Rift in the Kenya Highlands, whereas there are many exposures on the slopes of Mount Eburru (e.g., Prospect Farm). While this may be due to lack of visibility and exposure in the basins, it does seem possible that MSA groups were concentrated at higher elevations and that they used the lake flats and margins only for short-term, probably seasonal, exploitation. As at the Ethiopian sites also, the numbers of points suggest, if they can really be regarded as projectile points, that "Prolonged Drift" may have been a hunters' seasonal camp of short duration.

Lukenya Hill (GvJm16) (Zone 2) (Merrick, 1975, pp. 26–228). This granite-gneiss inselberg is some 40 km southeast of Nairobi and lies on the ecotone between the grasslands of the Athi Plains and the more heavily vegetated, rocky area of Basement rock. The MSA occurrence is found in the lower of two superimposed rockshelters in what was designated Cultural Unit A (Merrick, 1975, pp. 34–49). The matrix is a pale orange to gray silty sand, probably colluvial, and is undated. By far the most common raw material is quartz obtained locally, together with small values of obsidian and chert. A small quantity of bone was present. The most common retouched tools are scrapers, which comprise 57.6% and are mostly single side- and convergent scrapers. Points (of various shapes) and point fragments have values of only 3.5%, and besides small numbers of burins, becs, *perçoirs*, and truncations, the only other retouched forms are "bifacial pieces" (16%); these comprise discoids, bifacial "knives," and unfinished points. In addition to retouched forms, there are some 13% of miscellaneous, modified pieces. Cores, both formal and informal, account for only 2% of the artifact assemblage and some 8% of the formal cores are discoidal. Levallois-type cores are not common. Of the informal or casual cores, 62% are single and double platformed. Allowing for the differences in raw materials, the Lukenya Hill assemblage is in general not unlike that from Prospect Farm and should possibly be classified as being "later" rather than "earlier" in the MSA sequence. At both sites a steady decrease in artifact size can be detected with the replacement of scraper forms by points.

Enkapune ya Muto (GtJi12) (Zone 1) (Ambrose, 1984, pp. 108, 113). This is a rockshelter situated high up (2400 m) on the east face of the Mau Escarpment where Ambrose (1984) found a late Pleistocene and early to mid-Holocene sequence with a developing Eburran sequence, beneath which was an unconformity and a 0.5-m deposit of reddish-brown loam with a previously unrecognized industry, rare but well-preserved bone, and a large hearth dated to > 26,000 B.P. The industry is dominated by scrapers and other pieces with *outils écaillés* modification. This is not a typical MSA assemblage (S. H. Ambrose, personal communication) but it calls to mind the undiagnostic assemblage with a date of 32,000 B.P. that separates the Howieson's Poort from the Robberg Industry levels at Boomplaas Cave.

Most recently, Ambrose (personal communication) has obtained a date of 29,000 B.P. on charcoal from the stratigraphic unit containing the LSA industry characterized by thumbnail scrapers. Below this is 1.3 m of deposit with a large backed blade industry and, unconformably below that, is the "pre-LSA", suggesting a probable age for the last in excess of 40,000 years. Further attempts are being made to date the "pre-LSA."

With the exception of the occurrences in Western Kenya in the Lake Victoria Basin (Zone 2A) described below, these are the only occurrences, other than small, mostly undescribed surface assemblages, that provide some understanding of MSA tradition in the higher parts of the country. It is clear that many more sites remain to be found and analyzed in the higher, better-watered areas of the plateau. In the drier parts of northern Kenya, in particular in the Lake Turkana and Baringo basins, MSA occurrences have yet to be recorded.

Tanzania

Two traditions can be recognized in Tanzania—one in which the technology and retouched tool component is what is regarded as a conventional MSA and the other in which the prepared core technology is not always so evident and where there is a Heavy Duty component consisting of core-scrapers, core-axes, and picks (Clark and Kleindienst, 1974, pp. 71–105). This tradition has been variously described as *Sangoan*, *Sangoan/Lupemban*, and *Lupemban* and it is the dominant form during the earlier MSA in the Lake Victoria Basin: the occurrences of this basin from Tanzania, Uganda, and Kenya are considered separately below. Where the Heavy Duty tradition occurs outside the Lake Victoria drainage, it seems likely to have been associated with more closed vegetation—coastal evergreen forest, woodland savanna, and thicket. The tradition that lacks the Heavy Duty element is associated with what is today more open country. It is likely that the habitat in earlier MSA times during isotope Stage 5 was not greatly different from that at the present, as the following two sites seem to confirm.

"Open-Habitat" Occurrences

There are only two, perhaps three, that can be considered as early.

The Ndutu Beds (Zone 2) (Hay, 1976, pp. 146–159). These beds lie unconformably within the Olduvai Gorge, banked against the Plio-Pleistocene succession of beds, and have been divided into two units. The lower unit —mostly conglomerate, sandstone, and eolian tuff—is probably of late Middle to early Upper Pleistocene age. The base could be as old as ca. 370,000 B.P., with which the faunal assemblage agrees. A vitric marker tuff high up in the lower unit is estimated to be 120,000 B.P. $\pm$ 30,000 years (Day *et al.*, 1980). No contemporary artifacts are associated with this lower unit except at the top.

The upper unit consists of eolian tuff with some weakly developed paleosols and root markings suggesting grassland; in the Gorge, these tuffs are fluvially redeposited. The climate during the time of deposition of the

Ndutu Beds was semiarid and perhaps much like the present (Hay, 1976, p. 157). The upper unit is thought to cover the time range between 60,000 and 32,000 B.P.

Two localities have produced artifact assemblages. The first of these is a small concentration of artifacts in claystone about 2 m below the top of the lower unit (Hay, 1976, p. 159). The other comprises two small concentrations of artifacts and bone in eolian tuff near the top of the upper unit. The two assemblages show no apparent differences and have been described together. Artifacts are made almost entirely from olivine basalt and the total assemblage consists of only 120 specimens. These comprise Levallois and discoidal cores and flakes with faceted striking-platforms struck from them (Figs. 10a–c). Dorsal preparation is both radial and convergent, the latter predominating. The only retouched tools are four scrapers, a discoid, and two small choppers (Leakey *et al.*, 1972, pp. 332–335). These assemblages also show a tendency to produce longer flakes, as end-struck forms are much more common than side-struck flakes.

Ngaloba Beds, Laetoli (Zone 2) (Day et al., *1980).* Some 30 km south of Olduvai Gorge, the Ngaloba Beds comprise the uppermost unit of the sequence at Laetoli. At Locality 2 was recovered a nearly complete skull (LH 18) (see below) from a 2-m thickness of these beds in association with MSA artifacts and mammalian, avian, and reptilian bones. The Ngaloba Beds are stream deposits—sandstones and claystones. The claystone yielding the human skull contains a water-worked vitric tuff that, on its mineral composition, is tentatively associated with the marker bed in the lower unit of the Ndutu Beds at Olduvai, which has an estimated age of 120,000 B.P. The MSA artifacts, in lava, have been analyzed but not yet described and can be considered as typical MSA, presumably similar to those from the Ndutu Beds (Harris and Harris, 1981; J. W. K. Harris, personal communication).

Nasera (Apis Rock) (Zone 2) (Leakey, 1936; Mehlman, 1977). This large rockshelter on the eastern edge of the Serengeti was first excavated in 1932 by Leakey (1936, p. 58) and later, in 1975–76, by Mehlman (1977). The true MSA occurs in the lower 5 m of deposit beneath a layer of eolian sediments with an industry (Naseran) dated to 23,000–26,000 B.P. and an unconformity represented by water-laid sediments. The raw material is predominantly quartz but white, lacustrine chert in varying percentages (between 11 and 15%) is present, most probably coming from Olduvai. The MSA represents a relatively dense scatter. Both radially prepared and bipolar cores in quartz occur and large faceted platforms on both quartz and chert are numerous. Retouched tools are mostly smallish and comprise unifacial and bifacial points—almost all in chert—together with convex and straight-edge side-scrapers. The butt ends of some points show intentional thinning. Bone is almost entirely absent but a rhinoceros tooth from near the top of the MSA sequence gave a uranium-series age of 56,000 B.P.

Mumba Rockshelter (Zone 2) (Kohl-Larsen, 1943; Mehlman, 1979, 1987, 1988). This is one of four shelters situated in an inselberg of gneiss on the northeastern side of the saline Lake Eyasi within the graben of that name. It lies about 70 km due south of Olduvai Gorge and overlooks the lake plain, being some 3 km east of the hominid skull site on the north shore of the lake. In the shelter is some 9 m of accumulated occupation deposit together with some sterile layers. The upper levels date to the Late Stone Age (LSA) and LSA/MSA transition, but at a depth of 2 m is a former high-level beach of the lake 28 m above its present level. This beach represents a time of lowered evaporation and increased runoff and is dated to ca. 25,000–27,000 B.P. and correlates with the unconformity at Nasera. Bed V below the beach is a loamy sand that contains an industry previously unrecognized in East Africa comprising giant crescents, backed knives, well-made points, small convex scrapers, Levallois flakes and cores, and bipolar cores also. This is a very significant find, as it is reminiscent of the Howieson's Poort Industry of the South African Middle Stone Age. This is all the more important as the age of this bed, from uranium-series assays on bone, varies from 24,000 to 66,000 B.P. Amino acid dates for Bed V are 35,000–45,000 B.P. but it seems possible that the lower limit of ca. 60,000 may well be a closer estimate of its age (Mehlman, 1988). The underlying 6 m (Bed VI) contains the MSA proper. The assemblage is similar to that from Nasera and the retouched forms are predominantly points (unifacial and bifacial and mostly leaf shaped to subtriangular), *racloirs* of various kinds, *grattoirs*, nosed scrapers, borers, backed flakes, burins, bifacially modified pieces, and Levallois flakes and cores. Two uranium-series dates from the lower part of Bed VI give ages of 131,710 and 109,486 B.P. and are probably reliable as indicators of the age of the MSA in the Mumba Rockshelter. Three hominid molars were recovered from a depth close to that from which the older bone sample came (see below).

Hominid Skull Site, Lake Eyasi (Zone 2) (Mehlman, 1987). Remains of an archaic *Homo sapiens* were found by the Kohl-Larsens in 1935 on the north edge of the lake, eroding from a sandstone bank, together with much fossil mammalian bone and artifacts. In 1936 the site was visited by Leakey and Reeve, who confirmed the source bed of the fossils and recovered artifacts described as "Levalloisian" (Leakey, 1946). In 1977 the site was reinvestigated by Mehlman (1987), who, by further geologic sampling, was able to correlate the lakeshore sediments with the lower part of those in the Mumba Rockshelter. The lake-plain sediments (Eyasi Beds) are stratigraphically lower and older than most of those in the Mumba Rockshelter. Mehlman has defined the Eyasi Beds as a formation at least 11.5 m thick comprising reddened, zeolite-cemented clay-pellet aggregates, alternating with lacustrine clays, sands, and gravels. The age is estimated, on the fauna, as later Middle Pleistocene, there being at least seven extinct forms. Attempts to date the Eyasi Beds have proved unsuccessful. However, a tuff in the lower part of the beds is similar to, but not the same as, that in the Ngaloba Beds at Laetoli (dated by uranium series to ca. 129,000 B.P.) and correlated with the marker tuff (estimated to date to 120,000 B.P.) in the lower Ndutu Beds at Olduvai. The trachytic tuff in the Eyasi Beds is, therefore, thought to relate to an older eruption, giving a conservative estimate for the Younger Eyasi Beds of > 130,000 B.P.; Mehlman (1987, p. 158) suggests that the age of the Middle Eyasi Beds could be 200,000 B.P.

The artifact assemblage associated with the Eyasi I cranium consists of a mixture of Heavy Duty forms, likened to those of the Sangoan, and other more characteristic MSA forms. The 1935/1938 lakeshore assemblage has been described by Rafalski *et al.* (1978). It consists of two large surface collections and several hundred specimens from excavated pits. Artifacts are made from lava, quartzite, and quartz, the last of these being used mostly for Light Duty tools. Artifacts collected at the skull site by Kohl-Larsen, Leakey, and Mehlman are considered to be an uncontaminated sample of the assemblage in the Eyasi Beds. It comprises typical MSA, radially prepared cores and flakes together with a number of flakes with plain platforms. Retouched pieces are points, scrapers, and modified flakes. Together with these is a Heavy Duty component consisting of core-scrapers, core/choppers, and core-axes of typically "Sangoan" form. Mehlman has named this industry from the Eyasi Beds the Njarasa Industry, and although it has a "marked MSA aspect," it is different from the MSA from Mumba and Nasera in several ways. Besides the Heavy Duty component, it differs in the preponderance of lava and quartzite used and the generally larger size of the Njarasa artifacts, and the radially prepared Levallois core technique is also more common. At one time an assemblage of this kind from a time range of 200,000–100,000 B.P. would have been placed in a "First Intermediate" category. It is certainly not Acheulean, nor is it a typical later MSA, and this writer believes that it should rather be considered as an early MSA industry that includes a Heavy Duty component that was functionally necessary within the Eyasi Graben at a time of fluctuating lake levels, toward the close of the Middle and beginning of the Upper Pleistocene.

Loiyangalani River Sites, Serengeti (Zone 2). A field survey in the Serengeti National Park in 1977 by Bower and others (Bower and Gogan-Porter, 1981; Bower *et al.*, 1980) located a number of eroded surface occurrences of MSA artifacts which were test excavated and appear to be the earliest evidence for human activity in this grassland plains region. Some eight MSA occurrences were found which differ in their assemblage content from other sites in northern Tanzania such as Nasera and Mumba and the excavators have named these the Loiyangalanian Industry after the name of the river flowing through the type-site (HcJd1E). Five discrete assemblages at this site are interpreted as separate activity areas, not necessarily all contemporaneous, so that the site appears to be a complex of time-transgressive, ephemeral activity concentrations within a stratified series of alluvial silts. With the exception of three separate, in situ activity horizons found in test excavations in the main locality (HcJd1E), these assemblages are thought to be in a secondary context.

The artifacts occur throughout clayey, low-energy silts of unknown depth, thought to represent a swamp or pond within the former channel of the river. This deposit is separated from a second, overlying silt by an erosional unconformity. More MSA flaking debitage occurs within and on the eroded surface of these silts, which are cut out by fluvial channeling with sand and gravels and Later Stone Age artifacts. The MSA artifacts are made predominantly from quartzite but also from quartz, although there are significant differences in the composition of the three main assemblage concentrations. Levallois and discoid cores are the dominant forms and appear to interrelate, but unprepared cores are also common. Flakes show both faceted and plain striking-platforms and radial convergent dorsal preparation scars. A significant feature, not due to selective sampling, is the high percentage of retouched and modified pieces—41, 64, and 49% of the total assemblage. While there is no doubt from the flaking waste that artifacts were made at the site, the high percentage of trimmed tools is suggestive of some special-purpose activity (Figs. 10d–f). The most common retouched forms are scrapers—side, end, and notched types being the most frequent—and a kind of composite scraper-borer. Denticulation is a feature of the retouch and there are small numbers of burins and borers. A number of pieces are casually retouched on dorsal and ventral faces and *outils écaillés* pieces are a significant type. Points, on the other hand, are almost nonexistent but there are low percentages (6, 9, 6%) of "choppers" made on flakes with unifacial sinuous flaking of the edge.

Associated fauna is essentially from larger game species found on the Serengeti today, although a large *Equus* might be an extinct form. Bones are broken in patterns common in assemblages processed by humans. The bone weathering shows several different stages, indicating that the assemblage might have been exposed for up to 4 years before being buried. Pollen is preserved in the lowest stratum at HcJd1D—mostly grasses, sedges, and *Podocarpus*, the last pointing possibly to cooler temperatures. The prevailing conditions would seem to have been those of an open countryside by a marsh or swamp.

These assemblages of artifacts and fauna, situated as they are in association with marshy deposits, do not suggest to the excavators a campsite, which would be more likely to have been situated on a river bank, so much as places where the MSA groups had trapped game and proceeded to cut it up and process the meat and bones. The driving of game into swamps or open water is a well-known, ancient, and very effective method of hunting.

The only other locations in Tanzania to yield assemblages that can be considered as falling within the chronological and technological range of this review are situated in the south of the country.

Isimila (Zone 2) (Howell et al., *1962; Cole and Kleindienst, 1974).* Situated in a southern highland region of deciduous woodland, this site documents the history of a late Middle to early Upper Pleistocene *mbuga* or swampy, grass-filled depression occupying an old valley floor. An early ponded stage may be as old as 260,000 B.P. on a uranium-series date. This valley gradually became silted up, swampy, and finally, filled with colluvium. Both members of the Isimila Formation contain variable-component assemblages of the later Acheulean which may have continued to be made over some 150,000 years. At the top of the upper member of the Isimila Formation are sandy clays that have been interpreted as the final phase of *mbuga* infilling; they contain scattered artifacts that are not Acheulean and resemble those referred to as Sangoan. So far as this writer is aware, these artifacts have not been described, but they include Heavy Duty core-ax and pick forms. Although no assemblage, as such, is present here, the sedimentation indicates that a relatively short period of time elapsed between the uppermost Acheulean occurrences and the inclusion of the Sangoan-like artifacts—a situation that confirms both the antiquity of the Sangoan and its distinctive identity, separate from the Acheulean.

Nyara River Occurrences, Mbeya (Zone 2) (Clark et al., *1970).* West of Mbeya in the vicinity of the limeworks, the Nyara—a tributary of the Songwe River of the Lake Rukwa drainage—has exposed a sequence of lacustrine tuffs, ashes, and limestone that are related to the sediments of Lake Rukwa. This is a complex cut and fill sequence of alluvial gravel (Unit F), reddish brown, interbedded clayey alluvial sands and tuffs (Unit G), and pale brown to light gray, interbedded tuffs, mudstones, and marls (Unit H) with numerous layers of bedded carbonate nodules. These deposits are topped by a moderately strong reddish-brown, calcareous paleosol that is conformably overlain by up to 4 m of brown clayey ash sand (Unit I) (C. V. Haynes, unpublished report).

The earliest artifacts comprise a Sangoan-like assemblage within Unit G, some occurring on top of a buried travertine that probably represents an ancient spring deposit. Other, abraded artifacts were found in the alluvial sand and gravel interbedded with tuff. This bedded tuff suggests lacustrine deposition in shallow water intermittently with alluvial deposition. There is also some evidence to suggest tectonic activity and apparent dips of up to 15°. The assemblage is small and consists of no more than 60 artifacts. These are core-axes (two), cleaver-flakes (two), choppers [unifacial (seven) and bifacial (five)], polyhedrals (four), and three small tools made on a flake, a fragment, and a chunk. The unmodified waste consists of flakes (20), some of which have faceted striking platforms and show multidirectional and convergent flaking on the dorsal face, suggesting that they came from Levallois-type cores. There are five chunks and eight cores, mostly casually struck. Most of the larger tools are made from fragments and cobbles of gneiss that precluded any fine degree of retouch. Other artifacts were made from large flakes of quartzite as well as small cobbles of quartz and chalcedony.

A further small assemblage, identified in the field as MSA, occurs 6 m above in Unit G. The bedded calcareous tuff in this unit suggests deposition in shallow water ponds intermittently with deposition of channel sediments. Artifacts are made from quartz, quartzite, chert, and ignimbrite(?) and include a discoid, a biconical core, seven flakes, one of which is notched, four casual cores on trimmed chunks, a modified chunk, and three flake fragments. Unit H unconformably overlies Unit G, is of shallow lacustrine origin, and consists of an upper and lower series of sediments. The top part of the lower series is dated on carbonate to > 24,600 B.P., which suggests a date for the MSA of Nyara well in excess of this age.

Galula, Lake Rukwa Rift (Zone 2). Several very abraded, diminutive flakes with faceted striking platforms and radial and convergent dorsal preparation, together with a discoid core of quartz, came from a gravel in the upper part of a > 30-m series of lake sediments in Galula at the south end of the Rukwa Rift. These occurred 10 m below the top of the series and represent a high stand of the lake. Mollusk shells collected from the top of the series gave an age of ca. 10,000 B.P. (Clark *et al.*, 1970).

The only other MSA occurrence from southern Tanzania is a surface find in quartzite and sandstone from the hills overlooking *Ilima*, south of Rungwe volcano. The artifacts consist of a few Heavy Duty choppers and picks together with discoid cores and flakes from prepared cores.

Tendaguru (Zone 4) (Smolla, 1962; British Museum Guide, 1926). In the coastal zone of forest/savanna mosaic some 60 km northwest of Lindi at the well-known Dinosaur area, Leakey found some 300 artifacts in sandstone (BMG, 1926) and E. Hennig collected a further 44 specimens from two localities about 64 km apart (Smolla, 1962). At Tendaguru, the artifacts are all surface finds, come from several places on and around the hill, and are made from the local sandstone. *Etat physique* suggests that they are more or less contemporary. Most of these artifacts are described as high-backed scrapers with a planoconvex cross section. Others, from illustration, look more like core-axes and perhaps large tranchets, like those in the Victoria Basin. There are also said to be flakes and cores with Levallois-type preparation and other artifacts were described as "bifacial scrapers". It is impossible to say more about this small collection, which Smolla (1962) describes as "Sangoan in the widest sense." It is important, however, since it shows that Heavy Duty artifacts—except for one specimen of a cleaver in no way resembling the Acheulean—are present in the coastal forest zone and show the potential for further fieldwork in this area—one, incidentally, in which rich assemblages have very recently been found near Kilwa (P. Schmidt, personal communication).

The Lake Victoria Basin

This is a shallow basin occupying a depression (1200 m) on the central plateau between the eastern and the western arms of the Rift and separated from them by areas of dissected highlands. The altitude of the plateau decreases rapidly along its western margin to the trough and lakes of the Western Rift. As previously stated, this is a region of higher rainfall (between 1100 and 1300 mm per annum) and forest/woodland/grassland mosaic. The earliest artifact occurrences in the basin and its peripheral parts are, technologically and typologically, related to those in the Zaire Basin and the Western Rift, while the younger occurrences resemble more those on the central Tanzanian and Kenyan plateau regions to the east.

Nsongezi (Zone 2A). Following the end of the Acheulean, assemblages first named Sangoan—from surface finds at the type-site on the hills overlooking Sango Bay in Uganda (Wayland, 1923)—occur on both sides of the lake. On the Kagera River at Nsongezi they are stratified above the Acheulean (Cole, 1967) in the "N" Horizon of the 30-m terrace sediments that represent lacustrine and fluvial sediments of a high level in a former riftlike arm of the lake: the geology has been reviewed by Bishop (1969, pp. 63–99). Wayland (1934) was the first to excavate in the 30-m terrace, between 1930 and the 1940s. He identified two land rubbles, the lower of which he named the "M" and the upper the "N" Horizon, and in many places, where these two run together, he recognized an "MN" Horizon. Many artifacts and some fauna were collected. In 1934–1935, O'Brien (1939) undertook an archaeological survey of Uganda and worked at Nsongezi and in particular, in a tributary valley—the Orichinga. He records an unconformity of some duration separating the M and N Horizons, and from the N Horizon and above he recognized two distinct but contemporary industries—a "Levalloisian" and a "Tumbian" tradition; the latter has since been renamed "Sangoan." O'Brien appears to have classified these on a typological basis and most of his collections were found eroding from the sands and overlying old swamp clays in the Orichinga valley. He does record, however, that, while both traditions occur in the N Horizon, two higher horizons with Levalloisian were found in the sandy clays and clays that overlay them (O'Brien, 1939, p. 208). O'Brien recognizes three stages of the Tumbian (Proto, Middle, and Upper); the "Upper Tumbian" is late and does not concern us. The "Middle

Tumbian" is associated with clays filling tributary channels above the N Horizon and its overlying sands. One of these horizons, a zone of ferruginous clays, were named the "O" Horizon by Wayland and Van Riet Lowe (Van Riet Lowe, 1952), 3 m below the top of the 30-m terrace.

As subsequent field studies and analysis have shown, all these assemblages belong to a single industrial entity within the upper deposits of the 30-m terrace in the N Horizon and from the overlying fine-grained sediments. The definitive work on the archaeology of Nsongezi is by Cole (1967), who has shown that the Acheulean occurs in stratified positions beneath the MN Horizon and that the assemblages within this landrubble are mixed Sangoan and Acheulean. He recovered Sangoan artifacts in situ from the N Horizon and overlying sandy silts, but he did not report on the overlying horizons and their assemblages. A number of other, surface, occurrences on hills on the west side of the lake (at Sango Hills, Gayaza, Kabingo) were examined and the artifact assemblages analyzed.

From the work of Wayland, Van Riet Lowe, O'Brien, and Cole, it is apparent that the post-Acheulean stone tool assemblages on the Kagera River at Nsongezi can be divided into an earlier and a later stage, but until the sequence is refined by further work, no additional subdivision is possible. The MN Horizon is seen as representing a time of generally drier climate when the lake level receded, although it should be borne in mind that tectonic tilting could have been a factor in bringing about this unconformity in the sequence. The overlying sands and sandy clays suggest a return to a high lake margin or *mbuga* conditions.

The nature of the assemblage at Nsongezi and Sango Bay is best illustrated by Van Riet Lowe (1952, pp. 62–89) (Fig. 11). His description is based on 577 selected tools, almost all in quartzite and quartz. The earlier stage comprises typical core-axes or picks with blunt, unworked butts; they are trihedral or high-backed, sometimes blunted at both ends and sometimes rhomboid in section. In plan-form, some of these core-axes are subtriangular. With these are small bifaces which are clearly Lupemban core-axe forms, a variety of high-backed core-scrapers, and a few modified/utilized flakes and rare, long, bifacial lanceolates. Although a rare form in the earlier assemblages, the latter represent the first manifestation of this characteristic tool of the Sangoan-Lupemban Complex. Typical Levallois and discoid cores, some high-backed, appear for the first time in the N Horizon and continue throughout the time that the MSA was being made in Uganda. Flakes are not specifically described but faceted butts are common.

From the overlying O Horizon, Van Riet Lowe describes and illustrates an assemblage from his excavations that equals a level of O'Brien's Middle Tumbian with Levalloisian. There are Sangoan- and Lupemban-type core-axes/picks, core-scrapers, various forms of Levallois cores, with radial

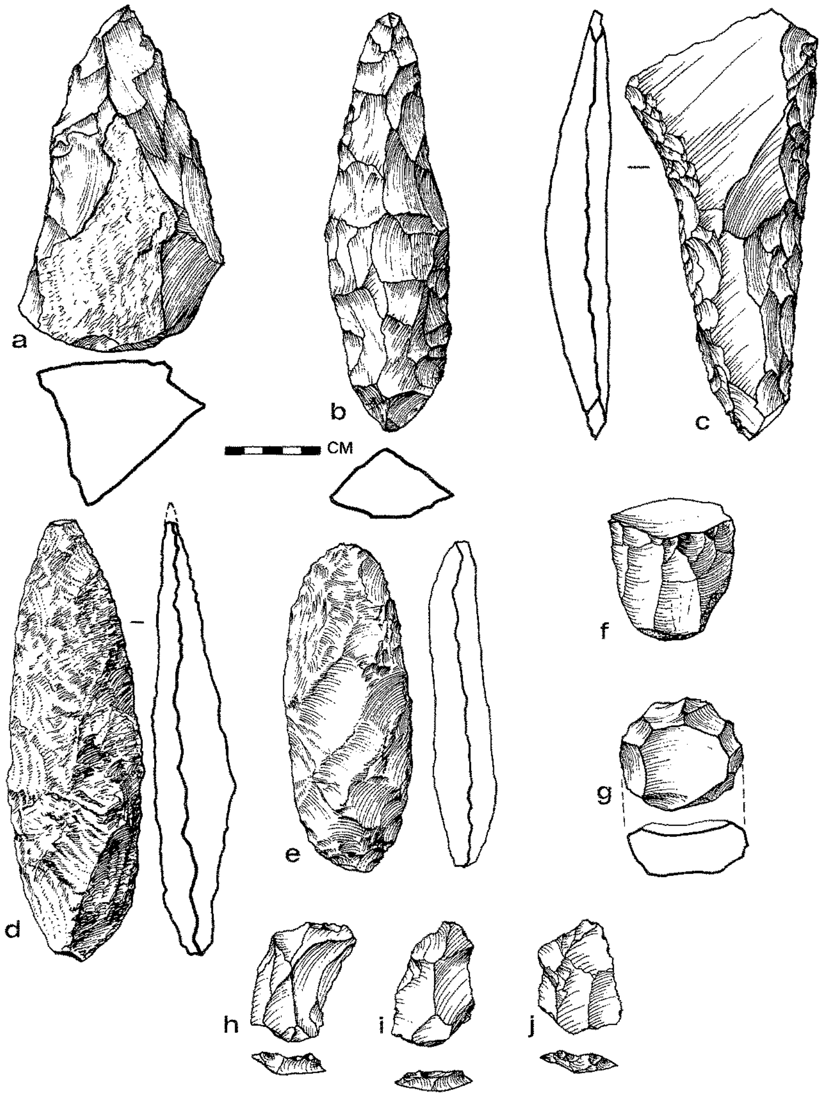

Fig. 11. Sangoan-Lupemban artifacts from the N and O Horizons at Nsongezi, Uganda. (a) Pick; (b) lanceolate; (c) tranchet; (d) lanceolate; (e) Lupemban-type core-axe; (f) one-directional flake core; (g) radially prepared Levallois core; (h–j) flakes from radially prepared Levallois cores. All in quartzite. a, b, f, and g are from N Horizon; c–e and h–j from washouts in Upper clays (a and c–e after O'Brien, 1939, pp. 229, 247, 251, 253; b, f, and g after Lowe, 1952, Plates XX and XXIV; h–j from the J. D. Clark collection).

preparation, Levallois flakes with faceted butts with both radial and convergent dorsal preparation, flake-scrapers, both side and end, lanceolate points, tranchets, and some other miscellaneous forms.

Muguruk (Zone 2A) (Leakey and Owen, 1945; McBrearty, 1986; 1988). Characteristic Sangoan and Lupemban artifacts were found by Archdeacon Owen in 1926 at localities on the north side of the Winam (formerly Kavirondo) Gulf in western Kenya. In 1936 he found the site at Muguruk, and following visits there and to other sites by L. S. B. Leakey, they jointly published their findings in 1945. Subsequently, in 1979 and 1980, Muguruk was excavated intermittently by McBrearty, who published a detailed description and analysis of the site and the Muguruk Formation.

The site is 3 km north of the lake and 40 m above the shore on the Muguruk River. Bedrock consists of two superimposed phonolite lavas that provide the raw material from which almost all the artifacts are made. The sediments of the Muguruk Formation consist of six informal members of fluvial origin. The basal member is a 2-m-thick conglomerate with clay lenses and contains occasional artifacts. Above member 2 is coarse to medium sand 1.5 m thick that contains artifacts of what has been named the Ojolla Industry. Overlying this sand is a mud-cracked gray clay 2.5 m thick (member 3) containing only rare artifacts in the upper part. Above again (member 4) is a red, clayey sand 3 m thick that contains a dense concentration of artifacts (possibly concentrated by termites) of the Pundo Makwar Industry and is classified as a lateritic soil (McBrearty, 1988). At the top is a black cotton soil (member 5) with Later Stone Age artifacts. In the southern area of the site, an ancient calcareous channel cut may have been contemporary with the Sangoan-Lupemban occupation during member 2 times. McBrearty suggests that the carbonate may be an indication of drier conditions while the Ojolla Industry was being made. The weathered lateritic soil of member 4 suggests a period of higher rainfall and humidity during the time of the Middle Stone Age *sensu stricto*. Soil acidity and chemical weathering have removed all bone. Based on sedimentation rates, McBrearty estimates that these Muguruk Formation beds may have accumulated over a period of 30,000 to 170,000 years.

McBrearty describes the lower industry at Muguruk as Sangoan-Lupemban and has adopted a local, informal name. The *Ojolla Industry* from member 2 is dispersed throughout some 55 cm, with two concentrations—the upper one at the contact between member 2 and member 3 and the lower at the contact with the conglomerate (member 1). Although in secondary context, these assemblages do not appear to have been significantly redistributed and microdebitage is present. The size range of debitage is also not very different from that of an experimental assemblage using phonolite. Retouched tools account for only 2.2%, the remainder being unmodified waste, so that these concentrations can be seen as manufacturing places. Heavy Duty tools comprise 41%, and Light Duty nearly 59%. Of the former, ca. 23% are large, bifacial tools, such as core-axes, planoconvex sectioned picks, and long, finely made lanceolate points with biconvex to lenticular cross sections. Like those from Uganda and the Congo Basin, these show considerable flaking skill and were probably made from long, triangular-sectioned flakes. The number of fragments of broken lanceolates suggests that this may have occurred in the course of manufacture. Clearly rare, since none are recorded by McBrearty, are large tranchets such as those found in the Orichinga Valley by O'Brien and that illustrated by Leakey and Owen (1945, Fig. 19). Other retouched forms are Light and Heavy Duty scrapers and "choppers." Flakes were removed from cores mostly by radial flaking and there is clear evidence for discoid and Levallois flake and point cores as well as for the flakes struck from these.

The overlying *Pundo Makwar Industry* occurs in the overbank sands and silts and the red clay sands above the artifacts, being vertically distributed over some 40–45 cm. The many concentrations of artifacts, in part, probably, the result of termite activity, consist mainly of flaking waste and only 1–2.4% of retouched pieces. Almost all artifacts are in phonolite but five pieces of obsidian, one an unfinished bifacial point, are derived from the Lake Naivasha area 190–195 km to the east: impressive evidence for the transport of raw material by Middle Stone Age groups. This appears to be a local expression of an MSA industry with emphasis on Levallois flake production and a range of Light Duty scraper forms, together with a smaller percentage of broken and unfinished points. A Heavy Duty component is virtually absent except for choppers and a single pick.

Both these industries seem to have been phonolite workshop areas and the most significant difference between them is the virtual absence of Heavy Duty tools and lanceolates in the later one, where much greater emphasis is placed on Light Duty retouched forms. Both made use of the Levallois method of flake production, which is also more common in the later industry. While the technology suggests some continuity, the discontinuity in retouched forms carries the implication of a chronostratigraphic break also. This is again evidenced in the Nsongezi sequence and once more demonstrates that the MSA lasted for a long period of time.

Songhor (Zone 2A) (McBrearty, 1981). This site is on the eastern edge of the Victoria Basin in the foothills of the Nandi Escarpment some 50 km east of the lakeshore at Kisumu. It is a short-term activity site and the tools and fauna are in near-primary context within a 0.25-m thickness of tuff stratified between two deposits of alluvial clay, the upper one capped by a paleosol. The raw materials used were nephelinite lava from a source 12 km distant and quartz, which was local. Also of interest are two small chips of obsidian, the nearest source for which is the Lake Naivasha region of the Rift. Test excavation and surface eroded pieces produced some 422 artifacts. Of these, very few were retouched tools (1.4%) and modified/utilized pieces (5.4%), the remainder being unmodified flakes, cores, and other flaking waste. Retouched tools are scrapers (four), Levallois points (two), and bifacial points (two). Discoid cores were prepared by radial flaking to remove mostly broad flakes. Material was conserved, for surviving cores are all of small dimensions. Bones and bone fragments (N-112) come from medium to large bovids. A rhinoceros, waterbuck, and wildebeest have been identified; no extinct species appear to be present, confirming the suggestion of the artifact assemblage that it belongs in the later part of the MSA. It resembles assemblages in the East African plateau grasslands and has none of the characteristic forms associated with the later MSA in the Congo Basin and the Western Rift.

The islands on the north side of the lake (*Buvuma* and *Bugaia*) have also yielded Sangoan-Lupemban artifacts from surface collection and excavation (Nenquin, 1971). These comprise typical Sangoan-type picks and Lupemban lanceolates and core-axes, as well as tranchets, radially prepared cores, and faceted flakes. Some leaf-shaped and subtriangular points of savanna MSA type may belong to a later time period.

The Southeastern Sudan (Zone 5)

Little is known of the late Middle to early Upper Pleistocene archaeology of this region. At *Khor Abu Anga* (Omdurman) (Arkell, 1949), a late Acheulean appears to give place to a Lupemban-like occurrence with lanceolates and core-axes with which appear to be associated Levallois flake and point cores and radially prepared flakes with faceted striking platforms. Pleistocene gravel terraces at Khashm el Girba (Shiner *et al.*, 1971, pp. 196–308) on the Atbara have yielded artifact assemblages in secondary context described as Acheulean and, possibly, Sangoan, also by reason of a Heavy Duty core-axe and scraper component. Associated fauna includes elephant, rhino, antelope, and gazelle. At one site (Site 116) in the "Depression," Levallois cores were found on the surface and abraded Acheulean bifaces in the underlying sandy gravels; no further details have been published.

Singa (Zone 5). Singa, on the Blue Nile about 200 km further upstream from Khartoum, was the site of the discovery in 1924 of the fossil cranium. No artifacts were associated, although a radially prepared flake in felsite with a faceted platform was picked up nearby at the foot of the river cliff where the skull was found (Arkell, 1949, p. 46).

Abu Hugar (Zone 5). At Abu Hugar, 32 km upstream from Singa, the same stratified sequence is exposed by the Blue Nile and a collection of artifacts made by Arkell was described by Lacaille (1951). These are all in a poor quartzite and vein quartz that give the artifacts a crude appearance. Heavy and Light Duty forms occur and are well illustrated. They include radially flaked, biconical and discoid cores, core/choppers, and steeply retouched scraper forms on high-backed chunks or cores, as well as flakes and other unmodified waste and hammerstones. A few radially prepared flakes with faceted platforms are typically MSA. All of these specimens were eroded and came from the foot of the section.

The fauna from Singa and Abu Hugar (Bate, 1951) was also eroded but is, nevertheless, important as it includes several extinct species. From Singa came rhino, hippo, a Hippotragine antelope, and *Pelorovis*, and from Abu Hugar, crocodile, an extinct porcupine, *Equus*, rhino, hippo, a Sivathere, oryx, an extinct Antilopine, gazelle, and *Pelorovis*. Bate favors an age of early Late Pleistocene for the fauna, although since these were surface finds, she qualifies this with a caveat that fossils of more than one age may be represented. If this is a homogeneous assemblage, the fauna suggests an environment of open wooded grasslands during a time of semiarid climate similar to that of the present day.

Both sites were reexamined by H. Ziegert (1981), who carried out excavations there. The 17-m section at Abu Hugar consists of two main series of sediments. The upper series comprises calcareous clays with kankar nodules (see also Arkell, 1949, p. 46) and the lower series is of sands, silts, and fine gravels. Carbonate root casts at the surface of this series suggest the possibility of an unconformity. According to Ziegert, both the upper and the lower series of deposits contain fossils and artifacts, and following the annual flood, bones from the upper levels are deposited with those from the lower sediments at the foot of the section. A crocodile skull, previously dated by C-14 to ca. 18,000 B.P., is said to be derived from the upper part of the sequence on account of its degree of fossilization. Artifacts recovered by Ziegert from his excavations at Abu Hugar led him to consider those from the lower sediments to be "Middle Acheulean" and those from the upper clay beds to be "Late Acheulean"; he ascribes the Singa cranium to the late Acheulean. The artifacts ($>$ 200) and bone from the lower series were found on three stratified horizons with what are described as traces of fire, and Ziegert considers that these are nearly primary context activity places. As yet, none of this material has been published and illustrated so that only Lacaille's description is available at present. From this it seems most likely that these assemblages belong in the earlier part of the MSA.

From the geological reports, it is clear that the upper clay series can be identified with the Gezira clays that are considered to be later Pleistocene.

Wickens (1982, p. 39) ascribed Singa and Abu Hugar to the later part of the Last Glacial (20,000–15,000 B.P.) but the fauna and artifacts suggest an earlier date. In this connection, Adamson *et al.* (1982, pp. 172–174 and Fig. 6) consider the carbonate gravel nodules at Singa and Abu Hugar to have been redeposited from an earlier cycle or cycles, and an age of > 40,000 B.P. for the redeposited carbonate gravel in a section at the Jebel Aulia Dam might be cited here as an indication of this.

The evidence from the central and eastern Sudan is, therefore, both slight and very inadequate and can serve as an indication only that prehistoric sites are present and may have good potential if systematically investigated. Following the Acheulean, there appears to be some evidence for Sangoan and, certainly, Lupemban traditions and for at least one regional variant of the MSA. If Ziegert is correct in assigning the Singa skull to the younger (Gezira clay) part of the sequence, then the age of ca. 18,000 might be acceptable. If, on the other hand, it belongs with the older sediments—and it is said to have been "heavily mineralized"—then it is more likely to be ⩾ 100,000 years old.

This completes the account of the earlier and later MSA occurrences in the different regions discussed in this overview but a brief account of the associated fossil remains is necessary before discussing the implications of all this material.

Fossil Hominid Remains from Greater East Africa Associated with the Middle Stone Age

Human skeletal remains associated with MSA assemblages in greater East Africa are few and not well dated. Those that exist are important, however, for showing the association in Middle Stone Age contexts both of archaic *Homo sapiens* fossils with some anatomically Modern features and of other fossils with essentially Modern characteristics. When viewed in the light of evidence from other parts of the continent, it is apparent that the fossils from East Africa are an integral part of the record that documents the emergence of the Modern genotype in South, Central, and North Africa ⩾ 100,000 years ago. This has recently taken on new significance in the light of the DNA data suggesting that this event took place in Africa south of the Sahara some 290,000–140,000 years ago (Cann *et al.*, 1987).

The fossil evidence has been described in detail, particularly by Stringer and Andrews (1988), Bräuer (1984), and Rightmire (1984), and is not repeated here. The consensus view is that a number of transitional forms can be recognized in the continent, and if these are correctly ordered chronologically, they show varying combinations of archaic and Modern traits between 400,000 and 200,000 B.P. and then, after ca. 100,000 B.P., the dominance of essentially Modern characteristics.

Leaving aside those older fossils associated with the East African later Acheulean—Ndutu, Kapthurin, the fossils from Bed III and the Masek Beds at Olduvai, and that from Bodo—fossils from six locations are of concern here.

Lake Eyasi (Zone 1) (Oakley et al., *1977, pp. 162–163).* Fragmentary remains of two, perhaps three, individuals derived from the Eyasi Beds and associated with a "Sangoan-like" assemblage (Njarasa Industry) (Mehlman, 1984, 1987) were found eroded from lake sediments in 1935 and 1936 (Wernert *et al.*, 1940; Reeve, 1946; Leakey, 1946). The latest investigations indicate an age probably well in excess of 130,000 B.P. Eyasi 1 is a partial female cranium, Eyasi 2 is an occipital (male?), and Eyasi 3 is another occipital fragment. Eyasi 1 has been compared with Kabwe (Broken Hill) and classed with the archaic *Homo sapiens* "rhodesioids."

Mumba Rockshelter (Zone 2) (Bräuer and Mehlman, 1988). Three molar teeth are associated with MSA artifacts in Member VIB at the bottom of the sequence in the Mumba shelter. Uranium-series dates suggest an age in the region of 109,000–130,000 B.P. The crowns are all small even in comparison with modern African populations, and as they show no archaic features, they are considered to represent early anatomically Modern *H. sapiens*.

Laetoli Hominid 18 (Zone 1) (Day et al., *1980; Rightmire, 1984, pp. 315–316).* From the Ngaloba Beds, dated to 120,000 B.P. by uranium-series (Hay, 1987), the skull is almost complete and preserves a largely anatomically Modern morphology, namely, the expansion of the vault and the rounded occipital. Associated with these features, however, are frontal flattening, a supraorbital torus, and a general thickness—all archaic features. The associated MSA assemblage does not appear to contain any Heavy Duty artifacts (Harris and Harris, 1981).

Omo, Kibish Formation (Zone 2) (Butzer et al., *1969; Day and Stringer, 1982; Bräuer, 1984, p. 343).* These remains consist of two incomplete calvaria: Omo 1, associated with some postcranial bones; and Omo 2. There are also some further fragmentary cranial bones (Omo 3). These fossils were found in overbank deposits on the surface of a stratum (e) with root casts at the top of the lowest member (Member 1) of the later Pleistocene Kibish Formation. Omo 1 was associated with fauna consistent with a late Middle or early Upper Pleistocene age. This is confirmed by a uranium-series date of ca. 130,000 B.P. on shell from the top of Member 1 and the deposit is beyond the range of the radiocarbon method. The only associated archaeology consists of stone artifacts of which 9% were waterworn. These are said to be undiagnostic except for five utilized or retouched Levallois flakes

(Butzer *et al.*, 1969, p. 20) associated with Omo 1. Again, therefore, the context is most likely MSA.

Omo 2 was found on the surface at a place some 2.5 km distant from Omo 1 and, so far as could be ascertained, probably came from the same horizon. The Omo 3 fragments are thought to come from Member 3 and are, therefore, somewhat younger but still older than 37,000 B.P. Omo 1 is shown clearly to belong with Modern *H. sapiens.* Omo 2 shows a number of *H. erectus* features that place it outside the range of Modern and, indeed, of Neanderthal crania, although a number of diagnostic parts are missing. If the two are contemporary, it would seem that two distinct populations are being sampled but the possibility exists that Omo 2 is, in fact, from an older deposit. Omo 1, although robust, is one of the earliest Modern human fossils yet known. If the dating is correct, its age places it as contemporary with the MSA Industrial Complex.

Kanjera (Zone 2A) (Oakley et al., *1977, p. 60).* In 1932, L. S. B. Leakey found remains of five individuals in sediments close to the south shore of the Winam Gulf in western Kenya. These consist of four incomplete calvaria (two of which are reconstructed) and two femora. The calvaria show anatomically Modern features. Much has been written concerning the age and association of these fossils but the latest assessments are that they are younger than the Middle or earlier Pleistocene fauna with which they were at one time thought to be associated, and since MSA artifacts are present in the locality, the hominid remains may be of this age or even more recent. Until more definite associations and age determinations are forthcoming, these crania should probably not be included in the sample of MSA fossils.

Porc Epic, Dire Dawa (Zone 3) (Vallois, 1951; Oakley et al., *1977, p. 18; Bräuer, 1984, p. 384).* This fragmentary piece of mandible was found in 1933 by Breuil in a breccia adhering to the cave wall. It is a large, robust adult jaw preserving P3–M3, all damaged, and the whole specimen is not well preserved. It shows several archaic features that are seen in Neanderthals but Vallois prefers to describe it as "neanderthaloid." Measurements and robusticity fall just within the range of variation of Modern humans. Mandibular robusticity of this kind is in keeping with what can be expected in fossils transitional between archaic and Modern forms and, indeed, in early Modern populations also (*vide* Klasies River Mouth). Excavations in 1975 showed the Porc Epic fossil to be asociated with MSA artifacts and fauna in a brecciated cave earth having a minimal age, from obsidian hydration dating, of 60,000–70,000 B.P.

Singa (Zone 5) (Woodward, 1938; Wells, 1951; Tobias, 1968, p. 118; Stringer, 1979; Rightmire, 1984, p. 315). The context and associated artifacts and fauna have been described above. The fossil consists of a heavily mineralized skull with most of the face missing, which has been described as

"Proto- or Pre-Bushman" because of the parietal bossing. More recently Stringer has shown that this fossil has a number of archaic features and should more probably be included in the late archaic *H. sapiens* group rather than with those that are fully Modern. However, Bräuer (1984, p. 358) considers the Singa orbital region to be almost completely Modern, as is also the rounded profile of the occipital. Singa is said to show similarities to the skull from the Ngaloba Beds at Laetoli.

These post-Acheulean and MSA fossils from greater East Africa show, therefore, features that place some of them in the archaic *Homo sapiens* category (Eyasi 1 and 2, Omo 2) and some in the Modern category (Omo 1, Laetoli Hominid 18, Kanjera?, Mumba), and there are others that appear to be more transitional (Singa, Porc Epic). The Eyasi fossils are probably the oldest (perhaps between 200,000 and 100,000 B.P.) described here. When the other fossils can be more precisely dated in relation to each other, it should prove possible to estimate the time involved in the change from the later archaic to fully Modern humans.

DISCUSSION

Chronology

As has been shown, there is reason to believe that early MSA assemblages of stone tools first made their appearance during oxygen-isotope Stage 6, some 200,000 years or more ago, during a time of lowered temperature and drier environmental conditions. Middle Stone Age technology, *sensu stricto*, came to an end some time between 40,000 and 30,000 years B.P. (Fig. 12). The major problem in calibrating the MSA is the lack of any really reliable dating technique, as radiocarbon is usable only for the latest occurrences. At present, the more methods used that produce consistent and coincident results, the more confidence can be placed in the dates obtained. Most of the occurrences considered either cannot be dated or can be assigned a relative age only where a representative faunal sample is present.

There are no reliable dates for the Sangoan, which has been shown to be > 130,000 B.P. in the Eyasi Rift and, on stratigraphic evidence, to belong to the closing part of the Middle Pleistocene, so that an age in the region of 200,000 B.P. would be appropriate. The Sangoan appears to be associated with ecosystems that today carry a woodland savanna vegetation cover. The only exception is Anderlee in the Afar Rift, although as yet, its ascription to the Sangoan is unconfirmed. The only faunal assemblage that can be associated with the Sangoan is that from the Eyasi Beds (Schröter, 1978). It is a large fauna but some confusion attaches to the taxonomic identification.

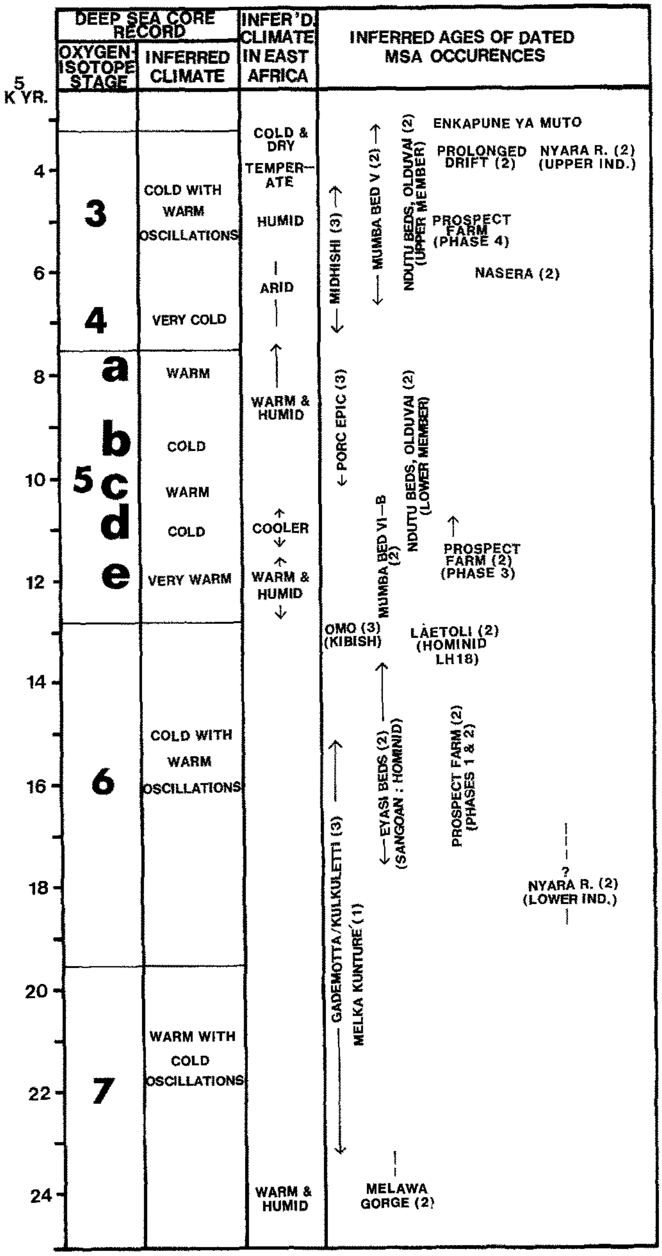

Fig. 12. Inferred chronology and paleoenvironmental associations from some Middle Stone Age occurrences from East Africa; based on radiometric, isotopic, and faunal data.

There are 32 species of large mammals, most of which are typically savanna forms with the exception of the giant forest hog and a mangebey that indicate evergreen forest. Mehlman (1987, pp. 144–146) lists seven extinct forms among the essentially modern species represented, confirming previous suggestions that this is a fauna of late Middle to early Upper Pleistocene age.

Of comparable age perhaps, since the associated fauna contains three extinct forms, is the assemblage from the Lower Unit of beds at Abu Hugar on the Blue Nile. Until Ziegert's collections are published, however, it is not possible to assess to what extent a Heavy Duty component is present; the artifacts illustrated by Lacaille only doubtfully show this. Since the Sangoan suggests wooded grassland, it is possible that only Light Duty equipment is called for. Undated but clearly also early is the Sangoan from the N Horizon at Nsongezi and the lower assemblage from the Nyara River in the Rukwa Rift. Possibly the Tendaguru finds, if they are really Sangoan, belong in this earlier time range, as also those from Khashm el Girba. Somewhat later perhaps, if typology can be trusted, would be the Sangoan-Lupemban ("Middle Tumbian") from the Orichinga Valley, the Ojolla Industry at Muguruk, and the assemblage from the upper levels at Khor Abu Anga.

If the dating is correct, there are several other occurrences that belong in the early part of the MSA but conform more specifically to the concept of the Middle Stone Age, namely, assemblages of Light Duty equipment made from flakes detached by the Levallois and discoid core methods but lacking the Heavy Duty component found with the Sangoan and Lupemban traditions. Gademotta, Kulkuletti, and Melka Kunturé lack the Heavy Duty component, but in the case of the first two, radiometric dating and, of the second, stratigraphy indicate that they are equally early. The assemblages from Koné, the lower units at Prospect Farm, and the *tuq* sequences in Somalia, although they are undated, should also probably be included. It is important to be able to redate the swamp deposits on the Kinangop Plateau and to reinvestigate the "Pseudo-Stillbay" and "Basal Aurignacian" as, if these are not intrusive, they must both be old.

Several other Light Duty occurrences have been dated by various methods to between $\sim 100{,}000$ and 50,000 years B.P. and so are either contemporary with or, perhaps, somewhat younger than those mentioned above. These are the assemblages from the Ndutu Beds at Olduvai, Prospect Farm (Phase 3), and the Mumba and Nasera Rockshelters, together with the hominid fossils and artifacts from the Ngaloba Beds and Member 1 of the Kibish Formation in the Omo Valley.

Of the same age, or later since the fauna represented is a Recent one with no extinct species, may be the MSA from Songhor, Loiyangalani, and Porc Epic Cave. Typology and stratigraphic position also indicate a later age for the Pundo Makwar Industry from Muguruk, the occurrences from the uppermost clays in the Orichinga valley, the upper assemblage from the Nyara River, and the Gorgora Rockshelter. Latest of all probably are Gotera, Aladi Springs, Prolonged Drift, Galula, and the industry from the base of the Enkapune ya Muto shelter.

The above are only rough estimates of age based on radiometric dating, where it exists; on fauna, where it might be considered in any way diagnostic of a time range; and on stratigraphic position in a depositional sequence and technical features of the lithic assemblages. The chronology, however, remains very inadequately known and open to major revision as and when more reliable calibration techniques become available. One point, however, is probably clear that, from the long stratigraphic sequences preserved at some of these sites, the Middle Stone Age lasted for a long period of time, possibly for 150,000 years into oxygen-isotope Stage 3 and the early Last Glacial.

Paleoenvironment

Middle Stone Age occurrences are found in a wide range of present-day habitats throughout the continent, but as the necessary pollen and other details are missing from most of these contexts, considerable caution is needed in any attempt to model the paleoenvironments of the late Middle and early Upper Pleistocene. Since wind systems are believed to have been basically the same, although fluctuating in intensity with temperature changes, and later Pleistocene correlations between tropical Africa and other parts of the world have been established by means of deep-sea cores, it seems clear that, generally speaking, during a full glacial period, the climate of tropical Africa was essentially more arid, while the interglacials were times of greater humidity and a climate similar to that of the present. There was certainly a major retreat of the tropical forests in the Congo Basin and West Africa during the maximum of the Last Glaciation and it is likely that similar readjustments occurred during times of earlier glacial stages. If the Penultimate Glaciation was the time at which the makers of the Sangoan entered the Congo Basin, as seems likely, the vegetation cover can be expected to have been more open, with grassland and montane tree species replacing tropical lowland forest. This is suggested by the pollen spectra from northeast Angola (Van Zinderen Bakker and Clark, 1962) and at the Kalambo Falls (Van Zinderen Bakker, 1969). Kendall (1969) and Livingstone (1980) also show that the Lake Victoria Basin was drier during the last glacial maximum. During the Last Interglacial, the environment is more likely to have been similar to that of today. If so, and after making allowance for human destruction and alteration of habitats since village farming began, existing vegetation patterns can perhaps be considered as reliable analogues for the past.

The Heavy Duty component of the Sangoan/Lupemban can be seen best, perhaps, partly as a natural response to living in a more closed, tropical habitat and partly as a general technological invention that took place at the beginning of MSA times and resulted in a significantly greater use of wood and its by-products—bark, resin, etc. From these, and with the invention of hafting, a range of new equipment could have been made that contributed to greater success in foraging and to improving the social life of the group. This is not to say that the makers of the MSA occurrences, which today are in open grassland and park savanna and for the most part lack this Heavy Duty component, were not also making use of wood, bark, etc. Undoubtedly they must have been, but for them, the core-axes, picks, and other Heavy Duty forms do not seem to have been the essential equipment they were for the makers of the Sangoan-Lupemban Complex. Instead, when a heavy chopping tool was needed, a suitable piece of unworked rock might have been used and then discarded in the same way as the *arapia* blocks were used by the Aborigines of the central Australian desert (Hayden, 1977); perhaps such natural blocks should be looked for, and if habitats were not dissimilar to those of the present day, such an explanation would not be unreasonable. In the later Middle Stone Age, with the onset of the Last Glacial in high latitudes and the reduced temperatures and increased aridity in much of the African continent, the need for formal Heavy Duty tools is likely to have been even more reduced or totally absent.

Technological Variability

The Levallois method of producing flakes, points, and blades was the dominant but not the invariable technique used and the nature of the raw material had an important effect on the choice of method. The size and form of the material—small cobbles or pebbles, boulders, outcrops—the distance of a workshop and living area from the material's source, the texture and flaking qualities of the material, and the technical skill of the knappers can all be shown to have affected the kind of stone artifact assemblage that was produced. This has been shown by the examples cited, and in general, where the stratigraphic sequence is a long one, it can be seen that there is no small amount of regional continuity in retouched forms and basic techniques and that, when comparisons are made, this is less so between the different regions. Most of this continuity is likely to derive from the raw material used. Flakes are more likely to be produced from quartz than are blades, and discoid cores tend to predominate over point or blade cores. When large pieces of good-quality obsidian or chert were used, Levallois points and blades were significant components. In fact, as has been said, it is likely that percussion-struck blade technology could have evolved locally in areas, such as Ethiopia, where obsidian was used, through the adoption of a Nubian type of Levallois point core. This can be seen at Koné, where refitting studies show that long bladelike flakes and blades were removed from such cores and preserve down one edge the pseudobacking that results from the prior preparation of the underside of the core (Kurashina, 1978, pp. 342, 426). True blade technology in the Ethiopian Rift Lakes region is early—some 30,000 B.P. (Street, 1980) —and might have been developed in this way out of the opposed-platform Nubian core, as has been well documented at Boker Tachtit in the Negev (Marks, 1983, pp. 167–190).

Those sites with long sequences—Gademotta, Kulkuletti, Koné, Prospect Farm, Mumba, Nasera, Lukenya Hill, and Porc Epic—show no very specific trends or technological changes through time. There is no consistent change from larger artifacts at the beginning to smaller ones at the end, as might be expected. In fact, at some sites, e.g., Prospect Farm, artifacts in the earliest phase have the smallest dimensions. The "Pseudo-Stillbay" from the Kinangop is another such example. However, blades and unprepared blade cores do become more common at the end of some sequences, e.g., Gademotta, and selection from larger blade forms is visible at Porc Epic. "Sinew frayer" or flake cores are present at Koné, in the Kenya Rift, and at Lukenya Hill but are not recorded from most other sites. Again, thin retouched disk knives also occur at the above-named localities. With the exception of those from Lukenya Hill, the material was obsidian and this may have been a contributing factor to their production; there is also a suggestion that they may be a late form. Where the material permits, Levallois points are manufactured, as in northern Somalia (chert) and the Ethiopian Rift (obsidian). As Levallois points decrease, so blades increase through time. Nubian cores do not appear to be present in assemblages south of Koné, although two are illustrated from Gademotta (Wendorf and Schild, 1974, Plate 27, Nos. 4 and 7), but whether its presence there is due to influence from the Nile is unknown. Points (unifacial and bifacial), side-scrapers, end-scrapers, and borers, even burins, are all recurring forms with local preferences as to shape, retouch, proximal reduction, etc. However, the data at present do not show any consistent trends and it is probable that it will remain so until the chronology becomes more precise.

There is, as yet, no clear evidence for the kind of interregional break with tradition such as the Howieson's Poort represents in South Africa. However, the blade-dominated "basal Aurignacian" on the Kinangop and the Mumba Industry from Bed V reported by Mehlman at the Mumba Rockshelter are early manifestations of industries with a strong backed-blade component of which at least the Mumba Industry is still within the MSA tradition. Where the Basal Aurignacian fits into the chronological sequence is unclear, but so far as the Mumba Industry is concerned, this appears to belong to the later or terminal part and does not represent a cultural discontinuity as does the Pre-Aurignacian at Haua Fteah or the Howieson's Poort in South Africa.

Intraregional variation is also present and can be seen through both space and time. The Lake Victoria Basin sites, Prospect Farm, Gademotta, the northern Somalia *tuq* sites, and those assemblages in the Eyasi and Mumba Beds and at Melka Kunturé show changes in retouched forms through time as well as shifts in raw material preferences. Such changes could, in part, be stylistic but might also reflect strategic and technical innovations. Perhaps the most interesting variation, however, is spatial and relates to behavior. Some sites, such as Mumba, Prospect Farm, Lukenya Hill, Porc Epic, and Gorgora, appear to have been continually occupied over a long period of time and exhibit a full range of retouched and modified stone tools. It would not be unreasonable to see these as seasonally reoccupied, favored localities or base camps. Other sites, such as Gademotta, Kulkuletti, and Koné, while they also appear to be "living sites," are, in addition, primarily quarry and workshop areas. Others again, such as Loiyangalani and Prolonged Drift, have more the appearance of short-term hunting camps or butchery places. At Porc Epic and Gorgora also, hunting and subsequent processing of carcasses are likely to have been a major reason for these sites' having been located where they are.

Raw material can also be used to show something of the extent of territorial range and interaction between groups, for example, the distances from which obsidian was obtained or exchanged from sources in the Kenya Rift, or obsidian and afinitic basalt in the southern Afar, or the unknown distance from which the chert was brought for the bifacial points at Gorgora or the chert, obsidian, and ignimbrite at Ala Kanasa. All this evidence suggests that these MSA groups were still wide-ranging and using the resources of an extensive territory.

Comparing assemblages from the different zones, it is apparent that those in the Lake Victoria Basin (Zone 2A), the Eastern Sudan (Zone 5), and the humid coastal zone (4) each have their own variant of a Heavy Duty component which distinguishes them from the assemblages in Zones 1, 2, and 3. The situation in Zones 4 and 5 in later MSA times is unknown but in Zone 2A the Heavy Duty component becomes rare at that time or is absent. In Zones, 1, 2, and 3, uncertain chronology, differences in raw material, and special single-context/single-activity assemblages render identification of stylistic differences dubious. If any can be recognized at the present time, these might be the preferential forms represented by the markedly subtriangular points at Gorgora, the pointed, leaf shaped forms at Porc Epic and Gademotta, the Levallois points at Midhishi, and the disk knives at the Kenya Rift sites and Koné.

The invention of hafting the stone working parts as simple composite tools has not, as yet, received the attention it deserves. This is a major technological advance which made possible an increased range of tool forms for special tasks through the different ways in which the stone artifact could be mounted. Hafting could have begun in the terminal Acheulean (*vide* the single tanged flake with Acheulean Stage 8 at Casablanca), but the first unquestionable use is seen in the tanged "points" of the Aterian in northern Africa with ages of $\geqslant$100,000 B.P. At the same time, reduced platform and bulb and thinning of flakes and blades by unifacial or bifacial retouch strongly imply that some, at least, of these retouched forms were also hafted and simply represent an alternative way of doing so. With the Aterian, a metapodial or other bone with a medullary canal into which the tang could be fitted and secured by means of mastic, could have formed a serviceable knife. Or again, a bone or reed collar would have effectively served to join the head and shaft of a tanged projectile weapon. In tropical Africa, however, it is more likely that wood and mastic alone would have been used, based on the evidence of the Later Stone Age mounted tools from South Africa (Deacon, 1966).

Although with the Earlier Stone Age several different kinds of Light Duty tools can be recognized—scrapers, borers, perhaps even burins—by Middle Stone Age times there is greater standardization in these forms, although not so great as that made possible by a true blade technology. With scrapers there is always the problem that the retouch they show may be the result of continued resharpening rather than the initial intentional preparation of the piece. The finished points, however, do, in general, seem to be carefully prepared forms and were probably interchangeable and mounted for use as knives and spearheads. The advantage of the latter was clearly as a weapon that could both penetrate and cut—a new development, since wooden-pointed spears could only penetrate. The cutting potential not only caused the animal to bleed and so to become exhausted more quickly but also provided a blood spoor that could be followed more readily and was especially useful in more closed habitats. If, as this writer believes to be most likely, points (small, leaf-shaped, lanceolate, and probably Levallois forms) were sometimes hafted as spearheads, then this is a strong reason for considering the MSA populations to have obtained a proportion, and no doubt an increasing proportion, of their animal protein and fat from hunting. Of course, with mastic mountings, it is also easy to remove the working parts and to haft and use them in some other way, as, for example, the way the Ituri Forest Pygmies use their spearheads at times as knives and machetes. Systematic use-wear studies should be able to show to what extent these and other tools were hafted, by the differential nature of micropolish and chipping between the distal and the proximal ends of artifacts. This clearly exists, as has been demonstrated for late Lupemban core-axes in northeast Angola (Clark, 1963, pp. 151–152, 328–335). The emphasis on points of various kinds at believed game-viewing and hunting camps, such as Porc Epic, Gorgora, and Prolonged Drift, may be a further indication of hunting and butchery, although this pattern is not repeated at the Loiyangalani believed butchery sites in the Serengeti. Not only will systematic use-wear studies help to resolve the question of both hafting and hunting, but in conjunction, actualistic control experiments in the use of points need to be carried out employing different raw materials. Since in Africa, if the dating is reliable, the technological advances made possible by the invention of hafting take place at much the same time as the appearance of anatomically Modern humans, the innovative technology this development made possible could have brought about major changes in the ways in which tools were used to extend and improve on the ways in which resources were exploited and processed.

Diet and Social Behavior

The East African evidence contributes as yet little that is new to a general understanding of the MSA diet. The fossil fauna shows that both large and small game animals, with emphasis on large, medium, and small bovids, were made use of but systematic studies of butchery practices remain to be carried out. Bone is sometimes comminuted and burned, suggesting that the joints were grilled and roasted, and hearths and ash layers (perhaps indicative of meat drying) are present at some locations. Nothing can be said about plant foods. Grindstones and pestle stones occur at sites outside East Africa in MSA contexts—at Kalambo Falls (Zambia), at Kalkbank (northern Transvaal), and in the eastern Sahara (F. Wendorf, personal communication)—and it can be expected that plant foods were also regularly obtained and processed by the East African populations, in particular buried staples such as tubers, rhizomes, and roots as well as fruits and nuts, but this evidence still awaits discovery. Also, other than the use of pigment, there is, as yet, no evidence of the complex behavior that is the special hallmark of the Upper Paleolithic/Later Stone Age. Pigment, usually hematite, sometimes with rubbed facets, is present, however, at some of the East African sites, for example, at Gorgora and Porc Epic Caves, and at the latter, a portion of an ammonite that had been completely altered to ocher has also been carried in. Presumably pigment was being regularly used in powdered form as a body paint and for decorating tools and equipment, for there is no indication of any parietal art on cave walls at this time. No burials are known from this time in East Africa. Since there are no distribution plots of "living floors" that might show activity-related assemblages, other than at the quarry sites, and the geographical distribution of sites is still inadequately known, demographic and settlement patterning remains to be demonstrated.

The MSA in East Africa is, therefore, largely an unstudied field but it has very great potential since it concerns a time that saw the appearance of anatomically Modern humans and important technological innovations. The artifact assemblages exhibit no small amount of variability, which is surely an indication of long ecological adaptation to the different physiographic regions of East Africa and the Horn. The evidence for the antiquity of the MSA, the length of time during which it was the dominant stone tool tradition, and the early appearance of true blade technology in Ethiopia and, possibly also, in the Kenya Rift are indications that the greater East African region can be expected to demonstrate as well as, if not better than, any other part of the continent the developmental stages of technological innovation and improved efficiency that led to the complex behavioral patterns that are the hallmark of our own kind. Moreover, since it was the more open ecosystems that were the favored habitats of Pleistocene foragers in Africa, it is likely that East Africa and the Horn were crucial connecting links between the subcontinent, northern Africa, and the eruption of anatomically Modern peoples into Eurasia. Besides the overland route to western Asia over the Isthmus of Suez, the Straits of Bab-el Mandeb would have been another point of dispersal into western Asia that should not be forgotten. In short, concentrated research on the Middle Stone Age populations of East Africa is long overdue.

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