Title
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Journal
Current Anthropology, 1(4)

ISSN
0011-3204

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Publication Date
1960

Peer reviewed

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by J. Desmond Clark

THIS IS an attempt to bring together the evidence of the cultural remains found in such profusion in the vast region of Africa south of the Sahara and to show what can legitimately be deduced from such evidence about the relationship between man and his environment throughout the various stages of prehistoric time. It is also an attempt to outline what may be inferred concerning the social and economic organisation of succeeding cultural stages.

Africa is important in this respect, because it has provided us with our most valuable knowledge about the living places of the earliest human societies. The extremely significant finds in China (Choukoutien), western Asia (Mount Carmel), and the more southern parts of Europe have included the less perishable material culture in quantity, and their contribution to our knowledge of, for example, food resources, use of fire, and the nature of the stone and bone equipment, is, of course, immense. But, as most of these finds come from cave sites, it is rarely possible to determine individual floors within the compacted occupation material in the deposits, therefore, as yet, they have not provided much evidence of floor patterns. Also, in higher latitudes subjected during the Pleistocene to glacial and peri-glacial climatic conditions, occupation sites in the open seem rarely to have survived except in loess regions; and tools from river gravels can never yield more than a small proportion of the clues necessary to interpret something of the way of life of their makers. In Africa we have been more fortunate, in that not a few of our discoveries have been undisturbed living sites in the open.

Certain data are essential to any study of the life of early man, if the results are to have lasting value.

Firstly, it is necessary for the *chronological framework,* from which a cultural succession is built up, to be established on a firm foundation and correlated on a continent-wide basis. The relative chronology for Africa, based on successive geological deposits, on faunas and cultures set in a presumed framework of fluctuating climates, still lacks the completeness obtained for other continents, and as yet absolute dating by Carbon-14 or the potassium–argon method is very much in embryo even for the later stages. Generally, however, while doubt exists as to the validity of some of the climatic interpretation, the broad chronology based on a succession of lithological units, fauna and culture need not be disputed, though a very great deal of detail still needs filling in.[1]

Secondly, it is necessary for sufficient *classificatory work*—taxonomic, if you like—to have been done to enable the various industries and technical processes to be pidgeonholed correctly, in accordance with the es-

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The present paper, submitted on June 9, 1959, was sent to twelve scholars for CA☆ treatment, of whom the following responded with written comments: Robert J. Braidwood, J. G. D. Clark, H. B. S. Cooke, F. Clark Howell, B. D. Malan, Kenneth P. Oakley, and Roger Summers. CLARK has incorporated several of their suggested amendments or improvements in the text, and discussed others in the footnotes. He wishes to express his gratitude to these scholars, and also to Irven DeVore, discussion with whom has helped him to "a clearer perception of the possibilities and limits of group behaviour among the earliest hominids."

[1] H. B. S. Cooke (1958) and Flint (1959*a, b*) have recently cast doubt on the climatic interpretations of the East African stratigraphical succession and have shown that the previously accepted framework of four "pluvials" separated by three "interpluvials" or "non-pluvials," while it may be the right one, is, on the available geological evidence, not yet proven to the satisfaction of geologists. The climatic interpretation of the geological evidence for the last pluvial and subsequent wetter periods is acceptable, but since it cannot be ruled out that tectonics, as well as climate, could have been responsible for the appearance and disappearance of the earlier Pleistocene lakes, the sediments represented by the rock units contained in their basins could equally well have been the result of earth movement, causing damming, diversion, or reversal of water resources. Since the East African climatic interpretation

sentially African terminology that is now universally adopted. As this must lie behind any study of prehistoric societies, it is not surprising that there is a wealth of material available for Africa (Goodwin 1946; Cole 1954; Clark 1959*a*).

Thirdly, we need to know the *spatial distribution* of our cultures and industries and also of certain specialised forms of tools. In other words, we need good distribution maps setting forth the regional spread of specialised culture patterns, industrial units, and individual forms. In this we are at present sadly lacking. For the Union of South Africa, where prehistoric research has been carried on since 1858, there are as yet no such maps, with the exception of one for prehistoric art groups. For most parts of East Africa we fare no better; and in others investigations have not even begun. In fact, for not more than half a dozen African territories do adequate distribution maps at present exist. However, the preparation of such maps is already under way for southern Africa and, it is expected, will shortly begin for the entire continent.[2] (See J. G. D. Clark [1].☆) Air photography is as yet little used by the archaeologist, mainly because it has a rather limited application in the African bush where vegetation usually obscures topography, though good possibilities exist where there is intensive agricultural activity.

Fourthly, it is essential that the *environment and ecological setting* of cultures in each case be established as accurately as possible, for, without this knowledge, we can hardly begin to interpret the cultural evidence (see J. G. D. Clark [2]☆). It is necessary to know the nature of faunas, of vegetation and climate, of kinds and forms of raw material (both stone and other) available to man, and so on. Here, to a very great degree, the archaeologist must rely on workers in other disciplines —geologist, palaeontologist, ecologist, palaeobotanist, soil chemist, and geographer, to mention but a few. It is now fully apparent that unless there is teamwork with other disciplines we cannot hope to extract more than a fraction of the evidence that in many instances our sites could yield. For example, only within the last five years have the possibilities of palaeobotany been appreciated with regard to tropical regions, but now palynology has made a good beginning in Africa and is going to be of the greatest importance to the archaeologist (Bakker 1958). Again, techniques for the study of fossil soils, such as those evolved by Brain (1958) in South Africa and Bond (1957*a, b*) in Rhodesia, are invaluable for indicating degree of climatic change, and they need a far wider application. Only teamwork of this kind will produce the evidence we need so badly, and, as yet, such teamwork is all too often a rarity in Africa, though in Europe and the United States, for example, it has long been a recognised feature of Quaternary research (see J. G. D. Clark [3]☆). In Africa one man all too often tries to undertake all this work and fails, though this may frequently be occasioned by the inadequate number of workers and the large field that each has to cover.

Fifthly, it is necessary to be *selective in the choice and excavation of sites*. Only camping and settlement sites will provide evidence of the nature of the home itself, of the settlement pattern, and of the groupings of the people who lived there. Sealed sites in the open yield better evidence of this kind than do cave sites, even though a greater wealth of cultural material may well be found in caves. Excavation technique must be of the best, especially for the earlier sites, since the older such sealed living sites are, the rarer they become. Unfortunately, it must be admitted that in Africa techniques rarely attain the high standard that the work requires, and it is hardly necessary to point out that once a site has been excavated, any evidence that has not been preserved has been destroyed and lost forever.

Recently, excavation techniques usually adopted only for sites of Neolithic and later age have been applied to Palaeolithic sites. These techniques, by which the whole or a good part of the site is uncovered and the spread of the occupation material accurately recorded, have been used to very good effect by Leakey (1952, 1958) at the Earlier Stone Age sites of Olduvai, Olorgesailie, and Kariandusi in East Africa; by F. Clark Howell (Howell, Kleindienst, and Cole 1959) at Isimila in Tanganyika; by Mason (Mason, Dart, and Kitching 1958) at the Middle Stone Age site of Kalkbank in the Transvaal; and by the writer at the Earlier and Middle Stone Age sites at Broken Hill (Clark 1960) and the Kalambo Falls (Clark 1954).

Sixthly, *surviving ethnographic evidence* must not be overlooked. Selective consideration of ethnographic parallels from studies of existing primitive peoples in similar stages of culture can help considerably to fill out the picture obtained from archaeological material cul-

has been applied by archaeologists to most other parts of the continent, the doubt that has now been cast on the interpretation of this succession in the type area must pertain to these other regions also. The succession in southern Africa is based on the interpretation of river-valley morphology, cutting and filling by streams and the distribution of aeolian sands. As there has been little significant earth movement in the sub-continent since the beginning of the Pleistocene, it would seem that the tectonic factor can be discounted, and it is difficult to see what agency other than climate might have produced the uniform pattern of four cycles of cutting and filling that has been established in many river basins there. It is on these geological sequences, together with the associated successions of fauna and artefacts, that correlation work within the continent has been attempted. Even though much work remains to be done before the pluvial and non-pluvial succession is established to full satisfaction, the broad faunal and cultural divisions provide a reasonably sound basis for correlation, as do also the different time horizons evidenced by the redistribution of aeolian sands in regions covered by sands of Kalahari type. Although the earlier part of the established climatic framework is now under a cloud, and only further geological evidence on the mechanics of sedimentation and soil formation will dispel it, yet we should not, because of this, "throw out the baby with the bathwater"; and the climatic interpretation of the later Pleistocene cycle of erosion and sedimentation in southern Africa now being confirmed by pollen analysis serves to indicate that similar phenomena in previous cycles may have a similar interpretation. This essay is not the place to discuss in detail the validity of the interpretation of the Pleistocene climatic succession in southern Africa, and readers are referred to the various authoritative works on this subject which present a great deal of evidence, though in some cases further investigation is necessary before the interpretation given can be finally confirmed. It can hardly be doubted that climatic changes were generally responsible for the erosion and sedimentation cycles in the river valleys in southern Africa, but it is the climatic inferences drawn from the geological evidence that are sometimes in dispute due to insufficient observation of the mechanics involved. (See, e.g., Brain 1958; H. B. S. Cooke 1946; Söhnge, Visser, and Lowe 1937; Janmart 1953; Leakey 1949; Dixey, in Clark 1950; Visser and Lowe 1955; Bakker 1957; Bakker and Clark 1960; Poldervaart 1957.)

[2] It should be borne in mind, however, that until ground survey has been carried out evenly over the whole territory, distribution maps will reflect the contemporary state of prehistoric research in particular regions. In order that this be not forgotten, the extent of research should always be indicated, so that the cultural distribution pattern may be viewed in its right perspective.

ture alone, though an uncritical use of such evidence is to be deplored (see J. G. D. Clark [4]☆). Bushman and Pygmy groups, pastoral Hottentots or Bantu mixed farmers and agriculturalists, preserve for us today living evidence of what some of our later pre- and protohistoric African cultures were like. Indeed, they are sometimes the living descendants of those cultures. Not nearly enough use has up to now been made of this important ethnographic evidence, nor of that preserved to us in the prehistoric art groups found in certain regions from the Horn to the Cape. Here is a most valuable record of racial characters, weapons and tools, food-collecting and hunting practices, dietary preferences, magico-religious beliefs and customs connected with initiation, death, and so on. This wealth of material has barely begun to receive examination from an ethnological point of view, and more analytical work of the nature of that initiated by C. K. Cooke (1958) is badly needed. A co-operative study of this art by ethnographer and archaeologist would give most valuable results.

Early investigators not infrequently had a less narrow outlook on prehistoric matters than some of their successors. For example, they did not neglect to draw parallels between the remnants of the Bushman peoples and the later prehistoric cultures. Unfortunately, their lack of critical approach and of selectivity rendered much of their work of dubious value and thus caused later investigators to concentrate on the narrower, but then more reliable, fields of typology and stratigraphy. The observation of one, Martin (who rejoiced in the pseudonym of "Barnacle" on account of his interest in strandlooping sites), that grind-stones associated with many of these Later Stone Age middens were used as "gravy dishes for the epicures among the natives," leads one to suspect that his knowledge of the life of hunter-gatherers did not go very deep (Martin 1872). The portrait painted by another early writer, of prehistoric man using his "rounded and notched nerve-scraper, preparing the skins of wild animals for his daily habiliments," at least shows a more practical interest in the ethnographic approach (Barber 1872). And the title of yet another early paper, "Evidence on the Antiquity of Man in East London, Cape Colony, with a Note on the Castor Oil Plant" (McKay 1896), shows that the study of early man was still regarded as closely allied with natural history, unless it be that some more subtle nuance is implied!

In short, in Africa south of the Sahara much spade-work has still to be undertaken, but not a little material is now ready for synthesis.

Before we consider what may be deduced and inferred from this material, the reader is reminded of the fact that it was during times of climatic change and, in particular, of *drier* or non-pluvial climatic conditions, that the most rapid changes in technology occurred, if we may take the imperishable equipment, which is often all that has been preserved, to be a true reflection of a culture as a whole (Summers [16]☆).

Five of these dry (non-pluvial) periods have been recognised in widely separated parts of the continent.[3] The first saw the introduction of tool making. The third saw the important technical advance that marks the change from the Earlier to the Middle Stone Age. The fourth coincided with the transitional cultures that herald the microlithic revolution (Clark 1959*a*). Finally, the fifth seems to have been responsible in southwest Asia for the fundamental change from food collecting to incipient food producing. (See Howell [6].☆)

These drier periods seem to have been times of cultural "speed-up"[4]—times of relatively short duration compared with the intervening wet periods, when new ideas and new forms were able to spread with greater ease throughout the continent and when less favourable living conditions stimulated man's powers of invention toward improved methods of securing food and more comfortable living quarters (an example, as J. G. D. Clark☆ has pointed out, of Toynbee's concept of "Challenge and Response" as a main explanation of the historical development of human society).

On the other hand, as soon as technical ability permitted (that is to say, from the end of the Earlier Stone Age onwards), the long periods of wetter climate made for stability,[5] slow development, and isolation of

[3] The terms "wet" and "dry," "pluvial," and "interpluvial" (or "non-pluvial") are used here in a purely relative sense, and it is in no wise implied that rainfall greatly increased or diminished during such times. "Pluvial" conditions need not imply that rainfall was much above the present mean for any given region, but it is likely that rainfall was more regular and more evenly distributed, so that important changes in vegetation patterns and in surface-water supplies could have resulted. For example, it is unlikely that, even at the height of a "pluvial," the climate ever improved beyond the semi-arid in the Horn or in South West Africa (see also Bond 1957*b*).

[4] Howell☆ says he "doubts the validity of 'cultural speed-ups.'" But, for example, radio-carbon dates and stratigraphical evidence indicate that the drier periods at the beginning and end of the Upper Pleistocene were of shorter duration than the anterior and intervening wetter phases. The pre-Gamblian drier or non-pluvial phase dates at the Kalambo Falls to between 43,000 and 40,000 B.P. ("before present") (Clark 1959*c*). Though it must be allowed that these dates most probably do not represent the extreme upper or lower limits, this period would seem to have been of shorter duration than the succeeding Gamblian Pluvial which, on C-14 results from Kalambo, Florisbad, the Cave of Hearths, and northeastern Angola, lasted from approximately 40,000–35,000 B.P. to 12,000 B.P. The post-Gamblian drier period seems to have lasted (with the same proviso), on C-14 evidence from Kalambo Falls and Mufo, Angola, from 12,000 to 9,000 B.P. The cultures of the First Intermediate period—the regional Sangoans and the Fauresmith—cover the time of the pre-Gamblian drier phase, while the Second Intermediate Magosian industries are the cultural forms found during the post-Gamblian phase. These cultural stages represent periods of typological and technical change in the stone cultures which, on chronological evidence, can be shown to have been relatively rapid and of short duration by comparison with the slower development of the Chelles-Acheul, on the one hand, and of the Middle Stone Age cultures, on the other.

[5] See Malan [11].☆ The significant point here is that favourable environments, i.e., where precipitation is not deficient, make for stability of culture at primitive subsistence levels, so that there is no economic need for groups to move out of their traditional territory. When, however, this stability is upset by climatic change or some other cause, the balance with the environment is overthrown, with the result that the population has either to adjust its culture to the new conditions or to migrate. It is perfectly possible for individuals and whole tribes to move half the length of the continent in a very short time, as Malan states, but they will do so only if the *need* to move is sufficiently pronounced. Such necessity is basically economic, especially for the hunting-collecting level of culture.

I would have thought that during wetter periods the contrast between forest and savannah was generally less, not greater, though temperature change is equally as important a factor as precipitation in influencing vegetation patterns.

Naturally many factors, of which Malan has mentioned some, come into play in building up culture tradition, and not simply that it was less easy to move about physically when the vegetation

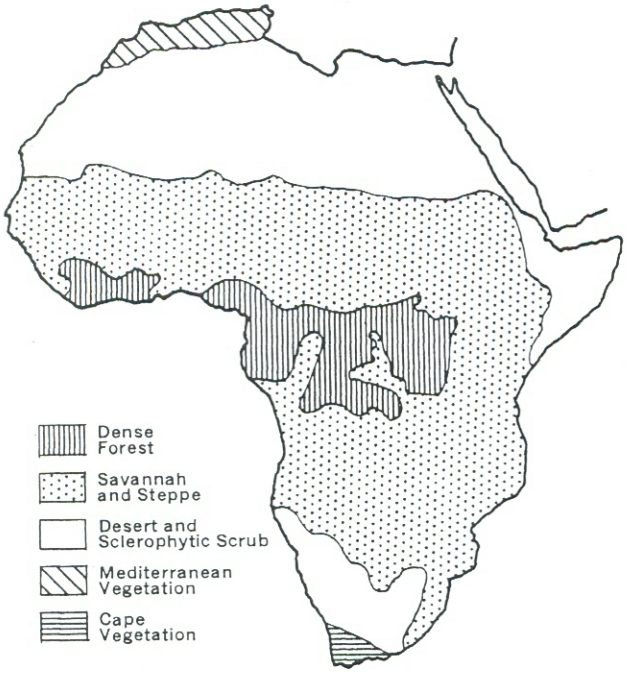

FIG. 1. Map showing simplified distribution of vegetation patterns in Africa. (After Schnell 1957.)

groups, and so resulted in a number of contemporary regional cultural variants.[6] Such variants may be taken to reflect the nature of the environment in which they flourished, for it must be accepted that the greater the adaptation of culture to environment among hunter-gatherers, the more efficient will be their economy (Steward 1955) and thus the greater their chance of survival. Generally speaking, the environment in Africa south of the Sahara today is much of it tropical and does not permit easy intercommunication among peoples to whom neither the pack animal nor the wheel penetrated until recent times. But an amelioration of the tropical environment during times of decreasing rainfall may be expected to have opened corridors and sometimes highways from north to south and from east to west, which seem to have invited, even though they also sometimes sidetracked, movement by groups forced to migrate by the deterioration of their traditional environment. Sometimes biological proof, in the shape of human fossils, confirms this.[7] At other times we have to rely on different evidence, for example the patterns of spread of new items of cultural equipment. Contact between bands naturally encourages the spread of cultural traits, and new inventions or techniques may be surmised to have been speedily transmitted at times of ecological change and population movement. Also, most hunter-gatherers appear to be exogamous, patrilineal, and patrilocal, and the assimilation of aliens seems generally to present them with few difficulties. Indeed, such ease of adoption has been established for other primates (e.g., baboons). It is small wonder that the idea of tool making, once conceived, should have spread so rapidly among the earliest hominids.

LOWER PLEISTOCENE AND PRE-CHELLES-ACHEUL INDUSTRIES

So far we know little about the living places of the earliest tool makers. These date to the end of the Lower Pleistocene. Relevant sites are few, and it is only since 1956, when Brain and Robinson discovered pebble tools in association with *Australopithecus* and *Paranthropus* at Sterkfontein and Swartkrans, respectively, that it became apparent that the Australopithecines not only used tools but most probably also made them and thus represent the first hominid stage. Confirmation came most dramatically with the Leakeys' discovery, in 1959, of the skull of the *Paranthropus*-like hominid, *Zinjanthropus,* on a living floor 25 feet down in Bed I at Olduvai Gorge. *Zinjanthropus* was associated with pebble tools and flakes and the dismembered remains of small and juvenile mammals, reptiles, etc., which there would seem little doubt formed part of the food of this Australopithecine. But the Australopithecine dentition (Robinson 1954; Leakey 1959) shows that vegetable foods also formed a very important part of their diet—probably, to begin with, the primary part. However, with the introduction of tool making and thus the greater proficiency in dealing with meat, they were increasingly able to satisfy better their carnivorous tendencies. The skinning and dismembering of kills required sharp tools, most commonly stones, and where such occur in nature there would have been no problem. However, in areas where the harder rocks were found only as erratics (most commonly as rounded pebbles) in sedimentary deposits, it would have become necessary to make sharp tools.[8] The pebble choppers, small utilised flakes and polyhedral stones (cutting and

pattern was more closed in "pluvial" times. But this does not invalidate my general contention that times of increased precipitation in southern Africa made for stability of population and culture.

[6] Well seen in the regional variants of Middle Stone Age times, and carried even further during the Later Stone Age.

Howell [7]☆ considers that cultural variants were present in Middle Pleistocene times in Africa. I would agree that the "Hope Fountain type" flake industries might be described as a "variant" of Chelles-Acheul culture (Clark 1960; Posnansky 1959*a*), but, I think they should be interpreted not as regional variants but as "occupational variants," since they are found in most of the main regions of southern Africa. Again, it is true that the regional form of the Acheulian in the Vaal Basin differs from that in the Cape, the Zambezi, or at Olduvai, but these differences, it is submitted, have been brought about by the *form* and sometimes the nature of the raw material most commonly employed. Handaxes and cleavers may be made from andesite flakes struck from large boulders by the proto-Levallois technique on the Vaal, from quartzite or chalcedony cobbles in the Cape or the Zambezi, or from obsidian or lava rock outcrops in East Africa; but the form of the finished implements shows little variation outside the temporal development within the culture complex as a whole. Thus, for example, virtually the same end-products resulted at the Erg Tihodaine in the Sahara, in the Kimberley district of the Vaal in South Africa, and in the Madras district of southern India. It is the remarkable uniformity of the end-products of Chelles-Acheul culture, from one end of the territory over which it spread to the other, that is one of its chief characteristics. Thus the variations that exist in Acheulian culture result, in the writer's opinion, from their makers' applying the limited technical processes available at that time to the different *forms* of raw material, not from specialised, regional economies, as can be postulated for First Intermediate and Middle Stone Age times. They are not, therefore, "variants" in the sense employed in this context.

[7] I.e., the evidence of skeletal remains of Afro-Mediterranean or "Erythriote" type in southern Africa, from the end of later Pleistocene times.

[8] I.e., on the middle Vaal, and in much of those regions where the soft rocks of the Basement Complex predominate at the surface.

tice among some primitive human societies to-day.[10] But for the hunting and killing of even small game it would have been necessary to group together, and in such a necessity can be seen the beginnings and the development of the band. There is evidence to suggest that small game may have been driven into swamps or water, or cornered in caves or on rocky ground and perhaps despatched by clubbing and stoning.[11] Leakey's (1958) excavation of the somewhat later BK 2 Site at the unconformable junction of Beds I and II at Olduvai showed that a gully filled with sticky swamp clay had been used by Chellian man, most probably on several occasions, for driving and bogging down game which he then dismembered and ate on the adjacent bank. This driving and "bogging in" of game has been practised in Africa until recent times, and it is probable that some of the Pre-Chelles-Acheul open sites were kill sites of this nature. The fauna associated with the Taung child and with *Zinjanthropus*—lizards, tortoise, crabs, small baboons, pigs, antelopes, and other juvenile mammals—probably reflects best the Australopithecine standard of hunting efficiency, and, where the remains of large animals form a significant percentage, they were most likely acquired by scavenging (i.e., "Limeworks," Makapan Valley).

The evidence put forward by Dart (1957) in support of his "osteodontokeratic culture" suggests that the Australopithecines made use of any natural tools that were ready to hand and suited to the purpose of the moment. A long bone or half a mandible from their meal debris would have served as an efficient clubbing or ripping tool, while natural stones such as are found in the Sterkfontein deposit could have formed equally effective missiles. The only bone tool showing definite evidence of utilisation is the pointed fragment from Sterkfontein (Robinson 1959).

We have only a half dozen or so sealed sites that may in any way be recognised as living or kill sites of these earliest hominids, though their stone implements are found also in river gravels and marine beaches of this time. At Aïn Hanech in Algeria (Arambourg and Balout 1952; Balout 1955) the site was a lakeside one, as was also the *Zinjanthropus* site at Olduvai (Leakey 1959). Other sites are all in the open by lakes or rivers, with the exception of those in the Transvaal Caves, and Taung on the Kaap Escarpment. It is possible that caves had been used as temporary homes by the Australopithecines, but there is as yet no indication, unless they alone can be held responsible for the quantity of dismembered faunal remains, that their occupation was anything more than very transitory. They could not have been occupation sites in the true sense, for as yet no factory debris has been found with the "pebble tools" at Sterkfontein or Swartkrans, such as are found with all except the most temporary of Stone Age habitation sites. Perhaps, therefore, the association of a comparatively small number of stone implements with a much greater selective accumulation of broken animal bones with the Australopithecines at Sterkfontein and Swartkrans can be accounted for by regarding these caves primarily as watering places. Since water is rarely found on the surface in flat or undulating, dry dolomite country, the pools in the bottoms of the caves would have provided almost the only permanent supplies. At the same time as taking water, these earliest hominids may also have turned the caves to good use as butchery places where they could lie up and attack other animals using the waterholes. The associated fauna could result partly from successful kills eaten on the spot, partly from meat carried into the cave to eat near the water, and partly from non-primate occupation by carnivores.

The stone tools of this time show no significant typological variation from one end of the continent to the other, and at the few sealed living sites they are found distributed as a thin lateral or vertical scatter, lying in small patches and never as a continuous concentration over an extensive area (cf. Aïn Hanech [Arambourg and Balout 1952; Balout 1955], Lochard [Bond 1946 and Jones 1946], Harrisdale on the Vaal [Lowe 1953], etc.). This absence of heavy or extensive concentrations of tools on these pre-Chelles-Acheul sites suggests that the Australopithecine bands may not have been very large. Any attempt to assess the size of the bands and group behaviour at this time, however, cannot fail to take careful account of observations of non-human, primate behaviour (Washburn 1957, 1959; Carpenter 1942; Bartholomew and Birdsell 1953; Scott 1958; Gavan 1955; DeVore MS; and many others).

The great apes, being adaptively specialised to a forest environment and vegetable foods, are organised in small family groups, so it is usually supposed, although larger groupings have also been recorded. Gorilla troops observed by Schaller (1959) comprised 8, 15, 5, 18+, and 11 individuals, though at times the first three troops would join together and sometimes nest within a hundred yards of each other. But the earliest hominids were omnivorous, living in open country. Probably, therefore, it will be from studying the behaviour of open-country primates such as the baboon, rather than the forest-dwelling forms, that we may learn most about the possible habits and group organisation of the first bands of tool makers. Thus Oakley [13]☆ stresses "that if the earliest hominids were comparable with baboons, the members who were in group contact at any one time may have fluctuated as widely as between 20 and 200, depending on the scarcity or abundance of food supplies." So far as the composition of the Australopithecine bands is concerned, it will probably never be possible to give any accurate indication, and all that can be said at present is that, on analogy with the gorilla and baboon, there would have been a greater number of adult females than adult males, together with a number of immature individuals of both sexes.

Since all primate groups, or for that matter all vertebrates, keep to a clearly defined range of territory, it is safe to assume that this habit had a major effect upon Australopithecine behaviour. One gorilla troop ob-

[10] Juveniles are still, or were until recently, sent out in the early mornings by the Mashi River tribes (17°00'S, 22°46'E) to locate where vultures were flying, thus pinpointing the place where a carnivore had made a kill. The villagers could then recover the meat. See also sixteenth–nineteenth-century descriptions of strand-looping Hottentots at the Cape.

[11] The following observations made in Northern Rhodesia may be of interest here. The writer was present when a hare was run down and caught among rocks by two Africans, by no other means than shouting and bare hands. R. R. Inskeep was present when one African caught a bushbuck by chasing it over a rocky hillside, cornering it, and killing it with his hands. Also, the throwing of stones when chasing animals has been observed by the writer on a number of occasions.

served by Schaller (1959) rarely moved more than half a mile a day, but the ground-dwelling baboons living in open country range farther but not more than two to three miles from their sleeping places (Haddow 1952; DeVore MS). Primitive hominids practising group hunting may be expected to have needed a wider range of territory, though not as extensive as that of the predatory animals (Murie 1944), or of human hunter-gatherer groups (Clark 1959*a*). However, as DeVore has pointed out (MS), a primate group living on the ground is much more vulnerable to attack by predators, so that the more restricted the territory, the more intimate would be the knowledge of it and the better the chance of escape. Moreover, to ensure the maintenance of an adequate food and water supply for the group, the territory has to be sufficiently small to be adequately protected from other groups. It may be suggested, therefore, that the Australopithecine bands, which were naturally adapted to drier open country where game was plentiful rather than to closed bush, may have had a range somewhere between the herbivores and carnivores. They probably ranged between several sleeping places, depending upon the number of water holes, but may not have moved much farther than four or five miles from their water supply.

Comparison of male and female crania from Swartkrans (Broom and Robinson 1952; Robinson 1958) demonstrates that *Paranthropus* had already undergone selective differentiation which showed that the male must have been the stronger and so the dominant partner. "A basic function of male dominance in a primate social system may well be protection—both from predators and from territorial encroachment by an adjoining group" (DeVore MS). Especially is this true where ground-dwelling primates are concerned, and it would seem probable, therefore, that the adult male Australopithecines were primarily responsible, in addition to their hunting duties, for the defence of the band, for keeping the peace among its members, and for protecting the weaker individuals.

The responsibility of protecting the Australopithecine juveniles is emphasized by Dart's (1948) and Robinson's (1956) studies of the deciduous dentition, which shows that the young were dependent upon their parents for nutrition and protection for several years, as are human young.

It may be suggested that, like the gorilla, the Australopithecines may, when threatened by danger, have relied for protection upon making a great deal of noise —upon simulated ferocity and aggressive gestures. Since there is no indication that the Australopithecines knew the use of fire, they must have been especially vulnerable at night, so that, like baboons, they may have used trees or naturally protected rock ledges or fissures as sleeping places (Oakley [15]☆).

MIDDLE PLEISTOCENE AND THE CHELLES-ACHEUL INDUSTRIES

When we come to the main part of the Earlier Stone Age (the Chelles-Acheul Culture), many more sites are known, especially of Acheulian age. The population must still have been extremely sparse and, from the distribution as known, was confined generally to open-country grassland and park savannah where lakes, broad river valleys, or the seashore made mobility easy and provided an abundance of water and of both animal and vegetable foods.[12] Caves do not appear to have been occupied as living quarters in Africa before the end of Acheulian times; at least no evidence exists for earlier occupation of this kind.

These Earlier Stone Age people were unspecialised hunter-gatherers, adjusted more or less to one type of environment that supplied their simple needs. Since there seems to have been little permanent change in type of environment throughout the length of the Middle Pleistocene, it is not surprising that there was only extremely slow development of culture.[13] At that time, man's exploitation of his environment was still very limited, and he had no sufficiently advanced technical equipment to allow him to occupy less favourable regions such as desert or forest.[14] Probably, however, owing to the sparseness of the population, this was not necessary.

The "*Australopithecus* phase" of hominid evolution gave place during the Middle Pleistocene to a "*Pithecanthropus* phase" (Le Gros Clark 1958; Washburn 1959, etc.). The human fossil remains found in association with tools of the Chelles-Acheul culture in Africa are regrettably fragmentary or incomplete and appear to conflict, i.e., *Pithecanthropus*-type jaws with a late Chellian/early Acheulian industry at Ternifine (Arambourg 1955) and *sapiens*-type calvaria with primitive handaxes at Kanjera (Leakey 1935). This apparent anomaly disappears, however, if it is accepted that the cranial form of the Pithecanthropoid stock in Africa underwent a fairly rapid development towards the early *Homo sapiens* form, though still preserving the robust facial features of the parent stock (Wells 1957). Whether this be so or not, the increased cranial capacity of man during the "*Pithecanthropus* phase" (900–1100 cc.) over the Australopithecines (450–550 cc.) (Washburn 1959) must nevertheless represent an improved intellectual capacity brought about, it is to be supposed, as a result

[12] The faunal remains on most of these Earlier Stone Age sites are of primarily parkland, or open-savannah, rather than forest or closed-woodland forms (see Arambourg 1955; Balout 1955; Leakey 1951, 1958, etc.; H. B. S. Cooke 1949, etc.).

[13] The so-called Kamasian/Kanjeran "interpluvial" or "non-pluvial" does not appear to have been as arid as has been previously suggested; whatever the degree of climatic change, however, it was nevertheless sufficient to bring about an extinction of certain genera and species in the mammalian fauna, and the change from Chellian to Acheulian culture. (See Leakey 1951 for particulars of significant faunal differences between Beds I and II [Kamasian] and Beds III and IV [Kanjeran at Olduvai].)

[14] The writer knows of no good evidence to show permanent occupation of what is now desert or moist forest country during Earlier Stone Age times, and it may be inferred that the climate pertaining usually to those regions during the Lower and Middle Pleistocene was not sufficiently different from what it is today to make them attractive for human occupation at that level of culture. Though, at periods when the climate permitted, such country might be temporarily occupied, there is nevertheless an almost total absence of cultural remains earlier than later Acheulian times in the Horn and in South West Africa; and, for example, the eastern Katanga was only temporarily occupied by pre-Chelles-Acheul man during the Lower Pleistocene dry period; the next and permanent occupation in the Katanga took place in final Acheulian times. (See Kamoa, etc. [Mortelmans 1957*a*].)

of tool making (see Oakley [14]☆). It is reasonable to suggest, therefore, that Chelles-Acheul man was generally more effectively organised than were the Australopithecines.

The living sites of Chelles-Acheul times are invariably found close to water and often adjacent to a good source of raw material for making stone tools. The Chelles-Acheul, in particular the Acheulian camping floors, cover a larger area than those of the pebble-tool makers. The concentration of tools is generally heavier, and the patches or "squatting-places" are larger and may cover as much as 2,500 square feet or more (approximate estimate for Kalambo Falls Acheulian). Sometimes several of these patches exist at one horizon (i.e., Olorgesailie, Olduvai, Isimila, Kalambo, etc.) and may indicate either that several groups or bands had come together temporarily, or that they represent several seasons' occupation by the same band. Camping places seem to have had no particular defined limits,[15] and the concentration and scatter-pattern of tools and equipment on them give almost no indication that even the flimsiest of dwelling structures was known.[16] The absence of any appreciable thickness to most of the floors indicates that the sites were only temporary camps in the seasonal movement round the hunting territory. If they had been occupied uninterruptedly for any length of time, some depth of deposit would be bound to have accumulated, in spite of the quicker dispersal of occupation debris that can be expected at open sites where there are no natural confines such as in a cave.[17]

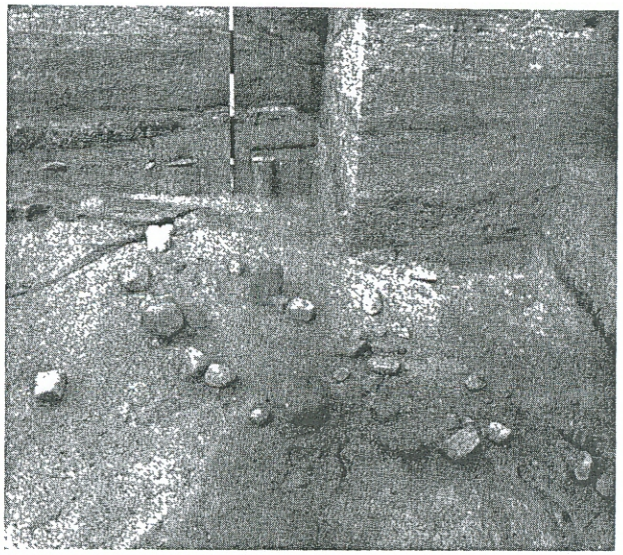

FIG. 3. The rough arc of stones (possibly the base of some structure) on Acheulian Floor 5, Kalambo Falls: Site B2 (1959)—partially excavated. Artefacts and waste outside the arc have been lifted; those found inside remain *in situ*. Note the somewhat later Acheulian floor with tools seen in the section of current bedded sands and fine gravels of early Upper Pleistocene age overlying the arc.

Some of these sites can have been no more than stopping places for consuming a single large food animal (Leakey 1951). Others, however, provide signs of deliberate and more prolonged occupation and are believed to represent butchery sites where a number of animals, on more than one occasion, were killed, cut up, and eaten, or where a seasonal crop of vegetable foods determined a stay of several days. The driving of game into water or swamps was practised, and there is some slight evidence to suggest that man may have carried some of the meat away with him to other camps.[18]

[15] Howell☆ has stated he thinks " 'camping places' do show limits (cf. Isimila, Kariandusi, Olorgesailie, Olduvai Bed II sites), and scatter patterns show much special activity going on." Of course the concentrations of tools and waste on these "living floors" have general limits which presumably show the general extent of the "occupation," but no consistent pattern has so far emerged to show that these camps or halting places were made on any regular plan. So far as can be deduced from the existing evidence, the scatter of the stone equipment never follows any regular pattern and is dictated solely by the circumstances of the site at the time it was occupied and by the number of individuals in the band.

[16] The only evidence known to the writer that man at this time may have used some kind of primitive shelter comes from Olorgesailie and Kalambo Falls. One or two irregular shallow depressions on one of the living floors in the Olorgesailie lake deposits in the Magadi section of the Gregory (Kenya) Rift might conceivably have been sleeping places and would come well within the range for Bushman or Hottentot sleeping "forms." At Kalambo Falls in 1959, on one of the late Acheulian living floors (Floor 5), a rough arc of stones was found which looks as if the stones had been intentionally placed there. Cultural material was found in quantity outside the arc, but very little occurred within it. It might be suggested, therefore, that these stones may have formed the base of a windbreak or screen erected to afford protection at a time when the climate was wetter and colder than it is today (Bakker and Clark 1960). In addition, these excavations yielded, on the same floor, three separate accumulations of matted grass stems, fibrous roots and twigs, all carbonised presumably due to fire. These filled shallow depressions, three to four feet in greatest diameter, call to mind the grass-lined bedding places made by Bushmen and other hunting-collecting peoples.

[17] No evidence of any long continued occupation of an Earlier Stone Age site in Africa is known to the writer before the end of Acheulian times. Some sites were consistently revisited though, and here several living floors may be found separated by thin layers of sterile deposit. However, the absence of any thickness of accumulation of occupation debris on the living floors themselves suggests very temporary seasonal occupation only—probably for no longer than was necessary for man's continued hunting to scare away the game. Malan [12]☆ has suggested that it is unlikely any considerable depth of occupation deposit could develop on an open site unless it is confined by topographical circumstances. While admitting that some outward dispersal of occupation material must take place where there has been continuous or interrupted occupation over a sufficient length of time, a vertical accumulation of debitage (waste materials) does result (shell mounds, cave sites, etc.); and, as we well know, Pleistocene living sites in the open, where fauna, both mammalian and molluscan, are well preserved, exist in both East and South Africa and under conditions where some compacting of the deposits might have been expected, though not sufficient to completely destroy any thickness of living floor, if it had existed. Caves and similar topographically restricted sites were, after the discovery of firemaking, regularly occupied, though intermittently, in the seasonal movement round the hunting territory. As a result, occupation debris accumulated at such regular stopping places (approximately 30 feet during final Acheulian/Fauresmith times in the Cave of Hearths). The fact that similar accumulations are not found at any sealed occupation sites in the open known to the writer serves to emphasise the very temporary nature of at least the Lower and Middle Pleistocene living floors, and, where topography placed no restriction on the choice of site, we can best see the transitory nature of this occupation. Some apparently favoured stopping places (cf. Olorgesailie, Kalambo, and Isimila), where several such living floors are superimposed but separated by thin layers of lake sediments, emphasise the seasonal nature of this occupation still further.

[18] See Leakey's description (1958) of the early Chellian butchery site (BK 2) at the junction of Beds I and II at the Olduvai Gorge; Power's (1946) Acheulian site at Pniel on the Vaal River; Cornelia (Oakley 1954) with a Fauresmith industry, in the northern Orange Free State; Hopefield, again with Fauresmith, in the western Cape (where concentrations of broken bones of *several* different mammals may owe their accumulation to man) (Singer 1957), and Summers [17],☆ for evidence, with the Acheulian again, from Southern Rhodesia; also, the possible driving of game through selected defiles and gaps in mountain ranges or hilly ridges as during final Acheulian and Fauresmith times at Wonderboompoort near Pretoria (Mason 1957). The discovery, in one of the lower horizons at Isimila, of a hippo carcase associated with a few

Although no regular pattern to the camping places can be seen at this time, the distribution of stone equipment and waste on some of these sites clearly indicates that different activities were being carried on in different parts of the camp. Most of the evidence on this is not yet published (Isimila, Hangklip, Olorgesailie, Kariandusi, etc.), but it can be clearly demonstrated from our own work at Kalambo Falls. In some places on the Acheulian floors at this site, only the coarse factory debris is found, together with unfinished tools or roughouts. In this instance the factory debris lay close to the source of quartzite boulders, and it could be seen how the boulders had been smashed up with considerable force by using others of similar size and weight. Large and small primary flakes lie about in profusion, and it is possible to fit not a few of these together again. It has been suggested that, at Hangklip, fire may have been used to split large sandstone and quartzite boulders, but the heat spalls on this site could be simply the result of ancient or modern bush fires. In other places at Kalambo were found concentrations (sometimes as many as twenty-five tools to a five-foot square) of handaxes and cleavers which had clearly been carried to the spot and used there. Here the waste is confined to typical "handaxe trimming flakes," which occur in some quantity and which could be flakes knocked off either during use or by intentional resharpening. The latter explanation is preferred, but the detailed study of the material has not yet been completed. In other places, again, isolated implements, or one or more handaxes or cleavers together, with several feet separating them from the next group, suggests that they may have been the tools of single individuals. Handaxes and cleavers have also been found standing on edge in the sand of the camp floor, which suggests that they may have been placed like that when the individual had finished using them (at Isimila—personal communication from M. R. Kleindienst—and Kalambo Falls, 1959 season). In other places, notably on the bank and down the side of a stream channel at Kalambo, were a large number of flake tools. These again suggest that some specialist activity may have taken place there. For possible explanations of the Middle Pleistocene flake industries see Posnansky (1959*a*) and Clark (1960).

The only formal tools of this time were the handaxe and cleaver, but numerous unspecialised flake tools were also used, as well as pounding and chopping equipment.[19] The preponderance of large beasts [20] at many of the sites, and the nature of their remains, indicate that the equipment was fully adequate for the dismembering of even the largest animals and made it possible for every part that was in any way edible to be consumed. Good circumstantial evidence [21] can be adduced to suggest that one of the main uses for the handaxes and cleavers, that occur in such profusion on the sites of this time, was as meat mattocks and flensers for dealing with thick-skinned, larger game.

There is every reason to believe that the stone equipment of Earlier Stone Age man was highly expendable and that, provided the raw material was available (as it usually was), tools were made for a particular occasion only and were subsequently discarded when the band moved on. The nature of his subsistence required that man be fully mobile, and it is unreasonable to suppose that large quantities of stone tools were carried about when man's technical ability enabled him easily to manufacture new tools. But if these and many of the smaller flake tools were domestic equipment, is it possible to determine what weapons these people possessed?

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artefacts, but from which the limbs and skull were missing, may perhaps be interpreted as a beast killed or scavenged by Acheulian man who would thus have been responsible for removing the missing parts. I am much indebted to Howell for this information and for making it possible for me to visit this site. See also in this connection the selective nature of the fauna in the Australopithecine deposit in the Transvaal caves.

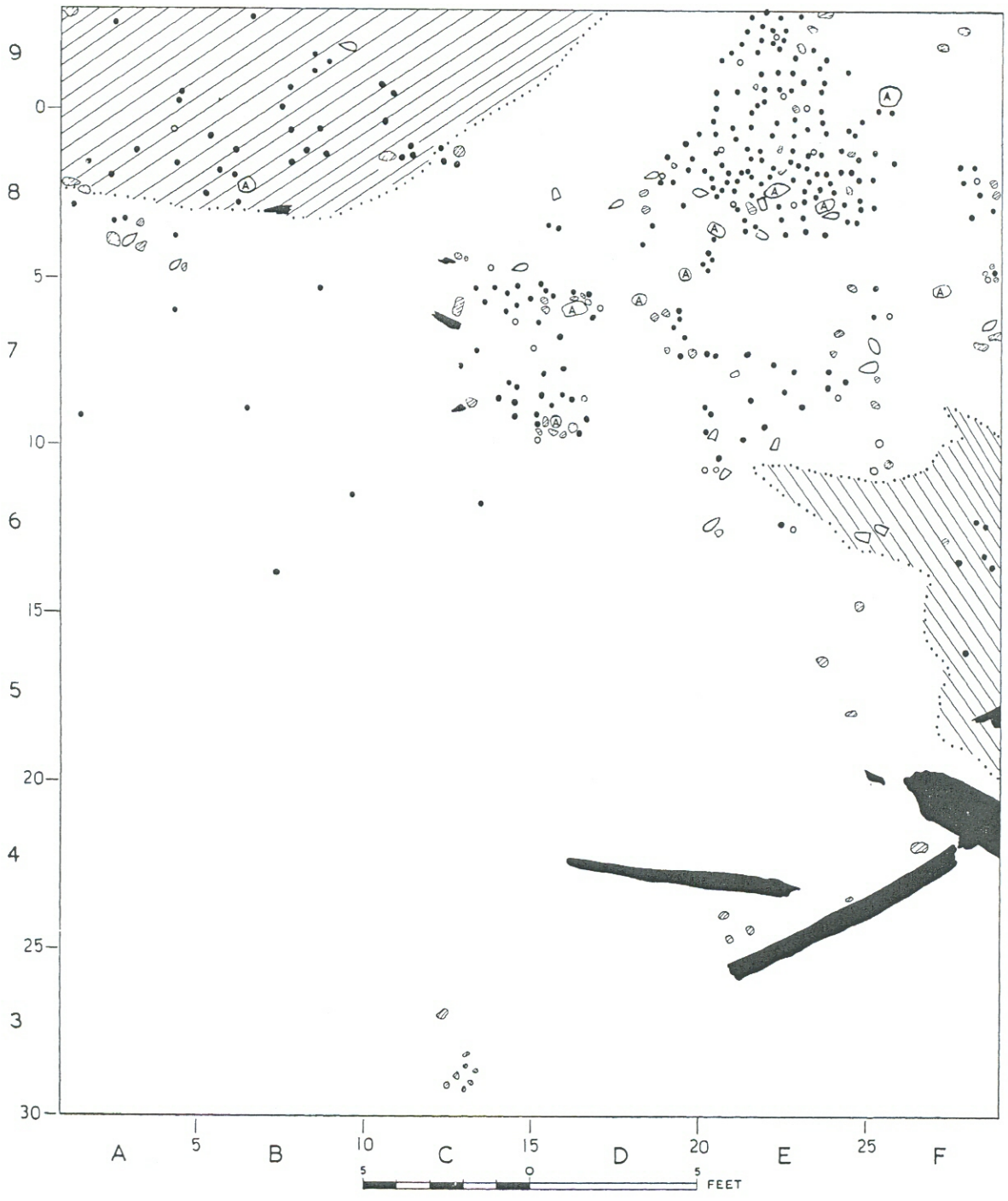
[19] Howell [8]☆ has suggested that there are a number of formal tools present in the culture assemblages at this time. I cannot agree that the flake tools, polyhedral stones, and choppers, etc., were formal tools in the sense that the handaxe and cleaver are. These latter tools were made to an intentional pattern or shape, and although the forms varied both regionally (see footnote 6) and in time, they were nevertheless made to conform to certain definite shapes which it must be considered represent the contemporary preferences of the individuals who made them. Thus Leakey (1951) was able to subdivide the stratified Chelles-Acheul culture at Olduvai on the basis of characteristic handaxe and cleaver forms. Van Riet Lowe (Söhnge, Visser, and Lowe 1937) has done the same for the Vaal River basin, and so on. Examination of considerable quantities of other tools and factory waste from widely separated sites has convinced the writer that the same intentional design of form does not lie behind the flake tools and other stone equipment of Middle Pleistocene man. It is true that it is perfectly possible to sub-divide flake tools, or choppers, for example, into many different forms—single and double side-scrapers, hollow scrapers, points, and so on—but a careful examination of the working edges indicates that the final shape of the tool can have been of little or no importance. It is not possible to show, for example, from the assemblages I have examined, that there was any special selection of forms of primary flake for the manufacture of special categories of flake tool. Any convenient flake or core seems to have been used. Edges show some secondary trimming and a lot of trimming resulting from utilisation, and it would seem to have been of no special importance whether one or both edges were used, or whether, in the latter case, the edges sometimes converged to a point, or not. The amount of "secondary working" seems to have depended on how much work had to be done with the tool, what it was used for, and whether the shape of the primary flake prevented more than one edge from being used. The same applies to choppers, chopping tools, and other core tools. Polyhedral stones would seem to have acquired their shape in the earlier stages as a result of utilisation (as hammer stones, anvils, nut and bone crackers, etc.), rather than by deliberate intention. No consistent design is apparent. But by the very end of Acheulian times these stones were being made into well-shaped spheres, and, it can be argued, had by then been adapted to some secondary use; they had thus become formal tools in the sense that handaxes and cleavers are so described here.

[20] Fauna lists from Ternifine (with a late Chellian/early Acheulian industry) include (Arambourg 1955, 1957): *Elephas atlanticus, Rhinoceros simus, Camelus Thomasi, Hippopotamus, Giraffa,* large and small antelopes and gazelles, *Machairodus,* giant pig (*?Afrochoerus*), giant baboon (*?Dinopithecus*). From the BK 2 (Chellian I) site at Olduvai (Leakey 1958) came: *Rhinoceros* sp., *Serengetitherium* sp., giant pigs, *Palaeoloxodon antiquus, Archidiskodon* sp., *Pelorovis olduvaiensis, Bularchus arok, Hippopotamus gorgops, Giraffa capensis, Sivatherium olduvaiensis, Equus olduvaiensis,* etc. At Elandsfontein (Hopefield) the larger animals included (Singer 1957): *Palaeoloxodon antiquus,* White and Black Rhinoceros, *Equus helmei* (cf. *E. capensis*), giant pigs, *Hippopotamus, Sivatherium olduvaiensis, Homoioceras* sp., and large antelopes. The culture associated with the Elandsfontein fauna is believed to be a regional Fauresmith.

[21] On living sites that have not been disturbed and where tools are fresh, it is apparent that the edges of handaxes and cleavers are always sharp, though blunting may result from differential battering of some parts during manufacture or re-trimming. This implies that these tools must have been used on *"soft"* rather than *"hard"* substances, as, if employed for chopping wood, for example, they would show shattering and blunting of the edges, which they do not. Some form of large cutting tools would be essential to dismember most large animals, as is apparent when one observes present-day Africans cutting up an elephant or hippo: machetes, axes, and knives are all employed. As has been demon-

KALAMBO FALLS : SITE A1 (1956)

FLOOR 4 : ACHEULIAN



KEY

- Handaxe
- Cleaver
- Flake and Flake-tools
- Core and Core-tools
- Anvil
- Natural Stone
- Wood

From contemporary sites in Europe we know that Middle Pleistocene man had wooden spears, and there is a suggestion from one of the African sites that they may have possessed the throwing stick or club.[22] When one adds to these the use of natural and artificially shaped stones as hand missiles, it is likely that the somewhat meagre inventory is virtually complete. Indeed, the Australian aborigine possesses little more than this even today. The emphasis in securing the meat supply must have been on mobility and co-operative hunting, the method best suited to the environment favoured by the Earlier Stone Age people.

Fish was sometimes collected and eaten, for fish-remains (*Barbus* and *Protopterus*) have been reported from a Late Acheulian living floor (Nyabusoro: M/N horizon) in the Kagera Valley in Uganda (Posnansky 1959*b*). Also, the irregular line of stones partially excavated on one of the temporary land surfaces round the one time Lake Olorgesailie in the Magadi section of the Kenya Rift is reminiscent of the small fish weirs and dams commonly built in tropical Africa round the margins of lakes and rivers where fish can be trapped as the water recedes at the end of the rainy season.

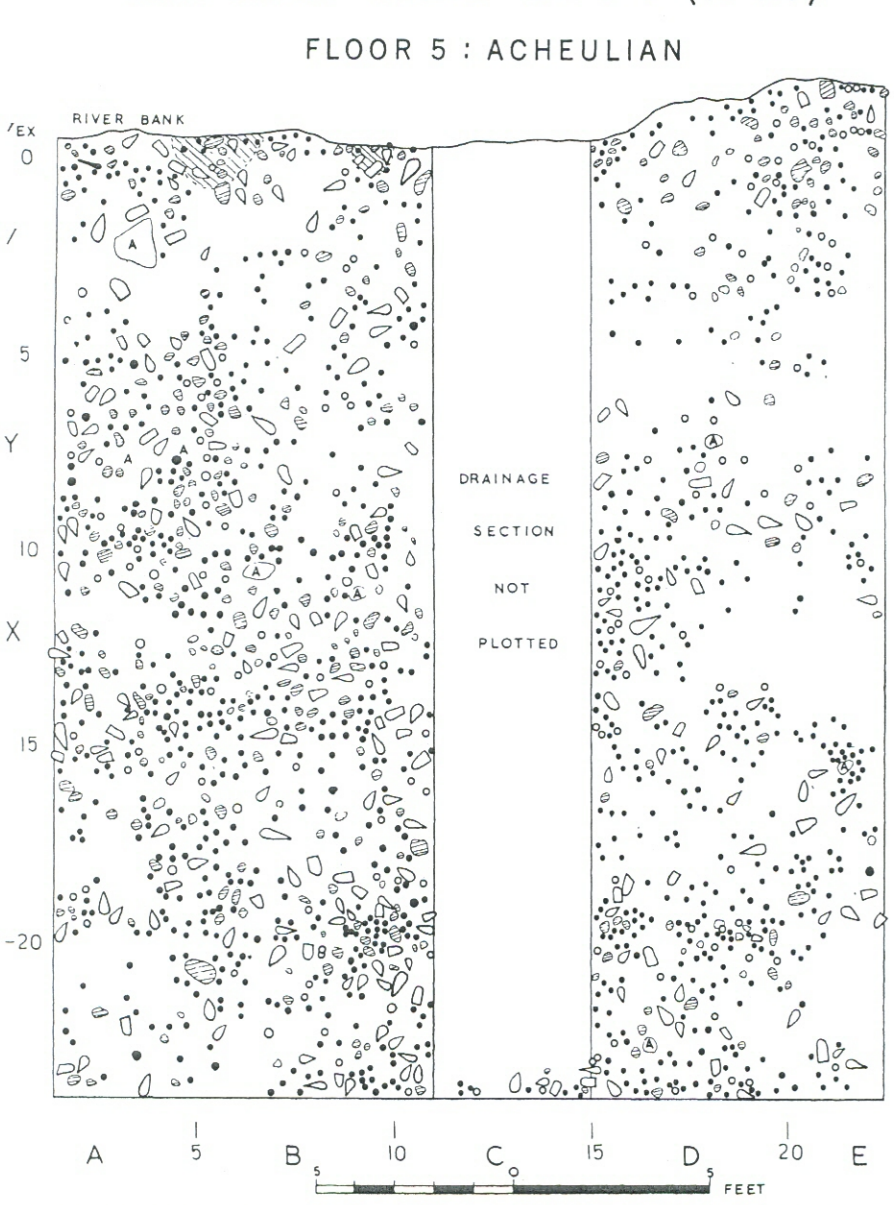


FIG. 4 *at left* and FIG. 5 *above*. Plans of parts of two Acheulian camp floors at Kalambo Falls, showing scatter patterns of tools and waste.

It is reasonable to suppose that there were no members of the band who were not engaged in collecting food, and, especially for hunting, there must have been some means of controlling behaviour and ensuring co-operation among the individual members. Even at this early stage co-operative effort would have been essential, and from this Sommerfelt assumes that some sort of language is as old as man himself, and developed with the tool (see J. G. D. Clark [5]☆ and Sommerfelt 1954). Such basic language would not have been speech, as we know it, and must have been very limited in its field of reference and probably confined to various inarticulate cries, signals, and gestures, though less limited and more fluid than that of other higher mammals.

Wild vegetables must have been also an important source of food, but to obtain these, little equipment would be necessary other than a digging stick and a sharp stone, and such sticks have been found at one African site (Kalambo Falls). The fruits and shoots best found in the fringing forests along the water courses can be collected with little more than a chopper to aid in tree

strated more than once, a handaxe or a cleaver would have formed a serviceable tool for skinning and dismembering a kill and for cutting up or scraping the meat off bones.

[22] Cf. the wooden spearpoint from Clacton-on-Sea associated with the typical Clactonian industry in the Elephant Bed (of Great Interglacial age) and a complete spear associated with an elephant and Levalloisian industry at Lehringen, near Bremen, Germany (of Last Interglacial age). Fragments of worked wood that may have formed part of a throwing-stick and a short club-like piece were found with a late Acheulian industry at the Kalambo Falls, Northern Rhodesia, during 1956 and 1959.

climbing and a natural container to hold or store the food. Honey may have provided the necessary sugar, and deficiencies in mineral salts could be supplied by some lake or river silts.[23] Thus we may presume a reasonably balanced diet for these people.

As to the size of bands during the Earlier Stone Age, there is little that can at present be said with certainty. A study of the number and variety of implements in relation to the number of food animals on the camping sites might be expected to give an approximate estimate. There is, however, no evidence of even semi-permanent occupation of a camp site during the whole of this period, and the composition of bands can, therefore, never have been very large. Before the spread of firemaking it is likely that man continued to rely for defence on numbers and group action, as do baboon troops, so that with his improved efficiency in tool making and foraging it may be supposed that Chelles-Acheul man was grouped into larger units than were the Australopithecines. The groups would still have been small enough to preserve the degree of mobility necessary, though it may be surmised that at favourable seasons, or for specific purposes, larger units would have come together (see Howell [9]☆).

The discovery of how to make and use fire apparently did not reach Africa until the end of the Earlier Stone Age, no doubt on account of the prevailing climate which was warmer than in Europe or North East Asia (Oakley 1955) where the first evidence for man's use of fire goes back to the Mindel Glaciation (Choukoutien). The social and economic advantages attendant upon this revolutionary discovery must, therefore, be considered to have been largely unexploited in Africa during the 400,000 years or so of the Earlier Stone Age.

The earliest evidence of fire in Africa is found at the very end of this period. At approximately the same time, evidence for the occupation of cave sites begins,[24] and regions that are now moist rain-forest and desert country began also to be occupied on a more permanent basis. The ability to specialise by adaptation now enabled man to establish himself in most areas, and there is a considerably more continent-wide distribution of sites. Both these circumstances—the occupation of caves, providing shelter and protection and a semi-permanent home, and the population of hitherto less attractive environments—were, it may be suggested, indirectly due to the use of fire.

The working of wood (Clark 1955, 1959*a*) must have been greatly facilitated by the use of fire, and easy woodworking, in turn, provided new methods of hunting. The felling of trees can now have presented no great difficulty,[25] and the use of various kinds of traps in more thickly wooded country may have given rise to more individual forms of food collecting. Thus members of a group were enabled to live in less close contact, and groups could develop independently. The greatly increased number of sites known from the times of the First Intermediate and Middle Stone Age cultures may be taken to indicate also an increase in overall population. The greater need for, and, it may be suggested, the more jealously guarded rights over, permanent water resources may have led to interband warfare.[26]

UPPER PLEISTOCENE: MIDDLE STONE AGE INDUSTRIES

If the desiccation [27] which brought the Earlier Stone Age cultures to an end saw the beginnings of regional specialisation in technical equipment, and so, we may infer, in society and culture, the Middle Stone Age, extending in time throughout much of the last or Gamblian Pluvial,[28] saw specialisation carried further and the establishment of a number of regional [29] cultural

[23] There is reason to believe that some of the lumps of peaty clays with burnt vegetable matter that have been found on Late Acheulian camping floors at the Kalambo Falls may be pieces of lake muds purposely collected for eating. Geophagy as practised in Africa today is normally related to mineral-salt or vitamin deficiency.

[24] Open sites with evidence of fire are a late Acheulian floor in the Kagera valley (Nyabusoro), where Posnansky reports burnt bone; and the Kalambo Falls, where charcoals, ash, and charred logs are preserved with the late Acheulian. Cave sites yielding similar evidence are the Cave of Hearths in the northern Transvaal and the Montagu Cave in the western Cape.

[25] Deciduous trees are regularly felled by lighting a fire at the base. African hoe cultivators, when clearing new bush for planting, fell large trees by lighting a fire at the base of the trunk.

[26] It is of interest to note in this connection the cast of the wooden spear in the head of the femur and pelvis of one of the Skhūl burials (Skhūl IX) at Mount Carmel, Palestine, the circular wound penetrating the temporal bone of Broken Hill Man (*Homo rhodesiensis*), and the circular depressed fractures on the frontal of the Florisbad skull.

[27] Good evidence for drier climatic conditions at this time is available from southern Africa—notably in the valley of the Vaal where calcareous and windblown sands choked the main river and overlie the latest Acheulian industries. At the Florisbad mineral spring, the vegetation of this time shows that the water was brackish and a saltmarsh flora predominated. In northeastern Angola and on the Zambezi, there was also much redistribution of sand by wind and surface wash. Sangoan tools are incorporated in the lowest levels, while earlier Middle Stone Age tools are interstratified in the main body of these redistributed sands.

[28] Evidence for the existence of this "pluvial" in the type area of East Africa has been summarised by Flint (1959*a*). Based mainly on strandlines representing fluctuating lake levels in closed basins, it has been shown by Leakey, Nilsson, and others that the lakes of the Naivasha–Nakuru basins were, at times during the later Pleistocene, considerably deeper and more extensive than they are today. Flint indicates that the extent of such fluctuation can, with probability, be traced along the Rift Valley into Tanganyika in the south, northwards into northern Kenya, and westwards into the Lake Victoria basin. Well-preserved strandlines also exist in closed lake basins in southern Tanganyika, though they have not been examined systematically as yet for artefacts and fossil fauna. Weathering profiles, the formation of laterites and ferricretes, and sedimentation in river valleys have been interpreted as representing oscillating and humid climates by De Heinzelin (De Heinzelin 1952, 1959) in the Congo Basin, and by a number of other workers, already cited, for southern Africa. Evidence for a general lowering of temperature during the Gamblian can be adduced from the former extent of glaciers on Ruwenzori (De Heinzelin 1959) and Mount Kenya (Nilsson 1940), from fossil pollens of *Podocarpus* and *Ericaceae* in significant percentages at Kalambo Falls and Mufo, and from a reassessment of the upper part of the Florisbad pollen diagram, which is now considered to compare with high montane grassland (Bakker and Clark 1960).

[29] Howell☆ points out that regional adaptation of culture is largely inferred and draws attention to the need for absolute data on the ecology of particular areas in which the different industrial variants are found. Such need cannot be overemphasized, and it must be realised also that only teamwork will produce this data. Upper Pleistocene vegetation patterns are inferred from faunal, botanical, and pedological evidence. Faunal lists from archaeological sites, present-day disrupted distribution of fauna and flora, and soil studies have up to now provided the most acceptable indications of palaeo-climates, but recent botanical work at "wet" sites is showing that fossil pollens are perfectly well preserved under certain conditions and may be expected to give the best evidence. Pollen analysis is beginning to confirm that changes in vegetation patterns under "pluvial" and "non-pluvial"

variants (Malan 1949; Clark 1959*a*). These demonstrate the extent to which their makers were able to exploit local ecological resources, in that we find some variants adapted to moist rain-forest, others to savannah, others to grassland, and so on. For example, in the Lupemban and later Sangoan variants there was a great emphasis on woodworking tools and equipment, suited to close bush in the thicker vegetation areas, and, perhaps, one may suggest for such cultures a heavy dependence on vegetable foods.[30] In this connection should be noted the grinding and pounding stones found with Middle Stone Age cultures in the savannah regions, and there honey may also have been easier to obtain if the state of the teeth of Broken Hill man is anything to go on. In other cultures hunting would seem to have assumed the greater significance, and the pressure-flaked points of the Pietersburg and Stillbay peoples, for example, show the importance of throwing spears and knives in the equipment of a band of hunters.

Now, for the first time, we have slight but definite evidence of the differing nature of wet- and dry-season camps.[31] The wet-season camps of hunter-collectors may be expected to be some distance from permanent water and the stone culture to reflect only transitory occupation by a band or small group of hunters without the full range of tools found at the more permanent occupation sites. (For Bushman wet-season camps, see Schapera 1930.) Alternating residence in semi-permanent camps, protected by fires, must have resulted in more specialised food collecting, according to season, and perhaps also in a more exact division of labour between the sexes. Certainly a greater specialisation in activities seems to have accompanied the increased use made of materials other than wood and stone.[32] Perhaps the percentage differences in tool form within a single site, and the variation in the percentages over groups of sites, may serve to distinguish equipment used primarily by men and that used primarily by women.

From his increased tool-making ability, it can be assumed that Middle Stone Age man's intellect had developed considerably beyond that of his predecessors, and the fossil record shows that, by the later half of this period, *Homo sapiens* had replaced the palaeoanthropic stock. There is indirect evidence that the social structure was more complex than in Earlier Stone Age times and that man was able to communicate ideas to his fellows in a way that is possible only by the aid of true speech. The development of specialised tools, the invention and spread of hafting,[33] the use of pigment presupposing art,[34] burial of the dead, and the closely similar pattern of industries, within circumscribed ecological regions, favour cohesion of groups that could have been supported only by a common tongue for each.

It might not be over-stretching the evidence, therefore, to suggest that loose tribal groupings were already present in Middle Stone Age times and that, with improved technical ability permitting greater exploitation of the resources of the environment, there was an overall increase in the size of the hunting bands. Presumably the same factors governing the relationship between rainfall intensity, natural resources, tribal area, and population density that are applicable to modern primitive groups apply also to prehistoric cultures (Birdsell 1953, 1957). But as yet we have only the most imperfect knowledge of the ecological background of these cultures in Africa, so that any attempt at estimating population density or the sizes of bands can be only guesswork.

conditions did not bring about the total extinction of genera and species of one pattern and its supercession by another, but were manifested rather in advances, or wider dispersal, of some forms and retreats, or contractions, of others. For example, the pollen spectra from Florisbad, Kalambo Falls, Mufo, and other sites in southern Africa (Bakker 1957; Bakker and Clark 1960) and from the Sahara (Bakker 1958) indicate that, since the beginning of the Upper Pleistocene, changes in precipitation and temperature have been sufficient to turn sour veldt into sweet-grass veld, saline to freshwater conditions in small lakes and pans, and to bring the montane cold-loving flora as much as 1,000 to 1,500 feet below its normal habitat. It was not sufficient, however, to cover the Free State with savannah, nor the Tanganyika Plateau with closed forest, and, while the cold-loving vegetation was able to spread over the higher parts of the central plateau, this repopulation can never have been more than of a corridor or gallery nature. Goodwin (1955) was one of the first to show that the modifications in the climate of Africa during the Pleistocene were not of the severity archaeologists have been used to suppose. Thus, generally speaking, archaeologists should think in terms of shifting belts of vegetation, of changes in accordance with a regular pattern where, if the precipitation is increased, desert is replaced by sclerophytic steppe, steppe by park and woodland savannah, savannah by various kinds of forest; or if the rainfall becomes less, a reversal of this pattern can be expected. Given, therefore, the existing vegetation pattern, and some knowledge of the magnitude of changes in precipitation and temperature from pedological evidence, it should be possible to reach an approximate idea of the pattern for the various regions at the peak of a wet, and lower level of a dry, period during later Pleistocene times, and to confirm this by future palaeo-botanical investigation. Some attempts have been made already to reconstruct vegetation patterns in certain regions during non-pluvial and last pluvial times (Butzer 1958; H. Wild, in Clark 1957; Clark 1959*a*), and more palaeogeographical work of this kind is urgently required.

[30] It is my belief that the heavier woodworking element in forest country implies, amongst other practices, a greater dependence on, or greater use of, vegetable foods. But, see Howell [10].☆

[31] A typical wet-season temporary hunting camp has been described from northern Bechuanaland (Bond and Summers 1954). Compare this with the equipment from cave sites such as Bambata, Mumbwa, Cave of Hearths, or Border Cave.

[32] As we have seen, bone as a raw material for tools was used from the time of the earliest tool makers, but it is not until later Pleistocene times that we find bone specially worked to intentional shapes. Some of the earliest evidence from southern Africa comes from the Broken Hill cave, where gouges, spatulate- and pointed-ended tools in bone occur, in addition to various utilised fragments (Clark *et al.* 1950). The utilised flake of hippo ivory, which bears a well-marked bulb of percussion, from the Chellian II living site (SHK II) at Olduvai Gorge (Leakey 1958), although it is made of ivory, cannot be classified as an intentionally shaped ivory tool in the sense employed here, since its maker has employed stone technique suggesting only fortuitous use of ivory as his raw material.

[33] The reduction of the bulb and striking platform that can be seen on flakes and flake-blades in significant percentage on sites of the middle and later stages of the Middle Stone Age can probably be interpreted as aids to facilitate hafting. A Carbon-14 date of between 27,000 and 29,000 years B.P. for a Rhodesian Lupemban industry at the Kalambo Falls, where such reduction of butts can be clearly seen, suggests that the introduction of hafting may have first spread generally within the sub-continent at some time shortly after 30,000 years B.P.

[34] Pigment with rubbed facets has been discovered in association with a few earlier Middle Stone Age industries, e.g., Bambata, Twin Rivers, and Broken Hill, and with a number of later Middle Stone Age industries. As Howell☆ points out, two pieces of red ochre were found on the Chellian living floor (BK2) at the base of Bed II at Olduvai (Leakey 1958). These pieces bear no signs of use by man, though Leakey suggests that they were intentionally brought to the site. They may have reached their position through the same agency that distributed the large numbers of natural pebbles and lumps of rock over the floor—through a natural, or possibly human, cause.

POST-PLEISTOCENE AND LATER STONE AGE INDUSTRIES

Somewhat more evidence is available for Later Stone Age time, however. These people were still in a hunter-gatherer stage of culture, but geared, one may suggest, more closely to that preserved in existing Bushman social structure. In some instances the recognition of wet- and dry-season camps, besides affording indication of specialised activity, has produced some idea of the size of the smallest groupings. Small dry-season camping places of the Wilton peoples in the Zambezi Valley are characterized by not more than two or three windbreaks along the river which show that, in this region of open forest on Kalahari sand, bands seem to have split up when the dry season was well advanced and converged in small groups on the banks of permanent water just as the Bushmen still do today (Bond and Clark 1954). In other areas, however, it seems that the dry-season concentration by the side of permanent water was an occasion for people to come together in larger groups. This latter form of grouping may possibly be connected with some specialised activity such as fishing (a supposition based on the high incidence of a particular tool form), and may be expected to have occurred at the end of the rains when the water in the rivers was just beginning to recede.[35]

Again, the specialised Ishango culture, with its range of bone harpoon types, found in the terrace silts and gravels of a former higher level of Lake Edward, could represent the fishing equipment of people who lived seasonally on off-shore papyrus sudd islands, as is done by some Nilotic and Negroid groups today (De Heinzelin 1957).[36] There is also evidence that specially favourable ecological conditions may have permitted more or less all-year-round occupation of an area by some groups. The strandlooping peoples living along the South African south and east coasts are a probable instance.[37] They lived permanently upon sea foods, though they still retained their mobility to some degree. The groups that specialised in hunting the eland in the eastern Free State and Natal are another instance of more specialised food collecting.

Estimates of band size are sometimes permissible from the evidence of foundations of windbreaks (Clark 1959*a*: 218–19), and approximate estimates of territorial limits, based on the distance of culturally related sites from the nearest permanent water, indicate that hunting territory in the drier parts of the continent was more extensive than that of bands that occupied ecologically more favourable regions (Goodwin 1936). Some indication of the spatial range of a group is given sometimes by rock paintings, e.g., of fishing scenes and marine animals believed to have been done by the same hand, and two such paintings are over one hundred miles apart and each about one hundred miles from the sea (Goodwin 1949). Again, seashells have been found on inland sites at even greater distances from the sea. That widely separated bands could come into contact, perhaps for barter, is shown by the presence of obsidian from the Rift Valley as far east as Mombasa, and carnelian and agate beads of specialised form from widely separated Later Stone Age sites in East Africa and even in the Sudan (Cole 1954: 238–40).

That the activities of these Later Stone Age, and even older, groups may have had some measure of effect upon their environment is not impossible, but, where there is no permanence of settlement, such effect must always remain difficult to estimate. However, it is not impossible that the retreat and restriction of the moist rain-forest and the re-distribution of wind-blown sands of Kalahari type were assisted by the deliberate burning of the bush in game drives or to promote new growth.[38] Without some such human agency, it is difficult to see how the destruction of the forest in Angola and the Congo Basin could have been so complete as to remove the vegetation cover sufficiently to allow the redistribution of the sands. This frequently-exemplified phenomenon can hardly be explained on the basis of natural forces alone.

It seems likely also that the encroachment of the Guinea type of bush on the rain-forest in Equatorial Africa was, in the first instance, brought about by Later Stone Age peoples possessing, amongst other equipment, the bored stone, the polished stone axe, and grinding stones in some numbers. It can be shown that these people may have practised some form of intensive collecting or even *vegeculture,* based on the palm-oil tree and the wild yam, and perhaps on the sporadic cultivation of the latter (Schnell 1957). These more intensive collecting or *vegecultural* (Braidwood and Reed 1957) activities must have been accompanied by a more stable settlement pattern, as can be seen from the presence of pottery at many sites and the probable use in West Africa of a medium of exchange in the form of finely perforated quartz pebbles often found in hoards (Shaw 1944). Equally important changes in social relationships must also have taken place. The distribution of the larger bored stones in relation to yam and/or millet cultivation is particularly interesting, since many of these stones are thought to have been used to weight digging sticks. The collecting of vegetable foods is primarily a female occupation, and it may not be too far beyond the bounds of possibility that cultivation brought about a change in the status of women. Polygyny may have been encouraged as one way of building up a labour force, and cultivation may even have been one of the factors in the establishment of matrilineal societies.

Additional evidence as to the division of labour between the sexes is apparent from grave goods and from historical record. Grave goods also give some indication of magico-religious beliefs, for example the painted

[35] E.g., certain sites on the upper Zambezi near Livingstone, and on the middle Zambezi in the Kariba Lake area. These waterside sites show a high percentage of crescent adze-flakes which suggest some specialised activity possibly connected with fishing—perhaps the manufacture of basket traps, fish spears, or arrow shafts from *Phragmites* reeds.

[36] De Heinzelin, on extrapolated radio-carbon dating, places the Ishango culture between 6,500 and 6,000 B.C. Carbon dates for the Wilton and Nachikufan cultures in Rhodesia show that the Later Stone Age there ranged between 4,500 B.C. and 240 B.C., though of course these dates must not be considered as representing the maximum lower and upper limits.

[37] A specialised variant of Smithfield A at the Matjes River Cave has been dated by C-14 to between 9,200–8,500 B.C. approximately.

[38] For the later re-distribution of Kalahari-type sands in Angola, the Congo, and Rhodesia, see Leakey (1949), Janmart (1953), Mortelmans (1957*b*), Clark (1950).

grave stones from the south coast caves, but, in the main, for the Later Stone Age peoples it is the rock art upon which we draw. From this art we can reconstruct a picture of rain- and hunting-magic and of ceremonies associated with burial, initiation, and perhaps marriage. Even the day-to-day lives of these people is well represented in this art. Further, the rock art provides a wealth of social evidence, the extent and nature of clothing, of weapons, of domestic equipment, the various techniques of hunting, fishing, and food collecting, raw materials, records of events such as dances, fights, cattle raids, and so on, and helps to fill out the information yielded by excavation. From it we see that in South Africa generally there existed, until comparatively late times, Stone Age hunter-gathering groups living side by side with more advanced peoples whose propinquity had modified their traditional culture patterns to varying degrees.

Neolithic [39] mixed farmers in the highlands of East Africa and Abyssinia, who built some permanent settlements but still no doubt also moved to a certain degree with the seasons, seem to have been the lineal descendants of the Mesolithic hunter-gatherers there. There is also evidence that they may have been in contact with outsiders, however, on the one hand with the Nile Valley, and on the other with the sea coast. Influence from these groups or from the Horn penetrating to South West Africa probably caused some of the western Cape peoples to adopt a nomadic, pastoral life.

Generally speaking, it is not until the southward movement of the Later Iron Age peoples and the northward movement of Europeans from the Cape exerting pressure on the hunter-gathering groups and bringing about large-scale population movement in search of fresh land or new wealth, that there is evidence for anything other than amicable relationships between gatherers and producers and a slow cultural integration. Signs of this latter can be seen in the various cultural borrowings between groups and in the modification of the use of certain forms of tool. Hunter-gatherers, no doubt impressed by the greater material possessions of the settled communities, seem particularly ready to borrow from their wealthier neighbours, and African prehistory has a number of good instances of this. This process can also be well seen in Africa today, and it is interesting to note that borrowed forms are not always made to serve the purpose for which they were originally intended.

Up to the end of the Middle Pleistocene, Africa's contribution to the development of human society seems to have been as great and probably greater than that of any other continent. But, from Later Pleistocene times onwards, possibly because it lacked the environmental stimuli present in more northerly latitudes, human culture south of the Sahara seems to have received more than it gave. This situation seems to have become more pronounced in later times, so that by the time the earlier food-producing cultures appear there, the imitative rather than the inventive trend of indigenous culture is clearly evident.

It must be apparent from this brief sketch that we are still a long way from being able to reconstruct even the latest cultural levels with anything like completeness. We know not a little about the manner of manufacture and use of tools and other equipment—how, for example, microliths and thumbnail scrapers were hafted and used—but we need to go further and endeavour to interpret these in terms of the social and economic life of their makers. We have some facts established and can reasonably infer others, but if the society and economies of African prehistoric cultures are ever to be interpreted properly, we need the help of natural scientists and anthropologists to provide the ecological settings, since such is fundamental to a more complete understanding of any culture, and we need many more efficient excavations to expose and accurately record the settlement patterns—more facts and more teamwork.

[39] The term "neolithic" is used here in an economic sense of population groups that were essentially food producers. Permanent settlement and/or crop cultivation and domestic stock are prerequisites of "neolithic" culture.

Comments

By J. G. D. CLARK☆

[1] Spatial distribution: This is an excellent statement, but I suggest that the danger of publishing distribution maps prematurely, i.e., before field survey has been carried out evenly over the territory, ought to be emphasised; otherwise there is a danger of conclusions being drawn from distribution patterns which reflect no more than the contemporary state of prehistoric research.

[2] The paragraph on environment and ecological setting might be combined with the one on chronological framework, since the main basis for a chronology of the Pleistocene rests on a study of changes in the environmental and ecological setting.

[3] The point made about the necessity for teamwork is well taken. It might be mentioned that this has long been a recognised concept of Quaternary Research.

[4] Ethnographic evidence: The danger inherent in an uncritical use of such evidence should be stressed. "Existing primitive peoples" are not in a strictly historical sense primitive, or at least cannot be accepted as such unquestionably; they are, after all, living on the same plane of time as ourselves, have had an equally long history, and during the last few centuries in particular must, or at least might, have been subjected to influences emanating from cultures at many different levels. Moreover, there are usually several alternative ways of meeting the same problem, and it does not follow that the same choices were made by the prehistoric people and modern "primitives" chosen for comparison.

[5] Language: Surely language in the elementary sense in which it is defined here is common to other animals and even insects, and is it not the case that co-operation between individual members is highly developed in many animal and insect communities?

By F. CLARK HOWELL☆

[6] Considerable evidence is still necessary to establish the actual existence of these "dry periods" in certain tectonically unstable areas of eastern-central Africa. I indeed doubt that several are clearly and unequivocably recognizable in that part of the continent *on present geological evidence;* not that such did not occur, but proving them is another matter! Surely it is still

premature to consider them, as some writers (including myself) have done, as of continent-wide application, especially when neither the number nor the magnitude of presumed climatic changes are known. This is also the point of view of H. B. S. Cooke (1958) and of R. F. Flint (1959*a*, *b*). There does seem to have been a drier period (Clark's third period) prior to the Gamblian Pluvial in many southern African areas, but in more unstable regions of the continent this is hard to establish. The Isimila site in the Iringa Highlands of southern Tanganyika provides quite good evidence of a damper-drier-damper succession (the rich late Acheulian occupations occurring during the relatively drier interval), but this sort of evidence is hard to find elsewhere in this area. The evidence for the second such dry period is even more rare, including southern Africa; a number of workers, including Flint, Cooke, Pickering, and the writer, are not fully convinced that Bed III at Olduvai Gorge represents an "interpluvial" in the usual sense in which that term has been employed. The Lower Pleistocene drier period (Clark's first period) is also poorly established, especially when one considers the curve of the amount of rainfall change indicated in the Krugersdorp cave fillings (Brain 1958).

[7] I think "contemporary" regional and other variants are present in the Middle Pleistocene, i.e., Early Stone Age, hence doubt whether, *on these grounds,* this conclusion is justified.

[8] There were a number of formal tools (polyhedral stones, choppers, scrapers, etc.)—not only the handaxes and cleavers.

[9] On the question of "favourable seasons," etc.: Isimila may show this in fact; many of the differences from site to site may be merely a reflection of this factor.

[10] I would question here the "greater use" of vegetable foods. Is it not also very likely a question of different uses of a different range of vegetable foods?

By B. D. MALAN☆

[11] Clark seems to place too much emphasis on wetter periods and the absence of the wheel and pack animals as restrictions on the movements of peoples and individuals, and consequently of "culture." We know that today individuals frequently travel half the length of Africa on foot in search of work, and the presumption is that Stone Age men had even better use of their legs. There is evidence in rock paintings of considerable movements of Later Stone Age artists between the coast and the interior. It is difficult to believe that ecological changes of the order postulated in Africa had any marked effect on human capacity to travel, or that the absence of the wheel and pack animals is relevant. Greater cultural movement and expansion may indeed have taken place during drier periods, but Clark seems to be clutching at straws to explain the phenomenon. Is it not possible that during wetter periods the contrast between forest and savannah environments was greater and so acted as a more effective barrier to cultural expansion and interchange? Perhaps the phenomenon depends on factors such as incompatibility of culture, lack of cultural adaptability, conservatism of tradition, or absence of pressure of population, rather than a hypothetical restriction on the physical movement of people during a wet period.

[12] Clark takes the lack of thickness of Earlier Stone Age deposits on open sites as evidence that such sites were merely temporary camps occupied for relatively short periods. Here again the conclusion is probably sound, but the argument open to question. It is difficult to see how, even during a prolonged occupation, any considerable depth of occupational deposit could develop on an open site unless the deposit was confined by some exceptional topographical circumstance such as a hollow in the ground. In other words, prolonged occupation of an Earlier Stone Age open site would lead to outward dispersion of debitage [waste materials] rather than a vertical accumulation or thickness of deposit. Only when the particular way of life demands the disposal of a considerable *volume* of waste, such as ash or shells, in the form of heaps or middens, can thick deposits be expected to develop on open and unconfined surfaces.

By K. P. OAKLEY☆

[13] After reading the paper I found myself attempting to assess very roughly the social structure of the early human groups in Africa at each of the main levels of culture. The result was as follows:

Earliest Hominids (Australopithecines): In size of groups and social structure they were perhaps comparable *initially* with baboons. Like baboons they were adapted to life in relatively dry open country. It has for long been inferred that their adaptation depended on developing carnivorous habits, maintained through becoming bipedal and thus having hands free for use of tools and weapons to supplement bodily equipment. We had known from field evidence such as that collected by Captain H. B. Potter (quoted in *Science News* [Penguin] 21 [1951]:77–78) that baboons are occasionally carnivorous and have been observed engaging in "apparently organized hunts." It therefore seemed highly probable that the hominids in becoming adapted to the same environment developed such habits to the full. However, it was not until this year that Raymond Dart's belief that the Australopithecines were hunters and at least tool-users was fully confirmed. From the food-debris at the living site of *"Zinjanthropus"* discovered by Mrs. L. S. B. Leakey, July, 1959, in Bed I at Olduvai, there is no longer any question that at any rate the more advanced Australopithecines were carnivorous, that they hunted small mammals and the young of medium-sized mammals, and that they were tool-makers.

From the point of view of the beginnings of culture it may be important to remember that if the earliest hominids were comparable with baboons, the numbers who were in group contact at any one time may have fluctuated as widely as between 20 and 200, depending on the scarcity or abundance of food supplies.

[14] *Middle and Upper Pleistocene men:* The increasing number of cultural elements in common with primitive hunting and food-gathering peoples of the present time suggests that the social structure of the Earlier and Middle Stone Age peoples of Africa may have *approached* that of man as we know him today. It is interesting that Clark sees in the archaeological record evidence of articulate speech, and is led to infer that within circumscribed areas the Middle Stone Ages peoples had a common language.

The Later Stone Age men probably had a social structure almost identical with that of the surviving Bushmen.

[15] Clark quotes (page 318) my suggestion that the occupation of caves depended on man having fire regularly available. In Africa there is no good evidence of the use of fire before Final Chelles-Acheul times. The discovery that the Sterkfontein caves had been entered by the Proto-Chelles-Acheul tool-makers might seem to contradict the hypothesis that there is a correlation between cave-dwelling and the use of fire. I do not think that it does. The dolomite caves in the Transvaal were probably entered by the early hominids during *day*-time in search of game or water, particularly under conditions of extreme dryness. Moreover, some of their activities may have required the shade of a rock-shelter at mid-day. But these same caves would have been avoided at dusk and throughout the night unless fire was available for use as protection against prowling carnivores.

Caves with unguarded entrances are particularly dangerous as *night* shelters for hominoids: for the simple reason that apes and men betray their presence by snoring.

By R. F. H. SUMMERS☆

[16] *A priori* the change takes place fastest during the *drying* phase, but this is also the period during which river deposits are laid down and so is the period about which we know most typologically. There is a possibility that too much weight might be given if one argues from observations only. I think that it ought to be stated that this is an *a priori* argument.

Geographically, cultural and industrial changes tend to take place quicker in drier, less favoured, marginal areas (compare Transvaal and Orange Free State with Southern Cape).

[17] The same phenomenon in a late Acheulian context has been noticed by a field worker (J. Masefield) on the Southern Rhodesia watershed near Lochard where sheet erosion has stripped a large area. Handaxes and "bolas" stones are concentrated in areas which Masefield considers to have been swampy. No bones remain, as the acid soil does not permit of their survival. (Unpublished information.)

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