CURRENT DIRECTIONS IN
WEST AFRICAN PREHISTORY

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INTRODUCTION

The tempo of prehistoric research in Africa has quickened remarkably during the past decade, necessitating important revisions in our understanding of the archaeological record. Africa's past in general is emerging as more complex, and more instructive from a comparative point of view, than earlier believed. With the more routine application of radiometric dating, old assumptions about chronology have fallen. Earlier it had seemed that Middle and Late Stone Age technologies appeared very late in sub-Saharan Africa compared with analogous Middle and Upper Paleolithic industries in Europe. This apparent lag led Graham C. Clark to declare in 1971 (51, p. 181) that much of Africa during the Late Pleistocene “remained a kind of cultural museum in which archaic traditions continued . . . without contributing to the main course of human progress.” Recent dates demonstrate that technological innovations like flake tools produced on prepared cores, punch-struck blades, and burins appear in Africa at about the same time they did in Europe (20, 28, 269). Far from remaining a “cultural backwater,” as Clark further suggested (51, p. 67), it now appears possible that microlithic technology, pottery, and cattle domestication were indigenous African developments.

Improved chronological resolution has also revealed that the pattern of technological change in Africa was frequently mosaic in character. Just as stone-tool using hunter-gatherers continued to inhabit regions subject to settlement by Iron Age farming groups up until this millennium in parts of Africa, so prepared core flake technology may have coexisted alongside backed microlithic technology in the prehistoric past (191). This complex situation is quite different from the more homogeneous pattern of technological change familiar from Europe.
For West Africa in particular, data is accumulating rapidly enough that
syntheses written as recently as 1980 (e.g. 148) are already out of date. Other
more detailed treatments published in the past 2 years have suffered the same
fate, exacerbated by long time lags between writing and publication (7, 48,
126). This article is intended to update earlier synthetic works on West African
prehistory (63, 160), including those concerned with specific periods, such as
the Stone Age (32, 47, 220) or the Iron Age (162, 181), or with individual
countries (11, 96, 103, 200, 219).

In addition to providing a broad outline of the most important discoveries of
the past decade, we have tried to emphasize the emerging complexity of the
archaeological record and the relevance of paleoclimatic change to interpreting
it. Selectivity in presenting material was necessary, and we regret having to
omit much substantial research. The general focus is on sites where controlled
clean excavation or survey, dating programs, plus comprehensive descriptions of
material culture and/or paleoenvironmental and paleoclimatic data have pro-
vided a crucial key to evaluating prehistoric remains within a wider region. The
integration in the narrative of research in both francophone and anglophone
countries has been a particular goal. In several cases, we have provided
expanded discussions of recent French discoveries which may perhaps not
become generally accessible to anglophone readers for a while.

We have defined West Africa as the land south of the Tropic of Cancer and
west of a line drawn north from the Cameroun highlands (see Figure 1). In
including the southern half of the Sahara in our discussion, we follow precedents
set by Andah (7) and Mauny (160). The northern boundary is clearly arbitrary,
allowing others to limit their definition to sub-Saharan regions while recogniz-
ing that discussion of Saharan events, particularly in the Stone Age, is essential
to understanding developments further south (220).

The portion of the archaeological record covered here extends from the Early
Stone Age, whose earliest manifestations have not been dated in West Africa,
through what may be termed the "prehistoric Iron Age." We have arbitrarily
defined the end of this period as A.D. 1000, after which point historical
documents, often quite detailed, supplement archaeological research as an
important source of information on Saharan and sub-Saharan regions. Historical
accounts of the forest regions do not, of course, become available for
several more centuries. But even in these regions, oral histories are increasingly
utilized to help interpret sites such as Ife, dating to the early centuries of this
millennium.

West African prehistory, thus defined, is an immense topic. For substantial
portions of it, both geographical and chronological, there is a critical lack of
data from controlled excavations. As scientific investigation has increased in
the past decade, however, several important themes have emerged.

One of these themes is the significance of paleoclimatic change for Stone
Age adaptations. Much of the evidence comes from sites in the current Saharan and Sahelian zones where even small fluctuations in moisture can have dramatic consequences. On several occasions within the last 50,000 years, it appears that human populations in the Sahara adapted to periodically deteriorating climatic conditions by migrating, by modifying their subsistence base, or by becoming more mobile. It is possible, for example, that present-day nomadic pastoralists in the Sahara are the scattered remnant of an earlier, more populous, and more sedentary pastoral adaptation. While monoscalar or deterministic explanations of prehistoric change in these areas are clearly to be avoided, the influence of major paleoclimatic shifts on human populations in large portions of West Africa is undeniable.

The complex and mosaic character of technological change in Africa has already been mentioned. This theme is clearly illustrated in West Africa by recent developments on the origins of metallurgy. Although earlier debate had centered on the question of indigenous innovation vs diffusion, it now appears that the combination of these two processes produced a uniquely African iron technology.

The most significant aspect of prehistoric Iron Age studies during the past decade has been the discovery that various large, complex sites, previously assumed to reflect the effect of Arab enterprise in developing trans-Saharan trade, in fact yield first millennium A.D. radiocarbon dates. It now appears that important developments in trade, social stratification, and even urban growth took place during this period. Increasing numbers of radiocarbon dates for towns and long-distance trade goods indicate earlier views in which outside stimulus, in the form of Arab trans-Saharan commerce, was seen as the major factor in the emergence of high levels of sociopolitical organization in West Africa.

A Short Note on Terminology

The discussion of archaeological material in this review follows a logical chronological order beginning with the earliest traces of human occupation. The narrative for all pre-Iron Age material, for example, is arranged under the major headings of “Early,” “Middle,” and “Late Stone Age.” These terms are employed, it should be stressed, informally. Their use in the formal nomenclature of African prehistory was officially abandoned at the Burg Wartenstein conference held in 1965 to revise and standardize the terminology of African prehistory (25). No alternative to these terms has yet been incorporated in the formal nomenclature, so many writers continue to use the old Stone Age divisions in the informal, broad sense of “general levels of cultural evolution, which may develop earlier in some regions or persist later in others” (49, p. 249). We follow this usage, while recognizing that these terms, however we may qualify them, still imply a chronological succession of industries that is sometimes inconsistent with archaeological reality (191, 192). There is a pressing need for a formal nomenclature that adequately reflects the complexity and variability of West Africa’s archaeological record. This can only be achieved, as the Burg Wartenstein recommendations make clear (25), on the basis of comprehensive description and analyses of whole artifact assemblages from datable, primary context sites. Few investigations of this kind have been conducted in West Africa, although this situation is improving. For the time being, informal terminologies must suffice.

A complicating factor is the usage in the Sahara of French terminology broadly adapted from European prehistory (Lower, Middle, Upper and Terminal Paleolithic, Epipaleolithic, Neolithic). Differences in methodology and historical tradition are partly responsible for the divergence in French and Anglo-American approaches to nomenclature and archaeological description. Such differences are neither easily dismissed nor resolved, as the Burg Wartenstein discussions demonstrated (25). It is purely for simplicity’s sake that we subsume the Lower and Middle Paleolithic under the headings Early and Middle Stone Age, respectively. All later Paleolithic material, plus the Neolithic in the Sahara, is included in the Late Stone Age section.

The use of the term Neolithic in Africa continues to be debated. Two definitions currently coexist somewhat uneasily. One is technological and applies in a general industrial sense to assemblages with pottery and ground stone (47, p. 565). The other is economic and includes only food-producing societies (116, p. 196; 233), and then perhaps only those with evidence of sedentary village life, stock herding, and agriculture (18). Additional confusion is created by those who mix the two by supposing that technological innovations like pottery are tangible evidence of economic change related to food production (34, p. 557). Since the earliest direct evidence for cultivated plants in West Africa postdates the appearance of pottery by 5000 years, such an assumption may not be warranted. We agree with Shaw (220) and Barich (18) that the appearance of pottery can be less ambiguously indicated by a term such as “ceramic Late Stone Age.”

In discussions of chronology, this review follows the conventions observed in the Cambridge History of Africa (48). All Pleistocene results are presented as B.P. dates. Holocene C14 dates are normally given as uncalibrated B.C. or A.D. dates. Readers should refer to original sources for details on individual dates.

CLIMATE AND PALAEOCLIMATE

Tropical West Africa possesses a remarkable record of climatic and geomorphological change covering the past 30,000 years (see Figure 2). The record is slanted toward several localities well studied by interdisciplinary teams [espe-
pecially the Atlantic Saharan coast (27, 185, 268), Senegal and Niger Basins (163, 164, 255), Lake Chad Basin (80, 210, 211), and Lake Bosumtwi in Ghana (251)]. Recent climatic syntheses (108, 238, 239) and interpretations of meteorological mechanisms (93, 131, 152, 154, 202, 204, 210) confirm this as a prime field of study for understanding the global circumstances of Quaternary climatic change. The interactions of atmospheric, oceanic, and continental systems which powered past climatic change are responsible also for today’s climate and its unmistakable imprint on present human populations.

Climate

Rainfall and vegetation are distributed in West Africa in parallel east-west bands which reflect the position of atmospheric circulation cells. To the south, precipitation derives from moist Atlantic (so-called monsoon) air traveling from the southwest and rising as it is warmed by the sun. This ascending air forms the equatorial side of the Hadley Cell. The warm air loses moisture (rain) as it rises; at a few thousand meters it moves polewise and then descends at the opposite side of the Hadley Cell as the desiccating NE Trades. The east-west front where moist air and the NE Trades meet and just south of which rain falls in the Inter-Tropical Convergence Zone (ITCZ). The front migrates north and south through the year, following the sun’s apparent position over the Tropic of Cancer in summer and shifting south in winter. The summer maximum of the ITCZ’s migration is on average 16°N latitude, and this maximum has shifted significantly in the past. Variations in the position, speed, and precipitation potential of the ITCZ (such as that experienced during the Sahel drought of 1967–1974) are caused by a complex interaction of the sun’s seasonal position (107), speed and position of the jet Stream of both hemispheres (152, 202, 204), the strength of desiccating anticyclonic systems on the equator of both Jet Streams (202, 204, 264), relative coolness of the southern hemisphere winter (152, 261), and ultimately by the relative size of the Antarctic and Arctic ice sheets (93, 131, 202, 204). As the effect of these variables on recent climate becomes better understood, enormous progress also has been made in attempts to reconstruct the regional effects of interacting climatic mechanisms during the Late Pleistocene and Holocene. Such reconstruction will then allow more sophisticated modeling of the plant cover and faunal resources during the principal palaeoclimatic episodes that has so far been possible (135, 154, 261). The effect on modern vegetation of zonally organized precipitation is dramatic.

The equatorial coast is swept twice annually by the ITCZ, once on its moisture-charged northern migration and again as it moves south. Precipitation is plentiful (1400 mm or more) and evenly distributed through the year so that rainforest and root crops (yams, cassavas) grow in the south. But as one moves north into the Guinea (1400–1000 mm) and Sudanic (1000–400 mm) savannas, the long dry season under the influence of the NE Trades (Harmattan) encour-
ages grasses rather than trees. The very short, single summer pass of the ITCZ over the Sahel (400–150 mm) ensures that evapotranspiration far exceeds total precipitation (250), and it is here that overgrazing and overcultivation contribute locally to the spread of the desert (54, 93, 118, 202). The Sahel supports a reduced harvest of savanna grains such as sorghum and millet; here pastoralism forms the livelihood of many. The progressive diminution of rainfall at approximately 200 mm per degree of latitude continues into the desert (dunes become active above ca 16°N latitude where rainfall is 150 mm or less). However, not all parts of the Sahara are hyperarid year-around, as some spring, winter, or autumn rain falls on the central massifs because of the “Saharan Depressions” (moisture-laden high-pressure anomalies at the interface of middle latitude cyclones and anticyclones) or because of occasional migration south of cyclonic winter rains from their usual position over the Mediterranean and Maghreb.

**Pleistocene Palaeoclimate**

The origin of the desert is difficult to date, but the Saharan core was hyperarid by at least the later Pliocene (154, 210, 237). East Atlantic sediment cores record many episodes of extreme deflation and dust transport during a generally dry Pleistocene (27, 73, 237). These alternated with conditions moist enough to support permanent lakes in the south Sahara (164, 210). Chronological resolution of these episodes improves appreciably only after 50,000 B.P.

Tropical West Africa was generally moist before ca 100,000 B.P. when, for example, the Senegal River fed massive lakes in the Ferlo and Trazza regions (163, 164). Evidence is strong for a severe arid period soon afterwards: the “Premier Erg” (dune sea) in the Chad Basin dates to ca 65,000 (81). This appears to be part of a remarkable system of dunes extending thousands of kilometers through the Sahara and Sahel, created sometime between 100,000 and >40,000 (250). Humid conditions followed, and Lake Chad rose to create its highest beach by ca 38,000 (80, 81, 211). At 30,000 another intense dry period is signaled by regression of the lake and aeolian reworking of basin sands, but by 22,000–20,000 Lake Chad had again grown to more than three times its present size. By 26,000 the lake began to receive moisture from both the southern monsoons and the northern “Saharan Depressions” (265). This lacustrine period is attested between 28,000–23,000 on the Mauritanian coast (268) and between 25,000–20,000 at other lakes on the Sahara’s south and north margins (164, 202, 204, 237, 265); from 22,500 to 17,500 Lake Bosumtwi was a high lake with dilute waters (M. R. Talbot, personal communication).

The mechanisms responsible for these late Pleistocene shifts are now better understood than ever. It is clear that tropical West Africa never behaved as a unitary climatological system. The several environmental zones recognized today expanded, contracted, or disappeared entirely at different periods in response to one or more temporally dominant meteorological forces which were succeeded by others with quite different effects. The end of the 100,000 to >40,000 B.P. hyperarid period coincides with an expansion of the Antarctic ice cap, strengthening the ITCZ and propelling monsoonal rains far to the north (202). The resulting pluvial ends at ca 30,000, coinciding with an Arctic icefield expansion which strengthened the northern Jet Stream and its attending (desiccating) anticyclonic system now located over the Sahara (204). The anticyclonic system weakened between 25,000 and 20,000, allowing precipitation to increase. But by the Late Glacial maximum (ca 18,000) low global temperatures (reducing evaporation over the Atlantic, hence preventing recharge of the monsoons) (93, 264), “continentiality” caused by sea level drop (204), and increased coastal upwelling (185) considerably disorganized the ITCZ. The Arctic ice sheet's rapid expansion pushed the Jet Stream far south; the attending anticyclonic and cyclonic systems migrated south of their current position. Cyclonic rains bathed all North Africa, and the “Saharan Depressions” fed lakes and Mediterranean vegetation in the Saharan massifs during all but perhaps the worst of the hyperarid phase (81, 129, 203, 265). But a greatly expanded as well as more southerly anticyclonic system created a very dry and cold Sahel and southern Sahara, with precipitation only 15–20% of today (250, 264).

These southerly areas today bear the hallmark of the 20,000 to 12,000 dry period—massive and almost continuous fields of longitudinal dunes extending 4000 kilometers from the Atlantic littoral to the Sudan Republic (108, 202, 204, 251). At this time, the Sahara shifted 450–500 kilometers south (164, 265), dunes were active 6° latitude farther south than today (93), and the Chad, Senegal, and Niger Basins were subjected to dune erosion over former lacustrine deposits (81, 163, 203, 210, 211, 237, 255). A low, saline Lake Bosumtwi (lowest level 17,500–15,000) lay in a landscape of grass savanna, where forest was reduced to valley remnants (251; M. R. Talbot, personal communication). As arid as this Late Glacial phase became, it was by no means as severe as that before 40,000.

**Holocene Palaeoclimate**

At the beginning of the Holocene (ca 12,000 B.P.) the rapid shrinking of the Arctic ice cap (93, 131) and global warming were complemented in West Africa by a weakening of the anticyclones (204, 264), expansion to the north of the moisture-charged ITCZ (93, 202, 238, 239, 261), and significant overlap of monsoons and “Saharan Depression” rains over northern Chad and the Saharan massifs (93, 129, 153, 202, 237, 264). Improvement was interrupted by short arid episodes at ca 11,500–11,200 and 10,500–10,000 (93, 129, 251). But by 10,000 stable pluvial conditions prevailed. Precipitation improved by 200–400% in the Sahel. Parts of the Sahara now receiving 5mm rainfall then received 250–400 mm (93, 238).
Temperatures rose very slowly and surface water loss declined as vegetation colonized former deserts, encouraging a favorable precipitation/evaporation balance. Nearly year-round precipitation maintained permanent streams in the Sahel and Mediterranean vegetation in the highlands (135, 155, 250). The Senegal and Niger rivers breached nearly stabilized barrier dunes, the sands of which were reddened as soils developed (108, 163, 164), and Lake "Megachad" formed at the +40 meter level (93, 210). To the south, forest recolonized the Bosumtwi region at ca 9000 and the lake was stable and high (251; M. R. Talbot, personal communication). The West African landscape was very different today with many interdunal lakes in the Sahel, and Saharan meadowland supporting shallow lakes and permanent watercourses (especially in the highlands and adjoining areas). True desert was banished to the far north (135, 202, 204), to low-lying central regions such as the Taoudeni Sebkha (108, 237) and the East Atlantic coast (183, 185).

A short but significant dry phase at 8000-7000 B.P. is attested by severe drying of southern Saharan lakes and watercourses (131, 237), remobilization of dunes in the Sahel (164, 250, 265), and a rapid decline in the level of Lake Bosumtwi (251). Debate on causes for this dry episode continues (see 93, 131, 155), but it is highly significant that air temperature over West Africa, which was still quite cool during the early Holocene, at this time becomes as warm or warmer than today. Lake Chad now supported only tropical diatoms rather than the cold-tolerant and tropical mix of the lower Holocene (210, 211). Despite the return of pluvial conditions ca 7000 B.P. [signaled by lake level rises at Adrar Bous and Lake Bosumtwi (50, 251)], the onset of higher temperatures signals the beginning of a slow, nonlinear decline to present arid conditions. Temperature increases soon created an unfavorable evaporation profile (93, 153) and rainfall in the Sahel and Southern Sahara became more episodic. As a result, streams that once flowed year-round became increasingly seasonal and temporary (155, 250). Various localities experienced appreciable lake level declines at 4500-3500 (129, 172, 250, 251), coinciding with general East African lake regression (178, 238, 239). Humid episodes at ca 3500-3000 (155, 178, 250, 265) and 2500-2000 (129, 265) are of short duration and perhaps local effect only.

By 2000 the Sahara and Sahel were as dry or drier than today and the effects of deforestation, overcultivation, and overgrazing were felt even in the forest and savanna regions (93). Research on the most recent periods (54, 93, 118, 155, 178) concerns the apparent correlation between climatic improvement in West Africa and cooling in the upper latitudes (such as during the "Little Ice Age" of the sixteenth through eighteenth centuries A.D.), predicting future effects of CO₂ concentration in the atmosphere and of local human abuse of the land.

This brief summary of Late Quaternary climate change can only hint at the sense of accomplishment researchers have felt as simplistic theories such as the Glacial-Pluvial synchrony or monolithic latitudinal shifts of climatic bands during the Pleistocene are discarded and the great complexity of meteorological interactions is appreciated. Certain methodological problems with the use of Saharan pollen (261, 265), diatoms (211), and radiocarbon dates on shell and precipitated carbonate (177, 202, 210) plague researchers still—but the overall picture after ca 30,000 has begun to come nicely into focus. Greatly needed now is that fine detail of local palaeo-environment which the archaeologist can provide. Collaboration between archaeologist and geomorphologist has been rare in West Africa. In those few cases where it has occurred [e.g. Clark in the Tenere of Niger (50) or Petit-Maire on the East Atlantic coast (183-185) and central Sahara (189, 190)]—results have been exemplary.

THE EARLY STONE AGE

Compared with the eastern and southern parts of the continent, studies of Pre-Acheulean and Acheulean industries in West Africa have had little impact on our understanding of the Early Stone Age (ESA). The East African Rift Valley situation, where rapid late Tertiary/Early Quaternary sedimentation was followed by faulting and exposure of those sediments, (127), is matched nowhere in West Africa. Pliocene and Pleistocene sediments are especially rare in West Africa south of the Sahara. Farther north, they are present up to 600 m deep in the vast Chad basin. Eroding deposits of this formation at Yayó yielded the heavily fossilized "Tchadanthropus" skull fragment, initially identified as an Australopithecine (58). The fossil is now recognized as more similar to Homo erectus in significant aspects (122, p. 122), which accords with the suggestion that the Yayó fauna is approximately coeval with Upper Bed II at Olduvai (ca 1 m.y.) (29, p. 35). Unfortunately, Chad formation exposures are limited, so much material presumably lies deeply buried.

Most of the evidence for makers of Oldowan-type and Acheulean tools in West Africa comes from surface finds (128). More rarely, collections have been made from test pits in river gravels or terraces where lithics have been redeposited. Materials recovered from erosion surfaces or secondary deposition contexts pose problems because they cannot be assumed to represent fully the original assemblage. Indeed, the various pieces found together may not even be contemporaneous. The initial problems presented by these contexts have frequently been exacerbated by preferential collection of "diagnostic" tool types for relative dating purposes. As a result, very few ESA assemblages in West Africa have been subject to systematic collection and comprehensive description and analysis. Not only is assemblage composition and variability
poorly understood, but the chronological framework for the West African ESA remains extremely rudimentary.

Pre-Acheulean lithics have been identified at a scatter of sites from the present forest region to the Sahara (63, pp. 92-98; 157; 219, p. 25). The man-made nature of some of the pebble-choppers collected by Davies in Ghana has been disputed, however (245). Some other Pre-Acheulean attributions, based on the identification of a few isolated core-choppers, are also suspect since these tools may be present in West African assemblages of any period (47, p. 534). It is certainly reasonable to suppose that the distribution of early stone tool makers ca 2.5-1.5 m.y. ago extended throughout suitable portions of the African dry savanna biotope. However, no direct evidence of their activities has yet been recovered in West Africa from an undisturbed context of demonstrably Pliocene/early Pleistocene age.

Acheulean industries are found throughout the central and southern Sahara, associated with fine-grained lake or swamp sediments or in older alluvial terraces of main drainage systems. A grassland/scattered woodland habitat is suggested by the large ungulate fauna accompanying Acheulean handaxes, cleavers, and discoids at the site of Erg Tihoudaine (32, pp. 42-45). Bifaces numbering in the thousands at El Beydyl indicate that favorable Saharan locales may have supported relatively stable populations over a long period of time (47, p. 538). These and other major biface sites in the Sahara [see (47) for an excellent summary] have only been surface collected, often in a highly selective way.

South of the Sahara, the Acheulean is thus far very poorly represented in Senegal (67) and absent in Liberia, Sierra Leone, and lowland Ivory Coast (247, p. 38). Putative Acheulean occurrences cluster in southeastern Ghana and central Togo along the Atakora highlands (63, p. 104). However, the best examples of fully characterized assemblages come from the Jos Plateau in Nigeria, where hundreds of bifaces were discovered as a result of tin mining in alluvial deposits (219). Against this backdrop of isolated surface finds and secondary deposits, the recent discovery in eastern Nigeria of what appears to be a major Acheulean handax quarry site and factory is of great importance. Excavations at Ugwuẹle have produced prodigious quantities of processed stone, especially broken and unfinished handaxes (8). The brittle character of the Ugwuẹle dolerite outcrop probably accounts for the many discards (9).

Dates for West African Acheulean assemblages are scarce. Until recently, the single available date was a C14 determination run on wood from the alluvial deposits at Nok (219, p. 29). At 39,000 B.P., it clearly represented a minimum age only. Now two burned flint bifaces from Lagreïch in the Malian Sahara have been thermoluminescence dated to 282,000± 56,000 B.P. (74). In the Libyan Fezzan, a team led by Petit-Maire observed Late Acheulean and Mousterian artifacts in lacustrine shell deposits uranium dated to 140,000-90,000 B.P. (100, 187). If these dates do prove to bracket the Early/Middle Stone Age interface in the Fezzan, this Saharan chronology will accord with sequences elsewhere in Africa, where this boundary dates between 200,000-100,000 B.P. (20, 269).

POST-ACHEULEAN INDUSTRIES: MIDDLE STONE AGE AND SANGOAN

Sterile, windblown sands overlie late Acheulean deposits at various Saharan sites, testifying to the onset of extremely arid conditions. The earliest known post-Acheulean flake industries have been found stratified above these aeolian sediments, probably representing a repopulation of the region as more humid conditions returned. Two kinds of Middle Stone Age (MSA) industries have been identified in the present Sahara: Mousterian, with high frequencies of scrapers and points produced on flakes struck from prepared cores; and Aterian, a closely related industry with a substantial percentage of bifacially tanged forms and a variable blade element (32, pp. 26-31; 49, p. 262; 254). In North Africa and Egypt, Aterian tanged tools have been found stratified above Mousterian assemblages (32, pp. 23-36; 270). Within the West African Sahara, however, only Adrar Bous has provided stratigraphic evidence for a possible Mousteroid facies underlying the Aterian (50). Too few Mousterian occurrences are known from the Sahara to determine whether the Aterian there represents a derivative industry or, alternatively, a largely contemporary special activity facies, involving the hafting of a variety of tools in sockets or split shafts (49, p. 259).

Aterian lithics are widely distributed north of 15°N at open sites adjacent to lacustrine and swamp sediments and in the valleys of major water courses. Because most of the Saharan assemblages are surface collections, dating is difficult. In the Air, redeposited Aterian artifacts occur in cross-beded sediments dated to 18,500 B.P. (167). Several North African dates between 40,000-25,000 B.P. provide a useful basis for extrapolation (32, p. 33). However, Wendorf & Schild (270, p. 234) advocate rejecting all existing absolute dates for the Aterian, citing their evidence from the Western Desert of Egypt that Aterian chronology exceeds the limits of the radiocarbon method. This being the case, they argue, datable materials can be seriously contaminated by the slightest trace of carbonates or brief surface exposure. Clark (47, p. 550) concurs that the Saharan MSA probably ended by 40,000 B.P. Almost all authors agree that it had certainly ended by the start of the hyperarid phase that began ca 30,000 B.P. Hugot's conviction (124, 126) that the Aterian is a Terminal Palaeolithic industry lasting as late as 9000-7000 B.P. in the southern Sahara has been largely discredited.
In a number of locales, Aterian horizons are heavily deflated by wind erosion or, as at Adrar Bous (50), topped by dune deposits, indicating renewed aridity. This same arid phase may be represented south of the Sahara by thick deposits of wind-blown sand on the Accra plains of Ghana. Stratified underneath, at the sites of Asokrochona and Tema West, are undisturbed post-Acheulian occupation levels. The 12,600 lithics recovered by Nygaard from Asokrochona constitute the first complete post-Acheulian assemblage excavated from an undisturbed occupation context in West Africa (179). At Tema West a very similar industry occurs, and it is overlain by a MSA assemblage of quite different character (S. Nygaard, in preparation). Both sites provide a consistent paleoclimatic picture in which occupation took place during dry savanna conditions similar to those prevailing today on the Accra plains. Geological features created during significantly drier conditions occur immediately below and above occupation levels at both sites (179; S. Nygaard, in preparation).

The Asokrochona assemblage and the earliest Tema West material comprise a large percentage of unmodified quartz flakes, chunks, and chips, plus a tool kit of scrapers, choppers, picks, and spheroids, all manufactured on quartz cobbles. Levallois technique appears to be absent. Comparable tools are reported from savanna regions elsewhere in West Africa (63, 235, 246). These relatively heavy-duty, crude, core-tool assemblages in West Africa have frequently been termed Sangoan, referring to apparently similar industries first identified in East Africa (49, p. 288). Because so many Sangoan assemblages result from selective surface collections, it has been unclear whether the heavy-duty picks and core scrapers represent a temporally discrete cultural episode or a facies of material culture that recurred intermittently throughout late Acheulean and post-Acheulian times. Clark (49, p. 288) favors the latter, interpreting the Sangoan as a special activity facies, possibly wood-working, of the MSA. Several authors prefer to avoid applying the term to West African assemblages until much more quantitative description and paleoclimatic analysis have been undertaken at systematically excavated sites (267; S. Nygaard, in preparation).

Post-Acheulian assemblages lacking a heavy-duty core tool component and possessing flake tools produced from Levallois prepared cores are also documented in sub-Saharan West Africa. Very little is known of these, referred to simply as MSA industries. The best-described MSA material to date comes from secondary deposition contexts in Nigeria (3, 4) and northern Cameroon (156, pp. 67–95), where radiocarbon dates unfortunately have proved unsatisfactory. Relevant new discoveries elsewhere include a flake assemblage with Levallois technique stratified above a core tool assemblage at Tema West (S. Nygaard, in preparation) and the report of an assemblage containing both “Sangoan” and Levallois flake elements in southern Ivory Coast (43). These finds, preliminary as they are, encourage the tempering of traditional emphasis on culture-stratigraphic succession with an appreciation of post-Acheulian assemblage variability.

**LATE STONE AGE**

**Academic Industries in the Sahara**

During the hyperarid episode lasting from 20,000–12,000 B.P., the Sahara down to 15°N apparently was uninhabited. Most of the population in West Africa at that time probably lived south of 11°N. When wadi channels began to flow with water again between 10,000 and 8,000 B.C., grasslands and large grazing mammals repopulated the Sahara, as, presumably, did hunter/collection. Archaeological traces of these groups are rare, however. They are probably represented by small scatters of punched blade industries known from a handful of Saharan sites. This industry is well described at Wadi Greboun in the Air (45), where a small group of hunter/collectors camped briefly on the banks of an early Holocene lake. Similar aggregates with distinctive, asymmetrically shouldered Ounanian points have been found at Adrar Bous, near Arawn, and further north in the Fezzan and Maghreb (16, 45). It appears that these industries are earlier than 6500 B.C. Confirmation of this chronology has recently come from Roset’s work (207a) in the Temet Basin in the northeast Air, where a blade industry associated with stone bowls and pestles has been dated to about 7600 B.C. In Egypt’s Western Desert, Terminal Paleolithic industries with backed bladelets and Ounanian points date to 7000–6800 B.C. and apparently represent the first occupation of the area since the Aterian (270, pp. 108–10, p. 277). The affinities of these blade and bladelet industries with earlier Epipaleolithic material in North Africa indicates that large parts of the Sahara were reoccupied from the North in the early Holocene (47, p. 564). Mori (169) has suggested that the well-known Saharan rock engravings of elephants and wild buffalo (Homoceros (Bubalus) antiquus) were created at this time. Muzolini, however, argues that the so-called Bubalus style is contemporaneous with other Saharan rock art dating to the second half of the Holocene (174, 175).

**Saharan Ceramic Industries**

The industries which apparently succeeded these punched blade industries in the Saharan have received much attention, focusing on one of their most distinctive characteristics: round-bottomed pottery, made in simple basket-like shapes and decorated by impressing or dragging a comb, fishbone, or awl into the wet clay surface. The most extraordinary aspect of this pottery is its enormous distribution in both time (eighth to second millennia B.C.) and space (the entire Sahara south of the Tropic, extending along the upper Nile Valley and into the East African Rift Valley lakes region). The pottery figures prominently in two conceptions of the Saharan Late Stone Age (LSA) that have become firmly entrenched in the literature: Camps’ (32, 34) formulation of the Saharo-Sudanese Neolithic and Sutson’s Middle African Aquatic (240–242). In addition to the distinctive pottery, both formulations identify several other
defining features including bone harpoons and an abundance of fish remains, with preferential site location along ancient lakes, depressions, and wadis. Camps and Sutton suggest that these elements reflect establishment of culturally related Negroid groups throughout the tropical Sahara which endured until aridity became pronounced in the second millennium B.C. Both accommodate the appearance of domestic cattle and sheep/goat sometime after 5000 B.C. within a framework of increasing regional variation through time.

Camps and Sutton interpret the nature of the economic adaptation reflected at these widely distributed sites quite differently, however. Camps insists that pottery is directly associated with changes in food habits due to agriculture (34, p. 555). Hence, the Saharo-Sudanese tradition is identified as Neolithic, despite the admitted absence of any direct evidence prior to 2000 B.C. for cultivated plants at sites west of Lake Chad (34, p. 556). Pre-Neolithic pottery is of course well known in the Old World from the Jomon (Japan) and Ertebolle (Denmark) cultures. Sutton views pottery as part of a “soup, porridge, and fish stew revolution” (240, p. 530), representing a new technology for processing wild resources. His Aqualithic formulation is deliberately “anti-Neolithic” (242, p. 322), emphasizing the success of the aquatic way of life while refuting food production as “an inevitable or an ideal direction of development” (241, p. 32).

Both Sutton’s and Camps’ formulations have been criticized for being overly generalizing, given the considerable archaeological variability involved (62, p. 616; 149; 220, p. 71). Maire (151, p. 718) denounces as an “abstraction” the idea of a single cultural ensemble persisting several millennia over a large part of the Sahara. He suggests (149, 150) that the use of bone harpoons and wavy line (sinuous cragged comb) and dotted wavy line (impressed curved comb) pottery as “fossiles directeurs” is largely responsible for generating a misleading picture of general uniformity. Far more attention needs to be paid to the other punctate, rocker, and straight comb impressions that predominate at nearly all Saharan sites. When all ceramic elements are considered, significant local differences can appear (150). Lithic assemblages also reveal enormous intersite diversity, ranging from the blade-based industries of the Acacus (17) to the ruder flake industries of the Hoggar (150) or the microliths in the Air (226) and at Early Khartoum (13). Within the Saharo-Sudanese Neolithic and the Aqualithic formulations, however, lithic assemblages are downplayed as sources of valuable information on cultural traditions and activities (32, p. 234; 241, p. 28). Neither concept, as currently laid out, adequately reflects the complex and variable LSA situation revealed by recent Saharan research.

8000–5500 B.C. Recent excavations confirm that the earliest use of pottery at Saharan sites coincides with a humid period in the eighth and seventh millennia B.C., when Saharan lakes reached their highest Holocene levels. The early dates present the possibility that the round-based pottery was an indigenous African development (34, p. 263; 116; 117; 241, p. 29). The earliest Saharan pottery sites known so far occur along wadis in the central massifs (17, 31, 151, 207a, 207b). The accompanying lithics are regionally distinct and late Paleolithic or Epipaleolithic in character (17, p. 151; 150); bifacial retouch and polished stone are absent. All sites have significant numbers of grinding stones, apparently for processing wild grains. Hunting was also a major element of the economy. At Ti-n-Torha, Barbary sheep constituted up to 70% of the mammalian fauna in the seventh millennium (17), raising the possibility of specialized hunting or even herding (53, p. 155). There is no evidence that domesticated cattle, identified at late seventh millennium impressed pottery sites in Western Egypt (270, p. 277), had penetrated the Saharan highlands by this time.

The available evidence for the earliest pottery-using Saharan groups does not yet confirm the existence of a widespread aquatic or lacustrine adaptation in the seventh millennium, as proposed by Smith (230, 233) and Sutton (240–242) and uncritically accepted by others (148). Impressed pottery, bone harpoons, and intensive exploitation of aquatic resources are the hallmarks of this proposed early adaptation. To date, none of the Saharan highland sites has produced bone harpoons or evidence of an economy based predominantly on aquatic resources, although some fishing was done at Ti-n-Torha and Amekni (17, 31).

No evidence of this kind has yet been unambiguously dated earlier than 5500 B.C., anywhere in the Sahara. The isolated, eighth millennium date for Tamaya Mellet, referred to by Smith (231, p. 140) must be rejected for several reasons, including the absence of information on the relation of the dated sample to artifacts at the site. The harpoon and pottery sites in the Azaooud (Mali), which Smith cites (231, p. 140) as characteristic of this early lacustrine tradition, have recently been dated to ca 5000 B.C. (186). Smith’s uncertainly dated Adrar n’Kiffi site was occupied sometime between 5500–4000 B.C. (226, p. 190).

Older fishing sites may yet turn up along early Holocene lake margins. Their apparent sparseness might be accounted for in some areas by the destruction and reworking of Holocene lake deposits during subsequent wet phases. Some evidence for this exists at Tichitt (123). Alternatively, it is possible that intensive exploitation of aquatic resources by pottery-using groups in the Sahara occurred only after 5500 B.C., perhaps correlated in some still obscure way with the end of an arid phase dated between 6000–5000 B.C.

5500–2500 B.C. After this, sites with aquatic fauna including fish (Clarias and Lates especially), molluscs, hippo, and crocodile are common in the Sahara until aridity becomes locally pronounced after ca 2500 B.C. Although discussion of these sites has tended to focus on a small number of superficially similar features, as mentioned above, the differences among them remain intriguing. At middle sites like those studied by Gallay (97) and Petit-Maire's
team (186) near Arawan (Mali), aquatic resources clearly constitute a substantial portion of the subsistence base. Grindstones are rare, and other lithic elements are poorly elaborated in comparison with the bone industry, which includes harpoons.

Further to the northeast in Mali, the lacustrine sites at Erg Sakhane suggest a more diversified economy, with large numbers of grindstones for grain processing, as well as fishing and occasional hunting of ungulates (190). The sites closest to the Holocene lake at Sakhane are extensive occupation sites with stone structures and fireplaces (190).

By contrast, sites at Adrar n’Kiffl consist of small microlithic and pottery scatter associated with diatomite deposits containing harpoons and the bones of fish, crocodile, hippo, and turtle (226). At other fishing sites, like Adrar Tiouyne, bone harpoons seem to have been replaced by tiny, barbed stone points (32, p. 237). Nor are there any bone harpoons at Ameñki rock shelter in the Hoggar, where broad spectrum fisher-hunter-collectors repeatedly camped during the seventh to fourth millennia B.C. (31).

One of the most elusive questions for this period concerns the extent to which these diverse “aquatic” and fisher-hunter-collector economies were contemporaneous with cattle and ovicaprid herding economies established in the central Sahara by 4000 B.C. Did these constitute chronologically distinct adaptations as Clark (47, pp. 565–67) implies by dividing the Saharan LSA into a Prepastoral and a Pastoral phase? Or were they different ways of life, possibly overlapping in time, pursued by “quite separate peoples maintaining distinct cultural traditions” (241, p. 39)? Alternatively, pastoral and “aquatic” sites may in some cases represent seasonal aspects of a mixed economy.

Investigation of these questions hinges on the ability to ascertain when domestic cattle are present in the faunal remains at a given site. This is rarely easy, given the normally fragmented and decalcified condition of what often are small archaeological samples, and the osteological similarity of the small African buffalo (Syncerus Caffer nanus) to domestic cattle (37, p. 280). The earliest accepted identifications of domestic Bos come from the sites of Adrar Bous, where an entire skeleton was recovered (36), and Uan Muhuggiag, which produced a nearly complete frontal (168). Both samples date to the early fourth millennium B.C.

The best evidence for Saharan pastoralism continues to be the prolific rock paintings in the northern massifs of Tassili n’-Ajjer and Tadrart Acacus (140, 168). Herds of cattle numbering up to 100 are shown with domestic traits such as spotted hides and a variety of horn shapes. Some have rope leads around their neck. Unfortunately, rock art is hard to date, since associated occupation deposits cannot be assumed to be contemporary (175, p. 30) unless painted material is actually found in the deposits. This was the case at Uan Muhuggiag, where a rock slab with painted cattle broke off from a rock overhang and became incorporated in deposits dated to the early third millennium B.C. (168).

The archaeological sequence at Adrar Bous (50) sheds some light on the appearance of pastoralism in the central Saharan massifs. After occupation by nonpastoral groups, perhaps in the late sixth millennium, Adrar Bous appears to have been abandoned during a dry phase, evidenced by a fall in lake level of at least 5 m and minor dune formation. As the climate became more humid in the early fourth millennium, the site was reoccupied by pastoralists whose material culture and economy resembled, in certain aspects, that of the earlier “aquatic” sites. On this basis, Smith (226, p. 191) suggests that the early Adrar Bous pastoral assemblage (identified as part of the Tenerean facies of the Sahara–Sudanian Neolithic) does not represent a migration of new groups from elsewhere. Rather, earlier traditions have been modified to include domestic livestock. It will be interesting to see if this continuity is confirmed at other Tenerean sites, identified throughout a vast area east of the Air (60, 199, 206, 207). Unfortunately, no other Tenerean sites to date have been investigated and reported to the same standard as Adrar Bous.

Both Clark (46) and Smith (23) theorize that the shift to pastoralism was related to increasing desiccation in the Sahara after 4000 B.C. Domestication may have been a response to resource depletion near lake basin and river valley habitats which probably supported fairly high population densities by 6000 B.C. “Acquisition of stock would have made it possible to maintain and even increase population densities by providing a “stored” source of animal protein that would have significantly reduced the problem of the famine season, not only through the regular supply of meat, but also through use of milk and blood” (47, p. 567).

However, the appearance of domestic cattle in the Air during or immediately after a dry phase can be contrasted with the situation at the Nábta Playa sites in western Egypt where the earliest domestic stock is associated with climatic amelioration and moister conditions (270, pp. 160–63). Wendorf & Schild (270, p. 337) suggest that Saharan pastoralists were the source of the Nábta Playa domestic cattle, which occur in a Terminal Paleolithic context dated to the early seventh millennium B.C. Clearly, we cannot yet be sure of the date at which cattle first appear in the Sahara outside the central massifs. We are thus a long way from understanding the process by which livestock was incorporated into the subsistence economy in Africa.

The origin of early Saharan cattle is problematic as well. Epstein (82, pp. 213, 314, 555) believed that humpless longhorn cattle were introduced from southwest Asia in the late fifth millennium B.C., followed two or more thousand years later by the introduction of humpless shorthorn (brachyceros) forms. This is hard to reconcile with the early dates for cattle at Nábta Playa and the fourth millennium specimens from Uan Muhuggiag and Adrar Bous, both
of which are claimed to be short-horned (36, 168). Consequently, many consider local domestication from wild North African Bos to be more likely (36, 229). The North African Bos stock was large, with long, forward-curving horns (Bos primigenius). Another wild species, Bos ibexicus, was very similar but smaller, and may merely be the female of Bos primigenius (229, p. 492). All the domestic specimens recovered so far from Saharan excavations have been smaller, shorter-horned varieties, suggesting that the domestication process, if indigenously achieved, involved body size reduction and selection for new horn shapes and sizes. The variety of horns depicted in the rock paintings range from long and lyre-shaped (sometimes identified as a separate domestic taxon, Bos afericanus) to short and forward curving (referred to by some as Bos brachyceros, although this assignation is strenuously rejected by Muzzolini (174, 176]). Far more faunal material from both wild and domestic African Bos needs to be found and methodically examined and described (as Grigson did for European specimens (105, 106)) before we can progress in the debate over the identification of domestic taxa and their origins.

The issue of ovicaprid origins is more straightforward. No wild progenitors are thought to have existed on the continent, so sheep/goat must have been introduced from elsewhere. Possible routes include a westward spread from the Near East via Egypt (82, p. 79) or the maritime expansion of ovicaprid herders along the North African Coast. There is some evidence from North Africa that the appearance of ovicaprids there preceded domestic Bos (229, p. 495). For the Sahara, however, the chronological relation of domestic sheep/goat and cattle is unknown.

Seasonal movements were probably necessary for the Saharan LSA pastoralists, given the large daily water requirements of cattle. Several authors have speculated on the nature and extent of these movements, extrapolating from case studies of modern Saharan and Sahelian pastoralists (47, 143, 232, 234). Some differences may be expected between the LSA and the modern pastoral adaptation, of course, since the LSA Saharan environment was more favorable and supported a much higher biomass than the marginal areas with which modern pastoralism is often associated. Nevertheless, ethnographic models can be used to generate predictions concerning LSA site distributions and resource scheduling which are applicable to the archaeological record. Haaland (110, 111) has used this methodology along the Sudanese Nile, demonstrating that two contemporaneous sites differing in size, location, subsistence, and tool kit probably represented seasonal occupations by a single herding-fishing-collecting group. Some of the Saharan fishing and herding sites may have similarly functioned as separate seasonal components of an integrated economy. The massive Area shell middens created between 4500–1500 B.C. on the Mauritanian coast at sites like Tintan (183, 184) and the grain processing sites around Foum el Alba [abundant grindstones and pottery, but very few fish and no large mammal bones (186)] also need to be considered from a possible seasonal perspective. Of course, not all inter-site differences reflect seasonality. Within the West African Sahara from 5500–2500 B.C., different cultural traditions and adaptations almost certainly existed. Pastoralism, although widespread, may not have penetrated some areas of the desert for millennia after its first appearance in the central highlands. Smith (233) reminds us that hunter-collectors persisted in western Mauritania until this century.

2500–0 B.C. The humid conditions prevailing throughout much of the Sahara in the fourth and third millennia permitted substantial population growth, to judge from the density of sites occupied during this period (188). The impact on these groups of increasing aridity, evidenced locally after 2500 B.C., and possibly exacerbated by the effects of overgrazing, was profound. Sites like Adrar Bous were abandoned (2400 B.C.) as lakes dried up and cattle herds became difficult to maintain (47, p. 568). Better-watered parts of the central massifs may have provided some refuge, and scattered, increasingly nomadic groups may have remained in the lowlands. But many pastoralists presumably followed retreating water supplies toward the south. Smith (228) argues that migration of the tsetse belt southward from 17°N at this time may have opened up parts of the Sahel and Sudanic zones to colonization by pastoral groups. In the Tlemesi Valley, for example, the sites of Karkarichinkat South and North were first occupied in the second millennium by herder-fisher-collectors bearing a material culture with Saharan affinities (224). Farther east, other herder-fisher-collector groups continued to move southward, it appears, colonizing the clay plains exposed by receding Lake Chad before the early first millennium B.C. Here the early settlers at Daima (56) and Sao Blamé Radjil (137) used grindstones and bone harpoons and made clay figurines of cattle and sheep similar to those from several other roughly contemporaneous sites in the southern Sahara and Sahel (102; 125, p. 509; 227). It is possible that pastoralists penetrated even beyond the Sahel belt, using tsetse-free corridors during the dry season. The bones of small domestic cattle and dwarf goat dating to the mid-second millennium B.C. have been recovered from Kintampo in northern Ghana (37). From the culturally related, approximately contemporary site of Ntereso, Davies found almost 100 hollow-based points of a type thus far known only from the Sahara, as well as bone harpoons and dwarf goat bones (64).

Increasing aridity after 2500 B.C. in the Sahara was interrupted by a short humid episode ca 1500 B.C. (155, 164, 172). The western Sahara was particularly attractive to human occupation at this time (184). In western Mauretanial, sites with economies based on grain processing (abundant grindstones), hunting (warthog and wild ungulates), and domestic stock-herding date to this period (184, pp. 233–34; 266). So do the pastoralist settlements distributed along the escarpment between Tichitt and Walata. Munson’s work showed that
the Tichitt inhabitants pursued a mixed subsistence strategy of herding cattle and goat, fishing, hunting, and collecting for 400 years along successively lower beach ridges of the slowly desiccating lake (170, 172). The disappearance of aquatic resources from the archaeological record at Tichitt is immediately followed by the appearance of domestic cereals, a phenomenon to which we shall return presently. The rapid incorporation of cereals into the economy apparently stabilized the subsistence base and actually permitted population growth, to judge from the increased size of the archaeological sites (5, 171). Claims for the urban nature of the larger Tichitt sites (125) cannot be evaluated here in the absence of excavation reports demonstrating accepted features of early urbanism, such as permanent settlement and occupational specialization. By 900 B.C., the lake dried up completely, and sites became smaller and more ephemeral. LSA settlement at Tichitt ended by 400 B.C., possibly influenced by the arrival of horse-riding nomads from the north (171). Past this point, throughout the Sahara, occupation sites of any kind become extremely rare. The persistence of highly mobile human groups in the desert throughout the terminal LSA and Iron Age is attested mainly by thousands of stone-covered tombs from this period, as well as by rock art (165, 166, 201).

Late Stone Age in Sub-Saharan Regions

Late Pleistocene and Holocene climatic fluctuations also affected LSA populations in sub-Saharan regions, although perhaps not as dramatically as in the Sahara. The consequences of fluctuating rainfall and shifting vegetational boundaries on the economies and population density of these groups have been hard to document owing to poor preservation of organic materials and the problem of identifying sites in heavily vegetated terrain.

Unlike the Sahara, which was hyperarid and apparently unoccupied for many millennia between the last MSA and the earliest LSA habitation, the southernmost regions of West Africa probably saw an unbroken development of these industries. The LSA over much of this area is represented by microlithic industries. The date at which this technology appeared in West Africa is unknown, but it was present in central Africa by 40,000 B.P. (263). At Iwo Eleru rock shelter, located just inside the Nigerian forest, basal deposits containing a microlithic industry date to 9200 B.C. (214). The numerous geometric microliths at Iwo Eleru may have been slotted into arrowshafts to make points and barbs (220, p. 58). Clarke (52, p. 452) reminds us, however, that microliths can just as frequently be "employed in composite tools for plant gathering, harvesting, slicing, grating, plant-fibre processing for lines, snares, nets and traps, shell openers, bow-drill points and awls." The presence of a high gloss along the edge of trapezoids from Iwo Eleru is interesting in this regard (219, p. 49). A number of other sites with aceramic microlithic assemblages are known from West Africa, although the frequency of geometrics and other tool classes varies greatly from site to site (6; 84; 87; 94; 95; 205; 220, pp. 66–67; 248; 272). Few of these besides Iwo Eleru have been dated, although an important sequence at Shum Laka, Cameroon begins with a microlithic industry dated to the seventh millennium B.C. (66, p. 2). Microliths continue throughout the deposits, joined ca 5000 B.C. by large basalt blades and hoe-like tools. This is roughly contemporary with the appearance of large flaked axes at Iwo Eleru (214). The fauna from Shum Laka (monkeys, gorilla) indicates a forested environment, thereby weakening the suggestion that microlithic industries were generally confined to the savanna (220).

Microlithic assemblages accompanied by ceramics and ground stone occur stratified above aceramic microlithic industries at several widely distributed sites (84, 214, 225, 248, 274). These innovations appear by the late fifth millennium B.C. at Shum Laka (66) and by the fourth millennium at Iwo Eleru (214), Bosumpa (225), and Dutsen Kongba (274), although the dating for this last site is somewhat confused. Whether the appearance of pottery and ground stone signals a shift in economy or a movement of ideas or peoples from the north is unknown. Ceramic microlithic sites are broadly distributed in West Africa (220, p. 67) from Senegal (70) and the Malian Sahel at Ninio (90) to the forest regions of Liberia, Nigeria, and Cameroon. This technological base endured into the first millennium A.D. at rock shelter sites in the Liberian forest (94) and Sierra Leone (14).

Rather crude-looking small, quartz flake industries associated with shell middens in coastal Ghana and Ivory Coast may be related to these widespread microlithic industries. In discussing the industry from the Gao Lagoon (Ghana) midden, dated between 4000–2000 B.C. (30, p. 7), Nygaard points out that standard microlithic forms are rare, although the tools are made on quite small flakes (180). Chenukian (40, 41) uses the term "generally microlithic" to describe very similar industries from Ivory Coast middens dated from 1500 B.C. to A.D. 1300 (161) and from other coastal and inland sites. He suggests (40) that the poor quality of the quartz is responsible for the crude appearance of these industries. Near Abidjan, an aceramic industry of this type was recently dated to 13,000 B.P. (42).

Elsewhere in Ghana and Ivory Coast, another kind of LSA assemblage becomes prominent ca 1500 B.C. Characterized by enigmatic, scored soft-sandstone "rasps," polished stone axes and bracelets, and undistinguished microlithic component, grindstones, and comb-impressed pottery (91), the "Kintampo Industry" is best known from the forest and savanna of central Ghana, but its distribution also extends to Ivory Coast and southern Ghana (11, p. 64; 243). The origins of the Kintampo Industry are obscure, although the Sahara (64) and Ivory Coast (92, p. 220) have been suggested as source areas.

A handful of LSA sites have revealed nonmicrolithic industries in which large flaked or ground stone axes, picks, and celts form a prominent element (6,
44, 57, 115). Some of these large tools may have been used to dig tubers such as yams. Atherton (15) suggests that the double-edge ground or flake celt was used as a wood adze. It is interesting that ceramic assemblages of this kind apparently succeed aceramic microlithic industries at the widely separated sites of Rim (6) and Afikpo (220, pp. 64–65). The meaning of this shift, and the relation of these assemblages to the better-represented microlithic industries remains unclear.

The Origins of Agriculture

There is at present no unequivocal direct evidence for domesticated plants at any West African site before 2000 B.C. Contrary to some authors’ convictions (34, pp. 555, 567), the presence of pottery and grinding stones at many LSA Saharan sites does not demonstrate that agriculture, rather than wild grain collection, was practiced. Claims for agriculture in the Hoggar, based on two pollen grains of “cultivated Pennisetum” millet from Ameikni (32, p. 226) and one grain of a “cultivated grass” from Meniet have been discounted (216, pp. 112–13). The difficulties with distinguishing pollens of domesticated grasses from their wild relatives in African samples are widely acknowledged in the literature (142; 236; p. 520; 261). Pottery impressions from Adrar Bous of a single grain of Brachyaria (Guinea millet) and sorghum were initially believed to be cultivated forms, suggesting that agriculture was practiced in the Air as early as 4000 B.C. Both impressions are now thought to represent wild forms (217, p. 102).

The lack of direct evidence for early agriculture may of course reflect the failure of archaeologists to collect paleobotanical evidence systematically, using flotation or screening. Yet the recovery, nevertheless, from numerous Saharan sites of wild grains and seeds, particularly Celtis (hackberry) and Zizyphus (jujube) (32, pp. 234–37), presents the possibility that cultigens are not present at these sites, and agriculture is a genuinely late development in West Africa. It may be the case that, at least in the cereal grass belt of West Africa, pastoralism predated agriculture by several millennia. Such a situation would profoundly alter our understanding of the evolution of pastoralism, now generally believed to be an offshoot of agricultural systems.

So far, only three sites, all postdating 2000 B.C., have provided definite proof of domestic cereals. Investigations currently in progress on surface sherds from Karkarichinkat South (occupied between 2000–1500 B.C.) (224) have revealed impressions of both wild and domesticated pearl millet (Pennisetum americanum) and Guinea millet (Brachyaria deflexa) (233). Among the botanical remains recovered by flotation from third century B.C. levels at Jenne-jeno, domesticated Pennisetum, sorghum, and African rice (Oryza glaberrima) have recently been identified (J. Harlan and J. Scheuring, personal communication). This is the earliest sorghum yet identified in Africa, support-
Kintampo (92) were cultivated or not. Extrapolating from the presence of possible cultivars at Kintampo, Flight proposes that yam-cereal agriculture was established at the site. He further suggests that yam-cereal cultivation, developed within the savanna-forest mosaic, may be the primary form of agriculture in sub-Saharan Africa. Others consider it more likely that cereals were initially domesticated in less humid areas than the forest-savanna margin where yams were probably first cultivated. Alexander & Coursey (2, p. 421) suggest that yam cultivation may have occurred only after the idea of cultivation was introduced by northern cereal growers. It is also possible that cereal and yam domestication originated quite independently, millennia apart, in response to different factors operating on different ecosystems (196; 217, pp. 75–76).

In any case, agriculture at Kintampo sites is not improbable, given the evidence for domestic livestock (37) and a settlement pattern comprising where information is available at open-air sites, small semisedentary villages of 4–7 rectilinear wattle and daub houses (10, 64, 78, 79).

THE DEVELOPMENT OF METAL- USING SOCIETIES

Over large parts of West Africa, the LSA seems to be directly succeeded by Iron Age assemblages, with no intervening period of copper or bronze use (exceptions will be discussed below). The earliest reliable dates for the use and working of iron in West Africa come from central Nigeria, just south of the Jos Plateau. The sophisticated Nok-style terracottas associated with these early Iron Age assemblages are well known (88, 222). After some initial confusion over very early radiocarbon dates for iron objects recovered from alluvial deposits at the type site of Nok (212), excavations at nonalluvial Nok sites, such as the iron-smelting site of Taruga (86) and Samun Dukiya (85), have produced a convincing cluster of seven radiocarbon dates in the sixth to second centuries B.C. (30). Thermoluminescence dates from a number of other Nok sites also fall within this range. (30).

Very few areas outside the Nok region have produced first millennium B.C. dates for Iron Age assemblages. South of Agades, a French salvage archaeology program has located over 40 sites with iron and slag and broadly similar material culture (characteristic items include stone scrapers, axes, and points, as well as a popular everted-rim pot decorated overall with twine roulette). Dates on charcoal from three of these sites ranged from the fifth to first centuries B.C. (104). Further east, in the Termit Massif, smelting sites at Do Dimmi date as early as the seventh century B.C. (30, p. 10; 197, p. 184; 199). Evidence that iron technology had spread into Mali comes from Jenne-jeno, where the earliest traces of permanent settlement found so far date to the third century B.C. and are associated with iron and furnace slag (147). Unlike the Niger sites, however, stone tools other than grindstones are absent. By the end of the first millennium B.C., iron is also attested in northern Ghana at Daboya in an assemblage similarly devoid of lithics, save grinders. As one of the few known sites comprising both LSA and IA deposits, Daboya may prove crucial to our understanding of this transition in West Africa (244; P. L. Shinnie and F. Kense, in preparation).

Origins of Metal Technology

The origins of this early iron technology are not well known. Some authors have seized upon the third and second millennium B.C. dates from the Nok Valley gravels to argue that iron-smelting was independently invented in central Nigeria ca 3500 B.C. (75, 77). This hypothesis assumes that the early radiocarbon results accurately date the iron artifacts at Nok. Most authorities agree, however, that the wide range of dates is attributable to alluvial mixing.

One of the major obstacles to a theory of independent discovery of iron in West Africa has been the apparent lack of any metallurgical tradition preceding the use of iron on the subcontinent. The role of copper smelting in the development of sophisticated pyrotechnology necessary for the reduction of iron ore has been recently emphasized (271). This view holds that the discovery of iron metallurgy was the ultimate consequence of the use of iron ores as a flux to facilitate the separation of molten reduced copper from copper ores (39). The discovery process must have been a long one. Since iron, unlike copper, was usually smelted below its melting point in antiquity, it bore little compelling resemblance after smelting to its final, usable form. Much heating and forging were required to achieve a utilitarian metal. Given the complex nature of iron, it is hard to credit the suggestion that knowledge of smelting could have been gained in West Africa through the experience of pot-firing in pits (77).

The recent discovery of early copper-using sites in the region of Agades has rekindled the question of a West African metallurgical tradition culminating in the discovery of iron. Sites with surface evidence of a copper industry have been located in two regions of Niger: northwest of Agades around Azelick (23), and southeast of Agades with a very important series of sites at Afunfun (22). Thirty-four C14 dates, many on charcoal from furnaces, reveal that copper working in these two regions was practiced throughout the last two millennia B.C. (104).

There are several interesting features of this enduring metallurgical tradition. First, none of the hearth pits filled with charcoal and copper drops is associated with any archaeological deposits suggesting permanent settlement. Associated pottery is strongly reminiscent of the Saharan LSA pottery in the same region. Stone tools continue to be used alongside the small copper pins, spatulas, and points (104). Second, throughout its 2000 year duration, the industry appears to have exploited the abundant native copper in the two regions investigated.
Metallurgical analyses of copper and slag from numerous hearth pits have revealed no evidence of copper ore smelting. Rather, metallic copper was apparently extracted from local rocks by crushing and then melted (260). Objects were fashioned by the use of simple one-piece molds or by heating and working. A similar copper industry has also been documented in western Mauretania dating from the ninth to fifth centuries B.C. (133). In Niger, the presence of arsenic as a natural impurity in the copper made the worked metal significantly harder and more useful than pure copper. The discovery of several bronze pieces may indicate that the alloying of copper with tin (from the neighboring Air region) may have soon been locally achieved, possibly by adding tin to the crucible under reducing conditions (259). Alternatively, the bronze pieces may be imports. The early copper industry in Niger thus lacks advanced pyrotechnology, such as copper smelting and the use of available iron ores as a flux. In the opinion of Tylecote (259) and van der Merwe & Avery (262), this argues against the local development of iron technology out of copper extraction.

It remains far more likely that iron was introduced to West Africa from the outside. It was earlier believed that a probable source area for the diffusion of iron technology was Meroe in the Republic of Sudan. Immense slag heaps, some 150 m long, still dominate the site, attesting to Meroe's importance as an early industrial center. Inspired by these mounds, the myth of diffusion from Meroe persisted for years in the virtual absence of direct supporting evidence (256). The slag mounds now appear to date to the first two centuries A.D., and the furnace type involved was a Roman-type, slag-tapping shaft furnace (258). Earlier iron smelting at Meroe, documented from the third century B.C. and perhaps earlier (223), was achieved in small bowl furnaces. The contemporaneous low-shaft Taruga furnaces are more technologically advanced than the earliest Meroitic furnaces (257).

It is more probable that West African iron technology was introduced from North Africa where iron-using Phoenicians founded trading colonies like Carthage and Leptis Magna from the ninth to seventh centuries B.C. Carthaginian-style bronze jewelry found in a sixth century B.C. context in western Mauretania suggests the existence of contacts between Punic North Africa and the Southern Sahara (132, p. 168; 134, p. 214). Berber tribes, such as the chariot-driving Garamantes mentioned by Herodotus, may have been the Saharan intermediaries through whom the knowledge of iron passed (162, pp. 277–86). Some authors suggest that the distribution of rock art depicting horse-drawn chariots in the Fezzan, Tassili, Hoggar, Adrar des Iforas, and Western Mauretania outlines the route of north-south contact [for full bibliography see (35)]. Views on the nature of these contacts vary: some believe they were regular (194) and involved extensive Phoenician trade (181). Others deny that regular trans-Saharan traffic or significant trade was possible before the introduction of the camel in the early centuries A.D. (99, 136, 162). Camps (33) rejects the idea of chariot "routes" altogether by noting that the concentration of rock art along a north-south axis reflects the distribution of rocky massifs and outcrops in the Sahara rather than any system of prehistoric highways. That goods from the Mediterranean world actually did penetrate south of the Sahara in the first millennium B.C. is demonstrated by two Hellenistic glass beads from first and second century B.C. deposits at Jennejeno in Mali (S. Goldstein, personal communication). This discovery unfortunately sheds no light on how they reached the Niger.

In any case, a Punic source for West African metallurgy cannot be regarded as firmly established. In the absence of comparative data on iron furnaces and technology in Punic North Africa, it can only be regarded as "the least improbable view to date" (62).

Other important questions about early iron in West Africa are now being raised. Once established by 500 B.C. in Niger and Nigeria, for example, how did iron metallurgy spread? A number of factors, including usefulness of iron in the local economy, access to good quality ores, and the cultural costs of working iron or trading for finished objects may have influenced the speed of iron adoption in different areas (1). Sites with both LSA and Iron Age (IA) components are clearly the most useful for dating the transition to iron use in a given area, but few of these have been excavated. At several rock shelters in Sierra Leone and Liberia, iron was not present in levels earlier than the late first millennium A.D. (14, 94). Iron may be similarly late at Dainam in northeastern Nigeria, where the LSA-IA transition appears to coincide with a significant decline in bone tools and ground stone axes in levels dated to the fifth century A.D. (55). Dating of levels directly associated with iron has been problematic, however, permitting no unambiguous conclusions about its chronology (56). Currently, the most reliable radiocarbon dates for iron in the region of northeastern Nigeria, southern Chad, and northern Cameroon are all later than 400 A.D. (61). The third century A.D. date cited by Calvocoressi & David (30) for iron objects associated with stone ax factory debris at Tsanaga II is now regarded sceptically by Mari jaic (158).

Categorical statements about the spread of iron in West Africa cannot be made on the basis of the small number of systematically excavated and dated sites with IA components. Nevertheless, available data are consistent with a mosaic pattern of acceptance, involving different local processes and chronologies (162, p. 332). Late Stone Age "survivals" were of course known up until this century in parts of Africa.

Local innovation in early African iron technology has recently emerged as an exciting and important issue. Even if West Africa may have adopted the earliest iron technology from a Mediterranean source, it scarcely did so passively. Recent research suggests that local metallurgists quickly elaborated on the
technology, possibly incorporating ideas from existing copper extraction. The early Taruga smelting furnaces, for example, bear a strong resemblance to the late Copper Age furnaces at Afunfun (259). By the end of the first millennium B.C., an extraordinary variety of furnace designs and smelting approaches had been developed in West Africa, including bowl furnaces, bellows-blowed shaft furnaces, and induced draft furnaces. There is now evidence from West Africa that some of these early furnaces were producing steel.

The process by which some African smelters created a bloom of high carbon steel directly in the smelting furnace has been recorded ethnographically among the Haya of Tanzania and recreated ethnoarchaeologically by Schmidt (209). A critical innovation of the process was the insertion of tuyeres deep into the blast so that the air inside was preheated, permitting melting temperatures as high as 1500°C. to be achieved. Products of this process were first identified archaeologically in Tanzania, possibly dating to the first millennium B.C. (209). Now artifacts of medium carbon steel with a homogeneously carbonized structure have been identified in second century B.C. contexts at Jenne-jeno, Mali (R. L. Tylecote, personal communication). Similar material has also been identified at Taruga, although most of the pieces analyzed were forged products of soft wrought iron (262).

Tylecote (259) and Willet (273) suggest that metallurgical innovation, particularly in copper technology, may have continued through the first millennium A.D. It is possible that local experimentation with copper smelting techniques (annealing, casting, chasing) and alloys culminated in the sophisticated cire perdu masterpieces dated as early as the ninth century at Igbo Ukwu (213).

Although many questions remain concerning the spread and elaboration of iron working, we can state with certainty that acceptance of the technology had far-reaching consequences for West African societies. In those areas lacking suitable stone for adzes and hoes, iron agricultural tools may have opened up large amounts of new land to tillage. The creation of demand for high-quality iron or ores probably fostered intensified trade contacts, with the concomitant appearance of specialized iron production centers or the elaboration of specialized castes of smiths. In many West African cultures today the blacksmith caste is an institution of fundamental significance to the texture of society. Blacksmiths figure prominently in the creation myths and oral traditions of many groups and are often regarded as imbued with mystical powers (12). The origins of social stratification in parts of West Africa may thus be intimately linked to the introduction of iron. Of interest is de Barros' current archaeological study of the effects of iron production in the Bassar region (Togo) on settlement patterns, trade, and specialization (65; P. de Barros, personal communication).

The potentially dramatic impact on fragile West African environments of fuel-hungry smelting industries has been discussed by Goucher (101) and Haaland (109). Schmidt & Avery (209) suggest that the necessity for fuel conservation may have sparked technological innovation in some areas.

EMERGENCE OF COMPLEX SOCIETIES BEFORE 1000 A.D.

From the beginnings of iron use until the historical period is inaugurated by Arab penetration of the West African Sahel at the end of the first millennium A.D., we know little in detail about the evolution of West African societies. Yet it is clear that changes of great importance were occurring in certain regions during this period, transforming the noncentralized societies of the Late Stone Age into highly stratified systems with power and wealth concentrated in the hands of god-like kings. By 1000 A.D., large areas of West Africa were organized into empires, such as the Empire of Ghana, replete with armies, cities, craft industries and long-distance trade. When and why did this happen? For many years it has been widely assumed that much of the impetus for the development of West African complex societies came from outside stimulation of the indigenous economy as North African Arabs initiated, in the late eighth century A.D., trans-Saharan trade for gold and slaves from sub-Saharan regions. During the past decade, however, controlled excavations incorporating radiocarbon dating programs have revealed evidence of complex social stratification, long-distance trade, and even urbanism in West Africa by the mid-first millennium A.D. (72).

Work by several different research teams at funerary monuments, occupation sites, and specialized iron production centers along the middle Niger has provided insights concerning the emergence of complex societies during this period. Excavations at the massive tumuli (up to 150 m diameter and 15 m high) in the lake region of the lower Inland Delta have produced four radiocarbon dates between A.D. 600–1000 (160, p. 110; 208). These erosion-resistant monuments, with their deliberately fired surfaces, were first investigated early this century. Desplagnes' excavations resulted in the only published excavations to date of burial chambers within the tumuli (160, pp. 96–77). The rich burials at El-Oualedji were accompanied by iron tools and jewelry, copper bracelets and earrings, pottery and food offerings. The Killi mound contained 25–30 adults and children who apparently had been pushed or thrown into the tomb. These findings of a wooden burial chamber with rich grave goods and probable human sacrifices closely resemble the burial ritual for the pagan king of the Ghana Empire which the Arab geographer al-Bakri described in 1067 A.D.

At Tondidaro, tumuli dated to the seventh century are associated with extensive alignments of megaliths with carved phallic and geometric motifs (160, pp. 129–34). The date of the megaliths is unknown. Other associations of
tumuli and megaliths occur throughout the lakes region, but Tondidaro is the most important. Unfortunately, it was vandalized by French officials earlier this century and little remains in situ for archaeological study.

Pottery very similar to the red-slipped tumulus pottery with its white painted or comb-impressed geometric designs has also been found in the upper Inland Niger Delta at the occupation site of Jenne-jeno. Not far from this site, probable funerary tumuli have been discovered but not yet excavated (147, p. 361). In addition to providing evidence of cultural contacts along the Niger in the first millennium, the 5.5 m stratified sequence at Jenne-jeno has yielded insights into the processes by which certain West African cultures expanded and became markedly more complex during this period. According to 28 radiocarbon dates (144), the site represents over 1500 years of continuous Iron Age occupation. Recent excavations confirm earlier claims that the site expanded rapidly in size in the first millennium A.D., reaching a maximum area of 33 hectares by A.D. 800, and then experiencing gradual abandonment after 1150 (145). This pattern of growth and decline is mirrored by hinterland settlements around Jenne-jeno, where site density in the period 700–1100 was almost ten times greater than the density of occupied villages today (147). Most of these sites were apparently abandoned by 1400, for unknown reasons.

Jenne-jeno’s location at the interface of two major ecotopes (dry savanna and sahel) on a floodplain lacking important resources encouraged interregional exchange. Iron and stone sources at least 50 km distant occur in the lowest deposits. The appearance of copper by 400 A.D., presumably from the nearest Sahara sources, and of savanna gold by 800 A.D. brackets a period of rapid site expansion, culminating in construction of a city wall 2 km long. It has often been assumed that long-distance trade in gold and copper between Saharan and sub-Saharan regions did not really develop until the Arabs organized the “Golden Trade of the Moors” (26). The Jenne-jeno evidence suggests the existence of an earlier indigenous trade. This is supported at Marandet in the Air, where sixth and seventh century dates were obtained on charcoal from refuse heaps containing over 40,000 crucibles used in working a remarkable variety of copper alloys (38, 141, 197, 273). Unfortunately, Lhote’s work at this important site has been severely criticized (96).

Early development of the middle Niger region as a major transport axis would account for the growth of Jenne-jeno, at the southwest extreme of the Inland Delta, as an exchange point for Saharan copper and salt, and savanna gold, iron, and agricultural produce. The appearance of rich tumuli in the lakes region would also reflect the effects of trade, possibly among groups in a position to control the flow of goods. The homogeneity of material culture throughout a large area of the Inland Delta from 700–1400 A.D. may indicate a degree of administrative control, ensuring a stable political environment for exchange (147, p. 443). Research by Bedaux et al (21) and Barth (19) at sites up to 100 km downriver from Jenne-jeno has revealed a material culture, radiocarbon dated between 900–1400 A.D., that is virtually indistinguishable from contemporaneous items at Jenne-jeno. Similar, though not identical, material comes from the Mema region bordering the Inland Delta (109, 182, 249). Haaland (109) suggests that the region’s iron industry, dated to 800–1150 at sites associated with huge slag mounds, was controlled by the Empire of Ghana. Excavations conducted by Robert and Berthier at Koubi Saleh, the putative capital of the Empire, may verify the existence of relations between that town and the Mema/Middle Niger. Findings presented so far indicate that an urban center had emerged at Koubi Saleh by the early ninth century. Pre-urban occupation deposits, dating back to the seventh century, extended a meter under the early urban levels (24, 83). It seems likely that the emergence of specialized industrial centers in the Mema, the consolidation of the Soninke Empire of Ghana, and the rise of Soninke trade towns like Jenne-jeno along the Niger were all intimately related to the development of indigenous long-distance trade in the first millennium A.D. (146).

A strikingly similar picture of first millennium developments is beginning to emerge along the Senegal River, although far fewer details are available. At mound sites like Sinthiou Bara along the middle Senegal, excavations by Ravisé and Thilmans have revealed that copper, brass, and silver were reaching the area as early as the sixth century A.D. (76, p. 462). Copper-based bracelets and small bells from undated sites in southern Mauretania and from sites farther down the Senegal River closely resemble the Sinthiou Bara material (252), possibly reflecting long-distance trade networks (72, p. 162). Somewhere along this stretch of the middle Senegal, the trading empire of Takur arose by the tenth century.

In the Ferlo region south of the river, numerous iron-smelting sites have been inventoried but not yet investigated (159). Throughout the northwest quadrant of Senegal, earthen funerary tumuli called mbanar abound. Over 6800 monuments, varying in size from 3 to 80 m in diameter and up to 10 m in height, have been located at a total of 1446 sites (159). These figures do not include the many shell tumuli constructed atop shell middens in the Sine-Saloum estuarine region (71). Excavations of earthen tumuli at Ndalane and Rao and several shell tumuli at Dioron Boumak revealed collective inhumations often accompanied by grave furnishings of iron, copper, brass, and gold (68, 71, 130). The few available radiocarbon dates suggest a tumulus chronology encompassing the eighth to twelfth centuries (68, 76).

Megalithic funerary monuments overlap with tumuli in both time and space. Available dates range from the sixth to eleventh centuries A.D. and later (69), refuting earlier ideas that the Senegambian monuments derived from Iberian megalithic influences in the second millennium B.C. (119). Throughout the megalithic zone, the basic pattern of a circular funerary monument associated
with one or more megalithic standing stones placed several meters to the east recurs. The nature of the circular monument varies, however. While earthen tumuli are most common in the northwest part of the megalithic zone, circles up to 10 m diameter of shaped laterite megaliths are well known in the central part. Farther east, stone tumuli and stone circles appear, constructed out of fist-sized blocks of unworked laterite. Since standing stones may or may not be associated with any given monument, many of the 16,000+ "megalithic" monuments known have no megalithic components. The frequent co-occurrence of two or more types of monument at the same site nevertheless suggests a close linkage among earthen tumuli, megalithic circles, stone circles, and stone tumuli. This is supported by the close resemblance of "megalithic" and "tumulus" pottery in the area where these distributions overlap (98). Hill (120) proposes grouping all these monuments within a single Senegambian Monument Complex. Structural variations among monuments may reflect symbolic, functional, or temporal differences, but with systematic excavations accomplished at only five out of 1000 known sites, it is too soon to draw meaningful conclusions.

Thilmans et al (253) and Gallay (98) have excavated several different types of megalithic monuments, revealing substantial variability in burial treatment. At Tiékné-Boussour and Kodiam, individual monuments contained one to six burials unaccompanied by grave goods (253). Farther west, three excavated megalithic circles at Sine Nguen contained collective inhumations of up to 59 individuals, including men, women and children. Some wore iron or copper jewelry or were accompanied by iron spears. Many appeared to have been simultaneously interred, suggesting human sacrifice on a considerable scale (253).

The first millennium dates for commerce, towns, and labor intensive funerary monuments in Mali and Senegal have necessitated reevaluation of discoveries earlier regarded as anomalous. At the site of Igbo Ukwu, situated on the forest fringe of eastern Nigeria, Shaw's excavations uncovered a stunning array of cast bronze vessels and finely crafted copper objects (213, 218). One of the excavation units revealed the burial chamber of a high-ranking individual, whose regalia included a bronze staff and wisk, chased copper pectoral and crown, and over 100,000 glass beads. Wood from the burial chamber has been dated to the ninth century A.D.

The large quantities of imported glass beads imply trading connections reaching into the Mediterranean world. The four ninth-century radiocarbon dates for Igbo Ukwu were initially dismissed by many scholars as centuries too early for such trade contacts to have reached the Nigerian forest [see (215) for discussion]. These dates no longer seem implausible in light of the growing evidence for an extensive pre-Arab trade (72, 144, 146, 147, 195). The rapid and early dispersal of North African trade goods far into the interior suggests that Arab commerce was effectively grafted onto a preexisting infrastructure of

Saharan and sub-Saharan networks. A similar model might be profitably applied to other Nigerian forest sites, such as Ife, where a prospering first millennium trade in kola may have contributed to the emergence of Ife by 1100 as a religious center supporting a royal court (221). Additionally, well-known sites such as Niani (89) and some of the larger "Sao" sites (137-139) may reveal comparable developments in the late first millennium once their early Iron Age chronologies are better understood. It is increasingly clear that much of West Africa's rapid development in the centuries after Arab penetration can be properly accounted for only in the context of earlier, indigenous processes of trade expansion, increasing social stratification, and urbanism.

CONCLUSIONS

A recurring theme in this review is the inadequacy of simplistic stadial models for West African prehistoric cultural change. As more archaeological and palaeoecological detail is known, the true complexity of events emerges. Palaeoclimatic researchers have jetisoned the notions of Glacial-Pluvial correspondence and simple latitudinal isopycnal shifts during major episodes of climatic change. The picture emerges of significant regional and even intraregional variability during all major periods. It is no longer advisable to predict the ecological profile of one area by reference to that of another hundreds much less thousands of kilometers away, regardless of currently similar conditions.

With the decline of these broad palaeoclimatic schemes, existing overly generalized stadial concepts of West African prehistory seem increasingly inappropriate. Formulations such as the Saharo-Sudanese Neolithic and the Aqualithic currently obscure significant variation in the evidence of local adaptations. Similarly, it is only by appreciating the local scene that we can understand the noncentric, mosaic pattern of indigenous food crop domestication. Assumptions about the spread of iron technology may also require revision. Rather than diffusing along a broad, ever-expanding front, iron may have been adopted early in some places, late in others, and in significant ways subjected to intense innovative impulses at the local level. The role played by an early, possibly indigenous copper technology in fostering this complex process of metallurgical adaptation needs investigation. And likewise, the picture of early complex societies and institutions recently has radically changed. Gone are the obligatory outside stimuli to states, urbanism, and long-distance trade. These developments now appear very early in an entirely comprehensible local context.

Future directions of West African prehistoric research will require new methodologies and new terminologies. With the decline of the monolithic models of implied pan-continental cultural stages we now need intensive, multidisciplinary research on local processes of change and adaptation. All
convincing and enduring conclusions about processes of change are built upon detailed cultural historical sequences. West Africa, however, has been so underpopulated by prehistorians in comparison to Europe, the Americas, and much of Asia that we still lack the fine-grained chronological control on local processes that are taken for granted in those other continents. But sterile stadial culture histories will not work here; terms such as the MSA or LSA (and stratification of those stages into "early," "middle," etc) may reflect the archaeo- logical reality of some parts of the world, but they inadequately describe West Africa's complex evolution. Research into West Africa's past is embarking in exciting directions as a newly emergent corps of West African archaeologist, with a demonstrated interest in documenting the regional context, collaborate with international interdisciplinary research teams. This collaboration will affirm West Africa's position as one of the world's most dynamic and individual theaters of prehistoric process and change.

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