Thesis By

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THE PALAEOLITHIC SETTLEMENT ARCHAEOLOGY OF SELECTED PARTS OF BIGHT OF BENIN, WITH REFERENCE TO AJIBODE LOWER TERRACE SITES IN IBADAN, NIGERIA

JUNE 2004

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DEDICATION

TO THE MEMORY OF:

- Late Professor Bassey Wai Andah, my former Academic Supervisor until his terrible and untimely demise on 22 December 1997. My consoling and eternal souvenir is that 'great minds like his discuss ideas, while small minds discuss people, and average minds discuss events'.
- Venerable late Professor Cheikh Anta Diop, whose lifetime work nutured my mind in the late 1970s about the worldwide importance of African Archaeology, and whose personal advice in the 1980s spurred my involvement in Stone Age Archaeology. My hope and conviction are that present and future generations will learn from his life that 'on the contrary to him people who watch things happen are only story tellers, while people as well as him who make thinks happen are undeniable creators of history, and such creators of history are immortal achievers'.
- My early missed father Seko Baagudu (alias Bio Kudi) whose sudden demise forty years ago taught me to trust in an African proverb which says that it is "Better to live one day like a lion than a hundred years like a sheep".

CERTIFICATION

I hereby certify that this work was carried out by Mr O. Bagodo, B.A. (Hons.), M.A. (Université Nationale du Bénin, Abomey-Calavi, Bénin Republic) in partial fulfilment for the award of Doctor of Philosophy Degree in the Department of Archaeology and Anthropology, Faculty of Science, University of Ibadan, Nigeria.

Signed ....

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ABSTRACT

This thesis is a study of the Palaeolithic Settlement Patterns of selected parts of the Bight of Benin in the Guinea Region of West Africa, with reference to Ajibode Lower Terrace Sites, N.E. Ibadan, Southwestern Nigeria.

Multidirectional approaches, multivariate analyses and alternative interpretations were employed with a view to shedding light on some conceptual issues, outstanding field problems, and questionable technological and typological analyses of local and regional West African Middle Stone Age (MSA) artefact-assemblages.

The field problems include the controversial interpretation and dating of units and sequences of secondary stratigraphic contexts at open sites such as Ajibode 'Umaru Farm' (AJB UMF) fluviatile Terrace Site, whilst the conceptual issues are centred around the need to clarify specific concepts such as environment, off-site reconnaissance, on-site survey, the Bight of Benin Region, the Dahomey Gap Scrub, the Lower Mono Basin and the Ajibode fluviatile Lower Terrace. Field investigations were carried out with a view to achieving these research aims, objectives and strategies.

Visits to the Central Niger Delta area in Southeastern Nigeria and to the Cape Three Points area in Southwestern Ghana were undertaken with a view to

recording GPS readings for a proper demarcation of the eastern and western limits of the Bight of Benin Region respectively.

Off-site reconnaissance work in the eastern Lower Mono Basin in the central part of the Dahomey Gap Scrub was aimed at uncovering and locating Palaeolithic sites, and also as a means of contributing to a better understanding of the problem of chronostratigraphic build-up of the 'Continental Terminal' and 'Terra barro' as local Quaternary morphogenetic sequences. Detailed on-site surveys, excavation and control cuttings were carried out at Ajibode and its environs, an earlier proclaimed area with in situ Palaeolithic finds.

Results obtained from the excavation and control cuttings at AJB UMF Site revealed the following: (i) Laboratory analyses of the sediment samples showed similarities in the physico-chemical characteristics and depositional processes with those earlier observed in the Orita and Agodi Members of the Bodija Formation; (ii) as with the Ibadan Railway cutting and the Olude Araromi sequences, the AJB UMF Site stratigraphic units could not resolve the outstanding dating issue; (iii) the AJB UMF Site chronostratigraphic Sequence showed Layers C and E as two occupational levels of the same facies of stone artefact-assemblage; (iv) in spite of the insufficient quantity of the sampled diagnostic tools, the typological and technological attributes of the artefact-assemblage strongly suggest that they represent a local facies of the Middle Stone Age (MSA) /Middle Palaeolithic (MP) cultures in the Bight of Benin Region.

The tools and blanks were observed to be made of a local variety of quartz and quartzite raw materials which were hardly and grossly trimmed. Subsequently, the tool-manufacturing technology appear to resemble what is emphasized elsewhere in the sub-Saharan Africa as a "ready-to-use-technology" which had been described as a sub-Saharan African MSA technological know-how that started some 200,000 years ago and was based upon half as large regularly formed flakes whose robust edges did not need strengthening by secondary trimming.

The "floating chronology" was adopted as a compensation for the lack of chronometric dates for the AJB UMF Site MSA patterns. A scenario of these local MSA patterns was matched with the Bight of Benin Regional Perspective in relation to the palaeoenvironmental changes established after the chronology of Isotope Stages 1 to 6 which are retrospectively ranged from the Early Holocene to the end of the Middle Pleistocene (i.e. between 12,000 BP and 150,000 BP).

During this long period of alternating humid/wet palaeoenvironmental changes in the Bight of Benin Region, the MSA lifeways occurred at AJB UMF Site probably in forest and woodland conditions. It was hypothetically suggested that changes in technology, subsistence-settlement patterns and social lifeways did probably occur on the basis of transitions, adaptations and advances rather than by radical surviving adjustments to perishing situations such as the forcing aridity factor.

The Ajibode MSA Sites deserve proper preservation and management for the purposes of education, public information and tourism. For the future, there is the need to extend excavations and control cuttings at AJB UMF Site for a better identification, interpretation and understanding of the artefact-assemblage. There is also the need to excavate other related Palaeolithic sites in the Ona River Terrace Sequences with a view to obtaining a more representative and complete picture of the entire Palaeolithic Sequence in Ajibode area. This exercise should be multidisciplinary in nature.

KEY WORDS: Bight of Benin, Settlement Archaeology

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CHAPTER ONE

RESEARCH RATIONALE AND METHODOLOGICAL FRAMEWORK

1.1 RESEARCH AIMS, OBJECTIVES AND STRATEGIES

The aim of this study is to tentatively review methodological issues and update information data for a better understanding of the Paleolithic Settlement Archaeology in the Bight of Benin. For this study, the Lower Mono Basin in the Dahomey Gap Scrub is selected for an off-site reconnaissance, while the Ajibode Lower Terrace Sites in the Northeastern area of Ibadan Metropolis is selected for on-site detailed surveys.

In order to achieve the ultimate goal of the work, the initial research objectives and strategies had to be adjusted through time (i.e. from 1992 to 1997, and 2001 to 2002) and space (from Lower Mono Basin to Ajibode Lower Terrace Sites).

1.1.1 Research Aims and Objectives

The research proposal was initially entitled "Archaeological Reconnaissance of the Lower Mono Valley: A Contribution to the Study of Prehistoric Settlement in the Southern Part of Benin and Togo Republics". This study was undertaken as part of the Benin-Togo Archaeological Rescue Project, titled "Mono Valley Archaeological Rescue Project" (i.e. ARSAVAMO Project) and under the joint directorship of Dr Alexis Adandé on behalf of the Beninoise Archaeological Team (i.e. Equipe de Recherche Archéologique Béninoise, or E.R.A.B.) and Mr. Dovi Kuévi representing the Togolese Archaeological Research Programme (i.e. Programme Archéologique Togolais, or P.A.T.) (ERAB/PAT/ARSAVAMO, 1990; ERAB/ARSAVAMO, 1991a-b).

It is within the ambit of the ERAB/PAT/ARSAVAMO Project that the idea and rationale of the first research topic was conceptualized. This project was initially intended (Bagodo, 1993: 28-29):

(i) to shed light on the past and present environmental setting of the Southern Bénin and Togo Republics in the peculiar bioclimatic context of the Dahomey Gap Scrub (cf. Section 1.3.2, below);

(ii) to critically assess propositions on early human occupations in West Africa, as highlighted by some archaeologists (Davies, 1964: 94-97; 1967: 104) and Shaw (1992: 618-619) that the Dahomey Gap's palaeoenvironments may have favoured Acheulian and post-Acheulian/Sangoan settlements and biota resources exploitation from the River Niger Valleys to the Guinean coastlands;

(iii) to examine the relevance of these propositions in the context of the Lower Mono Basin (cf. Sections 1.3.3 and 3.1.1).

Unfortunately, no potentially valuable archaeological context of Stone Age(s) site was identified during the 1990-1991 and 1993-1995 field seasons in the Eastern Lower Mono Basin (Bagodo, 1993; 1994a-b). During the same period, Palaeolithic occurrences were discovered in Ajibode area, N. E., Ibadan, Southwestern Nigeria (Andah and Momin, 1993; Andah 1995a; Momin, 1995).

In view of this situation, the area of this research was relocated from the Lower Mono Basin to Ajibode area. Consequently, the initial research topic had to be reframed in order to reflect the modification in geographical location. Thus, the Lower Mono Basin was designated as the off-site while Ajibode area and environs were regarded as constituting the on-site location. In line with this adjustment, the topic was modified to: "The Palaeolithic Settlement Archaeology of Selected Parts of Bight of Benin, With Reference to Ajibode Lower Terrace Sites in Ibadan, Nigeria."

The aims and general objectives of the modified research topic are as follows:

(i) to delineate the eastern and western limits of the Bight of Benin in the spatial context of the Guinea Region of West Africa, with a characterization of the present ecosystems of both the "Dahomey Gap Scrub" and the "Southwestern Nigeria" that encompasses Ajibode area in Northeastern Ibadan Metropolis;

(ii) to review the indicators of the Quaternary environmental setting of these two specific parts of the Bight of Benin; and

(iii) to inter-relate this past environmental setting with the local and regional chronosequences of Palaeolithic subsistence-settlement patterns, with special reference to the artefact-assemblage of the Ajibode Lower Terrace Sites.

These research aims and objectives are related to the study of the topography and drainage of the Ajibode Terraces, both of which are the by-products of the Quaternary evolution of River Ona and its Northern confluent tributaries such as Tabi, Orogun, Lalewon, Yamoje and Odo-Ona Streams. This was done with a view to:

(i) observe, delineate and describe the specific setting and succession of the toposequences (i.e. hills, plains, terraces, valleys, river beds) and chonosequences of the Bodija Formation in Ajibode area;

(ii) relate the area's remnant topographic patterns to the current erosional processions and also relate the latter to the exposed bedrocks such as augen/banded gneiss, quartzite and granite, with a view to shedding light on the evolution of the incised valleys, meanders and gullies of the dentritic and trellised drainage;

(iii) reassess and/or confirm the location of the successive 195 m, 210 m and 225 m (a.s.l.) terraces that were initially identified as containing litters of stone artefacts (Andah and Momin, 1993; Momin, 1995; Andah, 1995a);

(iv) examine the chronostratigraphic context of the litters of stone artefacts and attempt a correlation with the already established Bodija Formation's chronostratigraphic sequences in Ibadan (Burke, 1970; Burke and Durotoye, 1970; 1971) and at Olude-Araromi (Andah and Ajayi, 1981); and

(v) finally select two areas for detailed surveys and systematic surface collection of lithic artefacts. In this respect, Ajaiye Hill (NNE, Ajibode) and Umaru Farm on the left bank of upper Yamoje stream (NW, Ajibode) are selected for the purpose of test-pit and excavation.

1.1.2 Field Research Strategies

In order to achieve the aims and objectives of this piece of work, certain strategies were adopted and adapted to tackle specific problems. For instance, the execution of the off-site investigations in Eastern Lower Mono Basin has necessitated the organization of multidisciplinary workshops prior to the successive field sessions from 1990 to 1995. This strategy was dictated by the strong need to uncover spots with stratigraphic units that contain stone artefacts. The ARSAVAMO Project's first field expedition from 21st August to 4th September, 1990, the second from November 12th to 27th 1990 and the third from

January 25th to 28th 1991 were carried out in compliance with this proposed strategy.

Our proposed strategy also consisted of field trips and brain storming sessions by a number of field archaeologists who are well versed in the contextual problems of the West African Stone Age Sites for proper advice (ERAB/PAT/ARSAVAMO, 1990; Bagodo, 1993: 29-30). As a participant in the last fieldwork in Eastern Lower Mono Basin, in April, 1995, Andah unequivocally advised that more time, means and efforts should be mobilised for appropriate Palaeolithic investigations in the area. Consequently, it was recommended that for a meaningful doctoral research work, attention should be focussed on the uncovered Palaeolithic occurrences at Ajibode since 1992 (Andah and Momin, 1993; Momin, 1995; Andah, 1995a).

During the year in suspense, i.e. between late 1995 and late 1996, a paper entitled "Lower Mono Basin (Southern Bénin/Togo, West Africa): Quaternary Chronostratigraphy and Archaeological Aspects" was presented at the 10th Congress of the Pan African Association for Prehistory and Related Studies, held in Harare (Zimbabwe), from 18th to 23rd, June 1995. This was done with a view to receive useful comments and relevant suggestions for a proper study of the lithic materials (Moutari-Mahamane, 1992) in relation to their sparse distribution in the lithostratigraphic context (Bagodo, 1993; 1994a-b-c).

With particular reference to Andah's advice and the comments of some scholars in Harare in 1995, and as a subsequent follow-up, surveys and excavations were carried out from late 1996 to middle 1997 at Ajibode and its environs. The six-month-period (December 1996 to May 1997) essentially consisted of series of alternate field and discussion sessions. These 1996/97 on-site detailed surveys at Ajibode and its environs (e.g. Olude Araromi) lasted up to March, 1997. This was done with a view to complementing similar previous field investigations that were undertaken from January to March 1992, and from December 1993 to March 1994 as part of the University of Ibadan's Archaeology and Anthropology Departmental field school exercises (Andah and Momin, 1993; Momin, 1995).

In 2002, additional on-site investigations were carried out at Ajibode in accordance with the 1996/97 research objectives and strategies. Thus, soil samples were again collected in order to cross-check the results of the laboratory analyses with those of 1997. Both results were found to be similar.

In 2001 at Oumako's Quarries in the Eastern Lower Mono Basin and in 2002 in Ajibode, the Central Niger Delta and the Cape Three Points areas, Global Geographical System (GPS) readings were taken in order to update and obtain precise coordinates of the research stations, and also for a proper demarcation of the eastern and western limits of the Bight of Benin.

1.2 THEORETICAL AND METHODOLOGICAL FRAMEWORK

1.2.1 Concept of Environments

The concept of environment is generally accepted as a polysemic one. For instance, the Dictionnaire de l'environnement (Ternisien, Bovard et Crétin, 1992: 132) presents the environmental setting as a whole spatially and temporally combined action of physical, chemical, biological and social factors capable of having a direct or indirect, immediate or progressive impact on the human communities and their activities, and on the zoological and botanical species. This definition of environment is similar to the one expressed by Lincoln, Boxshall and Clark (1998: 101) in A Dictionary of Ecology, Evolution and Systematics, as well as the one in The Penguin Dictionary of Physical Geography which stipulates that (Whittow, 1984: 170-171):

> (…). More specifically, the term is qualified in numerous ways: e.g. the natural environment is that created before the influence of man; the built environment refers to the artifacts created by man in the evolution of the cultural landscape (…).

Also on the definition or the conceptualization of environment, The Penguin Dictionary of Human Geography emphasizes that (Goodall, 1987: 155):

> (…) the term has also been used in geography in a more limited way. In some cases it has been used to denote the natural environment – the landscape before people arrived – or the physical environment which includes all phenomena apart from human beings and the things they have created. In others the geographical environment has been viewed as a unified milieu of people and environment, embracing both the phenomenal environment and the behavioural environment, in which relationships are

> considered in terms of spatial location. The distinction between the impersonal/objective environment and the personal/subjective environmental is valid and important (...).

The concept of environment is in addition emphasized by Goodall (1987; 155) who made special reference to notions such as "affinity environment", "built environment", "congruent environment", "daily-life environment", "functional environment", "perceptual environment", "social environment"; while the notion of "environmental archaeology" is explained as that which deals with all the physical and biological components of people's environment.

Sowunmi (2001a: 76-77, citing Kormondy, 1976 and Odum, 1993) first defines the environment as the biologically inhabitable and inhabited part of the Earth, and the living organisms within it. She then makes a distinction between the natural environments and the "fabricated" and "domesticated" environments. In accordance with the "unique character of human ecosystems" emphasized by Butzer (1994: 32), Sowunmi (2001a: 80-81) in addition presents environmental archaeology and ecological anthropology as similar both of which are aimed at emphasizing the complex and dynamic interactions between hominids, cultures and the rest of the environment with a view to understanding and explaining where, when, why and how the hominids lived and what they did.

1.2.2 Meaning of Off-Site and On-Site Archaeological Reconnaissance

It is not until the late 1980s that dictionaries of Archaeology started to mention and explain the word 'site', particularly in the case of both English and French scholarship. For instance, in their first editions, The Penguin Dictionary of Archaeology (Bray and Trump, 1970), the Dictionnaire de l'archéologie (Rachet, 1983), and the Dictionnaire de la préhistoire (Brézillon, 1969), no mention was made of the term 'site'. However, a true change was ushered in the Colins Dictionary of Archaeology (Bahn, 1992) where an attempt was made to define such concepts as "site", "site catchment analysis", "site exploitation territory", "site formation processes" and "site structure" (Bahn, 1992: 460). Specifically, the (archaeological) site is defined as (Bahn, 1992: 460):

> (...) any place where there is evidence for past human behaviour. A site can be as small as an isolated find, which is either a single ARTIFACT or a small number of artifacts from which few inferences can be drawn, or as large as an ancient city. Sites are classified according to their function, although different regions of the world tend to have different terms for specific types of site (...).

Exactly four years before, an earlier attempt was made in the Dictionnaire de la Préhistoire (Leroi-Gourhan, 1988: 978-979) where concepts such as "site (archéologique)" (i.e. archaeological site), "site catchment analysis", "site d'habitat" (i.e. settlement site) and "site spécialisé" (i.e. specialized site) are defined. According to Leclerc and Terrête (1988: 978), the concept of (archaeological) site was borrowed from the geographical vocabulary which classifies sites after both their physical and functional characteristics. The same concept of site also refers to any archaeologically excavated station.

In contrast to these two definitions of site, The Oxford Companion to Archaeology (Fagan, 1996a) deliberately favoured the multidirectional concepts of "site formation processes" (Schiffer, 1996: 649-650), "finding archaeological sites" (Michaels, 1996: 650-651), and "site assessment" (Carlson 1996: 655-656).

Regardless of whatever the conceptualization and definition of an archaeological valuable site may be (Butzer, 1994: 258-260), the emphasis is always related to the presence of evidence, yielded on surface or interpolated in lithostratigraphic unit(s). Ajibode Lower Terrace is a case in point as shown in Chapter Three (Section 3.3.2) and in the entire Chapter Four.

In contrast to the on-site concept that is usually based upon the site's presence, a proper understanding of the "off-site" concept must make a proper reference to the word 'off'. Literally the word 'off' implies absence or removal, and the term "off-site" can therefore mean absence of site and be considered as synonymous with "non-site" (Nance, 1983) or "siteless" (Dunnel and Dancey, 1983). Consequently, "off-site reconnaissance" can be synonymous with "siteless survey" (Dunnel and Dancey, 1983) and "non-site sampling" (Nance, 1983: 316-320). Archaeologically, the concept of "off-site" can alternatively become meaningful when it is related to field investigations that are not mainly or exclusively aimed at locating artefacts or other archaeological evidence at one or many points. In other words, an archaeologically-oriented off-site reconnaissance is concerned with a practice of archaeology as "human ecology" (Butzer, 1994) that implies a contextual and ecosystem approach (Butzer, 1994: 3-32). From a palynological viewpoint, such a contextual and ecosystemic approach is referred to by Sowunmi (2001b: 89, citing Edwards, 1984) in order to point out that "An off site" location is one that has no visible sign of former human occupation, and that an "off site" might have been an "on-site" before. On the other hand, archaeological off-site investigations are generally related to nearby and comparable on-site contextual pictures on a regional scale (Tubosun, 1997: 20-21) Such geo-archaeological field approaches are usually aimed at explaining and understanding the environmental determinants that are favourable or unfavourable for the human past subsistence-settlement patterns. Thus, off-site approaches in archaeology cover a wide range of materials and methods (Nance, 1983; Dunnel and Dancey, 1983; Jarman, 1972; Tubosun, 1995: 6-7; 56-102; 1997).

The archaeological reconnaissance in Eastern Lower Mono Basin, as presented in Chapter Three (Section 3.1), is a case in point of an "off-site" archaeologically-oriented reconnaissance.

1.2.3 Theory of Palaolithic Settlement Archaeology

Systematic theories and models of Settlement Archaeology are not a commonplace in the current archaeological literature. In the case of Palaeolithic investigations, such theories and models are a matter of exception. This viewpoint is in consonance with the one expressed in The Oxford Companion to Archaeology (Fagan, 1996a), specifically in its section devoted to settlement archaeology (Schreiber, 1996: 636):

> (...) Settlement archaeology traces its theoretical underpinnings to the nineteenth-century work of Lewis Henry Morgan, who was one of the first researchers to discuss the relationship between settlement types and social evolution. The ecological approaches of Julian Steward also form an important component of the theoretical basis for settlement archaeology, specifically as it deals with the relationship between human subsistence settlement systems and the natural landscape.
> Archaeological settlement surveys, as they were often done in the past, and are still done in many parts of the world, were typically designed to locate sites for excavation (...).
> The first truly modern survey is generally considered to be that of the Viruu Valley of Peru, organized by Gordon Willey in the 1940s. (...), but it was not until the 1960s and 1970s that settlement archaeology came into its own. (...).

As rightly quoted above, Settlement Archaeology essentially consists of settlement surveys designed to locate and excavate sites. From such surveys are derived reports, theses, syntheses, or articles. In terms of theorizing or modelling settlement archaeology scope, researchers chiefly refer to key concepts like "settlement pattern analysis", "settlement pattern study", "subsistence settlement system" and "archaeological settlement pattern". In the formulation of these key concepts, particular attention is usually focussed on the term settlement. Thus, the definition of this word seems to be central to any theoretical or/and methodological explanation.

The Penguin Dictionary of Human Geography (Goodall, 1987: 427) defines a settlement as any form of human habitation, from a single dwelling to the largest city; with different use ranging from dormitory settlement, squatter settlement, dry-point settlement to wet-point settlement. The list must rightly be extended to factory, marketing or farming settlement, as well as to fishing, foraging, hunting or scavenging settlement.

Such an understanding of a multi-facetted meaning, scope and scale of settlement is in accordance with the notion of "settlement pattern analysis" as expressed in The Oxford Companion to Archaeology (Kantner, 1996: 636):

> A settlement is the distribution of human activities across the landscape and the spatial relationship between these activities and features of the natural and social environment. By assuming that these relationships are patterned in a predictable manner, the analysis of settlement patterns can be used to reconstruct and explain the organization of human societies and their surrounding environment. This analysis can be performed at several levels, from the spatial analysis of small activity sites to the large-scale investigation of human settlement across an entire region (...).

With regard to the concept of "settlement pattern study", many archaeologists in accordance with Collins Dictionary of Archaeology (Bahn, 1992: 450) view it as a type of archaeological study that is aimed at recording all human-made features of the landscape, both in temporal and spatial contexts. The importance of such studies is related to the broad regional perspective of cultures and their dynamics through time. With such a meaning, the concept of settlement pattern does not seem to be different from that of "archaeological settlement pattern." Both are topical approaches of the broader archaeological sub-discipline – "settlement archaeology", as rightly defined above by Schreiber (1996: 636) and Kantner (1996: 636).

The 1960s and 1970s referred to by Schreiber as when settlement archaeology analysis came into maturation correspond to the inception and ascent of the "New Archaeology" (Clarke, 1972a-b; Binford, 1972a-b; 1983; 1989; Renfrew and Bahn, 1996; Trigger, 1994; Wilson, 1976). The latter is generally said to have profoundly influenced the theoretical and methodological guidelines of settlement archaeological research. Amongst the scientific methods and analytic tools borrowed from the "New Archaeology" for the analysis and study of archaeological settlement, is the use of Quantitative statistics for a better understanding of the spatial distribution and the stylistic attributes of artefacts (cf. Chapter Five, below), as well as for producing more detailed environmental reconstructions. Prior to the 1980s, archaeologists have been employing quantitative models and statistical methods for their surveys and analyses of settlement patterns. From the late 1980s up to present day, computer analytical techniques and databases on one hand, and the use of Global Positioning System (GPS) for field surveys on the other had jointly improved, refined and diversified archaeological settlement pattern studies (as shown in Chapter Two, Section 2.1; Chapter Three, Section 3.2 and Chapter Four, Sections 4.2 and 4.3). Also from the 1980s onwards, multivariate or infinite sophisticated analytical and modelling tools have become available for larger regional data sets in relation to ethological, economic, demographic, sociocultural and political networking. Such regional data sets can be used, managed and manipulated according to databases known as Geographic Information Systems (GIS), for a better understanding and explanation of prehistoric and historical human behaviour as part of the environmental setting active agents (Kantner, 1996: 636-638).

The GIS in particular of which the GPS is a component, is a seminal and powerful tool for theorizing and modelling in modern Settlement Archaeology. This is because the GIS consists of a number of thematic data layers including contour lines, soil types, slopes, hydrology, vegetation zones, roads, as well as spatial coverages like aerial photographs or satellite images that are relevant to picturing all kinds of points, structures, sites and landscapes. Archaeologists have also begun to use GIS capabilities to handle previous challenging problems to investigations in the field of Settlement Archaeology. Some of these problems are concerned with the site-catchment analysis' concentric rings, the predictive modelling of archaeological site discovery and location, and attempts to replace the traditional site's gridding with viewsheds' constructions with a view to relate points one to another over the site extent (Maschner, 1996: 248-250). In an attempt to utilize the GIS potentials, archaeologists have come to realize that such a practice is mostly, or partly, dictated more by technological fascination than by genuine scientific advances. This is because the results are not yet sufficient to provide solutions to the long lasting field problems confronting Palaeolithic Settlement Archaeology. Even those problems that were genuinely reformulated during the 1970s, 1980s and 1990s are still waiting for relevant and constructive issues, in terms of theoretical framing and methodological perspectives.

From 1970s to 1990s, researchers in archaeology and related disciplines were involved in attempting and proposing archaeological spatial gridding, theoretical issues and methodological models in settlement pattern analysis. They principally did so, as a follow up to pioneer researchers like Morgan (in the late 19th Century), Steward (in the 1930s) and Willey (in the 1940s). Some did so as followers or challengers of other prominent theorists like Clarke (1972a-b; 1978), Chang (1967; 1968), Binford (1972a-b; 1983; 1989) and Butzer (1994). Emulated by the pioneers and stimulated by seminal continuators, the followers or challengers have positively contributed to research advances in Settlement Archaeology. Their numerous contributions have led to a better formulation of concepts and issues in the determinants of settlement patterns (Trigger, 1968; Vogt and Leventhal, 1983), some demographic explanatory models (Hassan, 1978), the beginnings of human behaviour (Foley, 1991; 1996a-b; Isaac, 1972; Wenke, 1990: 75-135; Megarry, 1995: 18-206; Campbell, 1992: 228-265; 343-369; Wilson, 2000), the hunting-gathering modes of subsistence (Isaac, 1972; Wai-Ogosu, 1970; Prince and Brown, 1985; Ellen, 1998; Parkington, 1996; Megarry, 1995: 207-346; Campbell, 1992: 322-342), the spatial organisation and built environment (Rapoport, 1998) and the continental patterning through time (Bailey, 1983; Gamble, 1983; 1986).

Through such cross-disciplinary contributions, archaeological settlement pattern's determinants, sets and networks are becoming more and more interrelated. Related concepts of "site catchment analysis", "central place theory" are subsequently understood and explained. Such advances are facilitated by the New Archaeology-oriented multivariate and multidimensional analysis (Clarke, 1972a-b; Binford, 1972b; 1983; 1989; Trigger, 1994: 289-328; Renfrew and Bahn, 1997: 35-37; Dark, 1995). Before the New Archaeology's lighting, Settlement Archaeology was not aimlessly practiced, although some fruitful debate took place in the 1960s as reflected in such publications as Settlement Archaeology (Chang, 1968).

Another book published a decade and a half later, but within the ambit of the New Archaeology, devotes a great deal of attention not to artefact-assemblages, but to site, settlement and subsistence patterns and networks on one hand, and to environmental/spatial archaeology, geo-archaeology, archaeobotany, zoo-archaeology and archaeometry on the other (Butzer, 1994). Entitled Archaeology as human ecology: Method and theory for a contextual approach, the book's contextual approach is that of fitting archaeological settlement patterning into ecosystemic and socioeconomic principles with a view to jointly examining the impact of settlement on the site formation, the effects of subsistence activities on plants, animals, soils and landscape modification, the processes of cultural change and continuity. The volume is divided into three parts, labeled "Perspectives", "Foundations" and "Synthesis".

Through "Perspectives", are analysed such patterns as contextual archaeology, ecosystemic variability and change, and the uniqueness of the human ecosystem. The nine chapters of "Foundations" range the components of geo-archaeology from its basic principles to landscape context, stratigraphic context, site formation, site modification and destruction, to human impact on the landscape. The first three chapters of "Synthesis" attempt to develop a comprehensive spatial archaeology based upon such settlement pattern systems' analyses as spatial integration of 'gravity models', 'central-place theory', 'resource-concentration models', hunter-gathers' subsistence-settlement reconstruction, site location and survey. The two last chapters are concerned with temporal integration in terms of sociocultural adaptation, change and continuity at both microenvironmental and macroenvironmental scale.

According to Butzer (1994: 3-13) such theorizing and modelling of archaeological settlement analysis is an empirical and pluralistic attempt matching human geography, cultural anthropology and environmental dimensions. It is a contextual archaeology that has as its practical general goal the study of archaeological sites or site networks as part of a human ecosystem. Because it is carried out by means of geological methods, techniques and concepts, it could be related to a geological archaeology, this latter being different from an archaeological geology pursued with an archaeological bias or application. In spite of its critical dependence on stimuli and models grounded in social, ecological and evolutionary anthropology, and on the empirical methods and models of natural sciences, archaeology is thereby accepted and practised in its own. This is because, as rightly pointed out by Butzer (1994: 11-12):

> (...) The specific methodologies of other disciplines (...) cannot simply be transferred; they must be transformed, according to a new paradigm rather than a secondary paradigm, if they are to have productive input (...) for deliberate exploration and development of an approach that will transcend the traditional preoccupation with artifacts and with sites in isolation, [and for] a realistic appreciation of the environmental matrix and of its potential spatial, economic, and social interactions with the subsistence settlement system (...).

This archaeological methodology for subsistence-settlement analysis provides both the tools and perspectives with which to critically re-examine usual quantitative models of subsistence patterns from the times of Stone Age lifeways to historical periods. Some of these models are (Butzer, 1994: 211-229): the "gravity models", the "Site-catchment analysis", the "Central-place theory" and the "Resource concentration models".

The prehistoric hunter-gatherer lifeways are also matched to subsistence-settlement adaptative strategies through "socioecological models" principally based upon "scale settlement analysis" (Butzer, 1994: 230-257). According to these models, relevant emphasis of the Palaeolithic and Mesolithic hunter-gatherer settlements and networks is to be related to the threefold microscale, semi-microscale and macroscale analyses of intersite patterning (Butzer, 1994: 231, table 13-1).

As an illustration of "Large-scale mobility models for hunter-gatherers", the mid-Pleistocene Acheulian sites at Torralba and Ambrona in central Spain, are referred to (Butzer, 1994: 234-240). On the other hand, the case of "Reconstruction of settlement patterns: hunter-gatherers" is illustrated with the "Middle Stone Age" ("Middle Palaeolithic") Sites of Alexandersfontein facies in the Orange-Vaal Basin of Southern Africa, in comparison with later Pleistocene regional settlement patterns (Butzer, 1994: 266-276).

In The Palaeolithic Settlement of Europe, Gamble (1986) agrees with Butzer's paradigms and models, illustrating trajectories and modalities which correspond to the European Late Pleistocene scene. The nine-chaptered book consists of topics such as: "hunter-gatherer regional systems" (pp. 28-68), "Pleistocene environments and resources" (pp. 69-115), "Technological, typological and experimental approaches" (pp. 116-136), "Space and subsistence" (pp. 250-304), "Society, sediments and settlement" (pp. 343-383), and the "The Palaeolithic settlement of Europe" (pp. 384-393). According to the author, the last chapter (i.e. the ninth) offers in summary his "(...) interpretative sketch of the palaeolithic settlement of Europe in order to suggest further applications of the regional model to the investigation of past behaviour (...)" (Gamble, 1986 :384).

Gamble refers – explicitly at least twice in the chapter (pp. 386 and 389) – to Butzer's "powerful arguments" that attribute the appearance of early Homo sapiens to an unequal distribution of resources at the European subcontinental scale on the one hand, and to his "interpretative model" on the other, in order to explain how large regional populations were living in dense, abundant and predictable resources within which also existed isolated populations in areas which could not sustain their densities. He does not forget to also refer to Butzer in arguing that the Pleistocene's predictable and long-term shifts in matching the process of habitat to resource would have led to bringing together and pushing apart these isolated populations. As a result, gene flow and genetic drift in association with directional selection are viewed as factors for the evolution of adaptive traits. In order to properly explain and picture the onset and succession of such new traits, the last interglacial/glacial cycle is used as a chronological framework. Well-established after correlating radiometric dates from deep sea cores, soil and ice stratified samples, pollen fossils, this cycle ranged from Isotope Stages 5 to 2. These Isotope Stages are used to provide a time frame in radiometric years to the continental "Pleistocene environments and resources" as follows (Gamble, 1986: 74-95):

(i) Stage 1: interglacial, ranging from 128,000 to 118,000 B.P.;

(ii) Stage 2a-b: early last glacial, ranging from 118,000 to 32,000 B.P.;

(iii) Stage 3: full glacial, ranging from 32,000 to 13,000 years B.P.; and

(iv) Stage 4: late glacial, ranging from 13,000 to 10,000 B.P..

From such a late Pleistocene chronological scenery, the author tentatively pictures a sketch of inferred subsistence-settlement strategies in terms of "Three models of what they did when they got to Europe" (Gamble, 1986: 386-393) in relation to plant/animal potentials (Gamble, 1986: 96-115), technological, typological and experimental approaches (Gamble, 1986: 116-136) and continental Palaeolithic recorded "signatures" (Gamble, 1986: 137-304). The three models are labelled and presented as follows:

(i) Model 1: meat management strategies;

(ii) Model 2: meat storage and self-sufficiency; and

(iii) Model 3: planned competition.

This meat based and oriented modelling is to be critically seen and understood (Megarry, 1995: 207-265) as one among many methodological issues to be spatially and timely adapted to varying case studies (Gamble, 1983; 1998); and Gamble (1986) accordingly recognises this fact without any bias (Gamble, 1986: 376):

> (...) the settlement histories are sufficiently different between regions to suggest that such models cannot be indiscriminately applied to all bodies of settlement data. Instead we should consider the possibility that some regions contained partial settlement records (...).
> The size of the territories exploited by Palaeolithic groups changed as a function of the structure of resources (...). They also changed due to the development of social solutions to the high cost tariffs involved in exploiting either r selected resources or large mammals at low densities and hence high risk. Combined with this were the equally important costs

> that resulted either from increased conflict (...) as groups became packed into territories and dependent up r resources such as fish, or from the costs and uncertainties involved with exploiting very large annual territories and maintaining mating networks (...).

1.2.4 Methodology of Analysis of African Lithic Artefact-Assemblages

On the general principles and methods of sorting and analysing the African lithic artefact-assemblages, successive Pan-African Congresses on Prehistory have adopted and amended recommendations since the mid-1960s. Such recommendations are accepted with a view of not imposing any compulsory rules or principles that could obstruct or fossilize innovative procedures on methods. This standpoint was adopted at a Symposium held in 1965 (Bishop and Clark, 1967: 861-900). At the Sixth Pan-African Congress on Prehistory convened in 1967, the same viewpoint was amended and approved as follows (Hugot, 1972: 594):

> It is our basic position that neither archaeological methodology nor terminology should or can be legislated. Particularly, methodology needs to be free to develop and improve. Only by experimentation and trying new approaches to old problems can this readily be accomplished (...). For this reason, we strongly favor those recommendations of the Symposium held at Burg Watenstein during summer of 1965, which encourages scientific methodology and points to acceptable minimal standards for archaeological reports. We understand that these recommendations are not an attempt to fossilize methodological procedure, but merely suggest avenues which may be more productive than those now commonly employed (...).

Archaeologists, geologists and associates participating in a West African regional Symposium in 1969 at the University of Ibadan, agreed with the 1965 and 1967 basic concerns and lines of arguments. They particularly emphasized that archaeologists view with concerns any authoritarian imposition of rules for procedure and classification (Daniels and Freeth, 1970: 40).

Since 1965 to the present day, the case of technical procedure of drawing stone artefacts can be referred to in order to show how some of the conventional methods are firmly adopted while others are simply suggested. In 1965 it was agreed upon that the metric system be adopted for standardization and comparison purposes (Bishop and Clark, 1967: 900). In 1967 it was suggested that not only the "classic" examples of stone artefacts be illustrated but also the less "classic" and more numerous materials (Hugot, 1972: 594). In accordance with these (1965 and 1967) different recommendations, some researchers insist on the relevance of using more and more precise techniques of analysis and meaningful definitions for the identification and description of the lithic assemblages (Clark, 1970: 37). These African based and oriented methodological procedures are in addition matched with a worldwide agreement that consists of admitting that light should come from the top of the left side and should progressively diminish giving place to shadow at the bottom of the right side of the drawn lithic tools (Assié, 1995: 194). It is also conventionally accepted that the size of these drawn materials should diminish from the top to the bottom on the page of illustration (Assié, 1995: 204).

Practising archaeologists in Africa, Europe and other parts of the world do not literally respect such principles and conventional methods. For instance, the procedure of illustration that consists of drawing from the bigger to the smaller tools is not always fully taken into consideration, even by such reputed "classic" typologists like Bordes (1988: 105; 114; 143; 145; 146). A similar adaptive practice is exemplified by Clark (1970: 69; 82; 87; 111; 127) and others (Isaac, 1995: 193; Shaw and Daniels, 1984: 213; 222; 227-228; Andah, 1978: 111; 113; 115; 119-120; 1979a: 64-65; 1980: 22; 24).

This liberal and adaptive practice is adopted in the typological and technological analysis of Ajibode Lower Terrace's lithic industrial occurrences, as shown in Chapter Five. In the course of this topical analysis, many-sided methodological advances in the study of Stone Age cultures since the 1940s are taken into account. It is important to mention that some of these advancing approaches have led to viewing archaeology as a diachronic "science of technology" (Hodges, 1998; Leroi-Gourhan, 1971), or to topically discussing on such aspects of Stone Age technologies as "tools and tool behaviour" (Tixier, Inizan and Roche, 1980; Hours, 1987). In addition, new analytical and experimental attempts have improved the understanding of the attributes, the manufacture and the use of lithic tools (Deacon, 1997; 2001; Brézillon, 1983; Tixier et al., 1980; Piel-Desruisseaux, 1990; Bordes, 1988).

Within the ambit of such theoretical and experimental approaches, the lithic occurrences from AJB UMF Layers C and E are identified, in Chapter Five, as a Middle Stone Age (MSA)/Middle Palaeolithic facies in the West African regional context of the Bight of Benin. The sub-Saharan African-based concept of "a-ready-to-use-technology" (Deacon, 1997: 322) is specifically referred to for a proper interpretation of the manufacture and use purposes of this Ajibode local MSA facies. In this regard, there was the need to carry out a "Microwear Analysis" (Bamforth, 1996: 391-392) of this local MSA facies, with a view to identifying the kinds of use modification of the tools' edges. This analytical procedure also known as "Functional Analysis" or "Traceology" was initiated by Semenov (1964) as cited in Perles (1988: 43), Gaucher, 1990: 110-111) and Camps (1988: 138). The procedure is capable of attaining a minimum magnifications of 10x to 75x, medium magnifications of 100x to 400x, or an even more powerful scanning electron microscope (SEM). The technical equipment and professional expertise for carrying out such analysis are not available in Ibadan, Abomey-Calavi, and other West African universities.

1.3 DEFINITION OF LOCATIONAL CONCEPTS

1.3.1 Bight of Benin Region

The concept of Bight of Benin Region is examined here from both historical and semantic perspective; the locational aspect being properly emphasized in Chapter Two (Section 2.1).

The concept is based on the name of Benin City. Ryder (1984) and many other authors affirm that Oba Ewuare rebuilt the city and gave it the name Edo. According to this viewpoint, the origin of the name 'Benin' given to the city and its kingdom and used by non-speaking Edo people is a matter of mystery (Ryder, 1984: 352; footnote 21):

> The name 'Benin' by which the city and kingdom are known to all non-Edo, is something of mystery. Folk etymology does not explain it satisfactorily. Possibly the first Portuguese to arrive on the coast picked up the name beni, meaning 'water dwellers' from the Ijo and applied it in error to the Edo.

Other literate accounts that are devoted to the traditions of origin of the Edo or Benin people insist less on the mystery than on the ambiguity of the meaning of both the terms 'edo' and 'benin'. In accordance with previous claims (Egbarevba, 1979), Okpoko and Agbontaen (1993: 213) are of the opinion that the term 'benin' serves as a territorial label (e.g. Benin City, Benin Kingdom or Benin Empire), while both 'bini' and 'edo' serve as linguistic and ethnic labels for the inhabitants of the Benin territory. The word 'edo' is the indigenous name for Benin City; Edo being said to be a slave who had saved Oba Ewuare from being killed. To immortalize Edo's name for the services rendered, Oba Ewuare changed the name of the city to Edo. The word 'benin' is said to pre-date that of 'edo'. The kingdom was initially known as 'igodomigodo', and later as 'ile' and 'ile-ibimu' from which successively derived the words 'ubini', 'bini' and 'Benin'.

As it is, the concept of "Bight of Benin Region" needs some clarification. This is because different concepts have been used in naming this West African sub-region. English and Anglophone scholars mostly use the word bight. In rare cases they use the term bay and the concept of Bay of Benin (e.g. Verger, 1976: 179-217). French and Francophone scholarship on the other hand usually refer to both the word gulf and the concept of Gulf of Benin (Medeiros de, 1984; Bokonon-Ganta, 1984; 1987; Gayibor, 1983; Adandé, 1990; Adandé and Bagodo, 1991). Sometimes French or Francophone scholars refer simultaneously - in the same book (Bach, 1986) - to both the concepts of Gulf of Benin (Soumonni, 1986: 47) and Bight of Benin (Bach and Laleye, 1986: 91 and 94; Courade, 1986: 22-23).

Such a confusion is not adopted in both English and French dictionaries of Geography. For instance, the Dictionnaire de la géographie (George, 1974) refers to the word gulf in order to make a bay synonymous with a bight (George, 1974: 30; 214). Whittow's comparable The Penguin Dictionary of Physical Geography (1984) attempts to provide more explanation and comparison in regarding:

(i) a bay as "An open, curving indentation made by the sea or a lake into a coastline" (Whittow, 1984: 56);

(ii) a bight as "A large-scale indentation of a coastline, generally of continental proportions, e.g. Great Australian Bight, Bight of Benin (…)" (Whittow, 1984: 62); and

(iii) a gulf as "An inlet of the sea of large areal proportions, more indented than a bay and generally more endorsed (…)" (Whittow, 1984: 239).

On the other hand, George (1974: 361-363) insists on the ambiguity of the concept of the region, and suggests its usage in accordance with determined criteria for specific cases. Apparently agreeing with the same standpoint, The Penguin Dictionary of Human Geography (Goodall, 1987: 399) defines the region as:

> Any area of the earth's surface with distinct and internally consistent patterns of physical features or of human development which give it a meaningful unity and distinguish it from surrounding areas. There are endless criteria on which to base the delimitation of regions (…).

In the West African spatial context the same concept of region is used to describe such scaled spaces as:

(i) "the Guinea region of West Africa" (Andah, 1979b: 9-46);

(ii) "the Asokrochona Coastal region of Accra: (Andah, 1979a: 47-85);

(iii) "the Gulf of Benin Region" (Bokonon-Ganta, 1984; 1987); and

(iv) "Ibadan Region" (Filani, Akintola and Ikporukpo, 1994).

1.3.2 Dahomey Gap Scrub

Mabogunje (1976: 4) mapped the West African vegetational belts and specified that the coastal and inner lands which extend from the lower River Volta basin (Ghana) to lower River Weme basin (Bénin Republic) is a "Coastal Scrub and Grassland". As a physical geographical notion, the term scrub is used to characterize a "vegetation type associated with poor soils, exposed locations or semi-arid environments, in which the species are stunted; gnarled or specially adapted to seasonal drought (…)" (Whittow, 1984-474).

The coastal and grassland environmental attributes referred to by Mabogunje had been studied by bio-geographers, climatologists, botanists and ecologists. Most of these natural scientists characterized the drier and peculiar central hole within the Guinean moist forest as the "Dahomey Gap". The concept of Dahomey Gap as used since the 1960s has of recent become synonymous with those of "bio-climatic anomaly" and "gap of drought" (Paradis, 1976), "diagonal of dryness" (Bokonon-Ganta, 1984), "savanna corridor" (Dupont and Weinelt, 1996).

In referring to ecological and geographical descriptions that are mainly based on field observations in Southern Bénin Republic (Paradis, 1976; Mondjannagni, 1969: 59-162), Adandé (1986: 369-373) expressed the opinion that archaeologists should look for proper methodological approaches which can contribute to an understanding of the story and the current environmental setting of the Dahomey Gap. Fortunately, this story is partly revealed by recent palynological investigations (Tossou, 2002: 108) that have led to the conclusion that the present scrub and grassland features were established during the Upper Holocene (i.e. since ca. 2500 BP).

1.3.3 Lower Mono Basin

Archaeologists of and in West Africa, are mostly used to investigate into and report on river valleys (e.g. in the series of the West African Journal of Archaeology – WAJA – since 1971). In fact, the areas that they usually present and describe correspond more to basins than to valleys. With regard to both the watercourse and drainage systems, and the archaeological subsistence-settlement patterns, a valley is a narrower patchwork than a basin. Such a standpoint is in accordance with the definitions of the two terms in specialized dictionaries (e.g. George, 1974: 34-35; 435-436; Whittow, 1984: 555; 566). For instance, Faniran (1986: 152-222) while dealing with the African "fluvial land forms", refers to the word basin in coupling it with the term river. In doing so, he delineates such headings as "Rivers and River Basins", "The drainage basin and river patterns" (Faniran, 1986: 153-159). Faniran (1986: 205) also presents the "River terraces" as "essentially in connection with Quaternary studies". Even in relating the

"Valley forms" to the "terrace sequences", Faniran (1986: 214) is more inclined towards the "large-scale features which are not necessarily confined to river channels but extend to the catchment divides, namely: terrace sequences (...)".

During the 1993 to 1995 off-site reconnaissance exercises (cf. Chapter Three, Section 3.1) a team of archaeologists, geologists and geographers discussed and agreed that for archaeological subsistence-settlement pattern analysis, the large-scale feature of basin is more relevant than that of valley (Bagodo, 1994b: 40-42; Adandé, 1994; Oyédé, 1994; Houndagba and Bokonon-Ganta, 1994). Since then (1994), the eastern Lower Mono large-scale watercourse is accepted to be synonymous with the lower basin. Because of democratic political transition's crisis in Togo, in addition to logistic constraints, only the eastern part (i.e. in Bénin Republic) had been archaeologically investigated.

During the 1990-1991 and 1993-1995 field investigations (Chapter Three, Section 3.1), the right partitioning of the river's 385 km-course into upper, middle and lower basins was discussed. After series of field and discussion sessions, it was agreed (Bagodo, 1993: 26; 1994a: 159; 1994b: 40-42; 1995):

(i) that the whole Mono basin stretches from longitude 1° 30' to 1° 55'E, and from latitude 6° 20' to 9° 20'N; and

(ii) the lower basin extends from longitude 1° 30' to 1° 55'E, and from latitude 6° 20' to 7° N (i.e. the northern limit of the Coastal

Sedimentary Basin in Southern Bénin and Togo Republics) (Slansky, 1962; Oyédé, 1991).

1.3.4 The Ajibode Lower Terraces

Geographers and geologists in general consider the terrace as a "(...) flat and gently inclined land surface bounded by a steeper ascending slope on its inner margin and a steeper descending slope on its outer margin (...)" (Whittow, 1984: 532). Climatic fluctuations and tectonic episodes are accepted as the two major factors in the formation of terraces; episodes to which correspond respectively the tectonic terrace and climatic terrace major types (George, 1974: 417). The climatic type is commonly known and referred to as marine-built terrace, as well as river, fluviatile or alluvial terraces. Thus, the concept of stepped terraces is emphasized in associating terrace formation with the bedrock which is exposed to and affected by erosion, while the notion of interlocked terraces is assigned to the erosional down cutting of previous alluvial deposits (George, 1974: 417).

Since the past decades, both the tectonic and climatic determinants are connected with local topographic and lithologic features in the emphasis of fluviatile terraces' formation, in particular in such parts of Europe as River Rhin and River Rhône Basins, in Germany and France respectively (Chaline, 1985: 137-142). According to Dubar (1987: 149), all over the world, the climatic factor is the key but not sufficient determinant. So that, the "litho-morphic" and tectonic factors are taken into account as complementary parameters (Dubar, 1987: 150-153). Concerning the dating methods of the age and succession of the fluviatile terraces, the stratigraphic units and their pedologic data are said to be more relevant where the raw materials are homogenous in all the layers and there is no local or occasional disturbance of the sedimentation process. The rarity of stratified organic fossils for biochronological dating is another impediment while the detritic nature of the sediments makes it unsuitable for geochronological and palaeomagnetic dating.

In general, the scale of both the extent and aggradation of terrace levels varies in accordance with the factors of their formation. For instance, since the 1920s, studies of the European Alpine Quaternary chronostratigraphies are referred to, in correlating the glaciation cycles to the terrace sequences as follows: (Chaline, 1985: 137):

(i) Günz or Sicilian: 100-90 m terraces;

(ii) Mindel or Milazzian: 60-55 m terraces;

(iii) Würm or Monastirian: 20-18 m terraces;

(iv) Post-Würm or Flandrian: 8-9 m terraces.

On the other hand, both the superimposition and extent of terrace sequences in Durance Basin, in France, shows (Dubar, 1987: 157) the following:

(i) Lower Pleistocene: five higher terrace cycles between a 710-480m above sea level (a.s.l.), with an extent of about 3 km;

(ii) Middle and Upper Pleistocene: five middle and lower terrace cycles between about 430-350m a.s.l., and 2 km of extent;

According to Faniran (1986: 214), alluvial terraces are common in periglacial regions such as Europe where River Rhin and River Thames are known to present thirteen and four alluvial terraces respectively. On the contrary, (Faniran, 1986: 215-216):

> (...) African rivers do not show conspicuous terraces. This perhaps explains why few, if any, descriptions of river valley forms have appeared in the literature of African geomorphology (...). Terraces occur, albeit in a disjoined and irregular manner, along many rivers (...).

The Kaduna valley in tropical semi-arid (i.e. Sudano-Sahelian) zone is referred to, by Faniran (1986: 215), as a valley-in-valley's case where the river's down-cutting shows a sort of terrace phenomenon which "cannot strickly be so described". Rognon and Coudé-Gaussen (1987: 145) refer to the same Sudano-Sahelian zone as where many river courses present terraces which are stepped sometimes. On the other hand, Rognon and Coudé-Gaussen (1987: 146) accept that the Quaternary deposits in the hot deserts and the intertropical zone are more complex and less known than those in the temperate and cooler zones. The two standpoints agree with the fact that there is the need for more investigations in intertropical Quaternary landforms in general and their terrace sequences in particular.

At Ajibode and other parts of Ibadan Metropolitan Region, the picture is not different. Geologic and geomorphic investigations (Burke, 1970; Burke and Durotoye, 1970; 1971; Akintola, 1994a; Faniran, 1994), some chiefly archaeologically-oriented (Andah and Ayayi, 1981; Andah, 1995a; Andah and Momin, 1993; Momin, 1995), have not yet established a definitive scenery of geological episodes in general and that of Quaternary sequences in particular. Detailed relevant information and documentation on superficial deposits and structural setting are still tentative in nature. Four or less cycles of erosion surfaces are said to represent (Faniran, 1994: 40) more a trend than actual past episodes properly correlated with well-established palaeoclimatic phases. While the four erosion surfaces are clustered at such above sea-level heights as 160-175 m, 190-205 m, 220-240 m and 250-270 m, the current plains at 180-210 m a.s.l. are said to be etched surfaces and estimated to represent about eighty per cent (80%) of the area's total surface (Faniran, 1994: 31). The archaeological field investigations from 1992 to 1994 have led to more presumptions than to establish the aggradation of three terrace cycles at heights 225 m, 210 m and 195 m a.s.l. respectively (Andah and Momin, 1993). Both the morphometric clustered four erosion surfaces and the suggested three terrace levels had given rise to further methodological problems. First and foremost, there is the need to know about the process or processes and dated periods of the palaeoclimatic episodes to be related to the formation and succession of these erosion surfaces and terrace levels. The three terraces' location at heights 195 m, 210 m and 225 m a.s.l. in particular require further emphasis because each terrace ought not to be referred to as a contour line but rather as a deposited landform that is specified by its thickness. This is a conventional practice as illustrated by (Chaline, 1985: 137) and Dubar (1987: 157). Except where and when the natural exposure and aggradation of terraces are clearly delineated, further combined chronostratigraphic, morphometric and pedologic field sessions and laboratory analyses are required before any suggestions could be made about the morphogenetic setting. According to Faniran (1986: 215-216) and Rognon and Coudé-Gaussen (1987: 145), the intertropical African geomorphology does not usually expose conspicuous terraces, but complex geomorphic phenomena which are not easy to scrutinize and delineate (Faniran and Jeje, 2002: 1-13; 190-244; Thomas, 1994: 3-15; 193-283). In addition, studies of such a complexity are not yet systematic nor coordinated, within and between the countries and regions of the continent.

CHAPTER TWO

ENVIRONMENTAL SETTING OF THE STUDY AREA: A BACKGROUND

2.1 LOCATION OF THE BIGHT OF BENIN REGION

Benin City presently is the Capital of Edo State in the Federal Republic of Nigeria. It is a modern town, a market for palm oil and lumber, a centre of handicrafts and tourism, with a National Museum and a Federal University. It is on latitude 6° 33'N and longitude 5° 37'E. It lies on a low plain westwards from River Ikpoba. Benin City is known worldwide as one of the most prized centres of African court art (Eyo, 1990: 132 and 134):

> Perhaps the best known, and certainly the most numerous, sculptures in bronze in the whole of black Africa come from the city of Benin, capital of the Edo kingdom. Knowledge of them reached the outside world as a result of a British punitive expedition to that city in 1897, when thousands of sculptures, not only in bronze, but also in wood and ivory, were removed first to England and from there to many parts of the world (...).

Many other publications are devoted to the greatness and the splendour of this court art (Dark, 1973). But, since the late 1960s and early 1970s, Benin City is remembered, not only because of its court art, but also due to its impressive earthworks (Connah, 1975). Sometimes, these earthworks are said to be (Darling, 1984: 6):

> (...) the longest and the most massive earth constructions yet known from the pre-colonial pre-mechanical era (...). Four times longer than the Great Wall of China and with over a hundred times as much materials removed as the Great Pyramid of Cheops, (...).

In a more recent assessment, Andah and Anquandah (1988: 488-529) framed Benin City into what they called "Guinean belt", or the "Lower Guinea Coast". They presented the area as extending from Cape Palmas to Western Cameroon. What Andah and Anquandah (1988) called the Guinean belt, or the Lower Guinea Coast, partly covers the usually named Gulf of Guinea (Fig. 1). The Upper Guinea is specifically presented as comprising "the countries between the mouth of the River Gambia and the Bandama" (Person, 1984: 301), or "between the Ivory Coast and the Casamance" (Andah, 1988: 530).

Historically, from ca.1669 to 1813, the word 'guinea' started being used as a name for an English golden coin equivalent to twenty one shilling. This coin is taken out of circulation in 1813. Since ca.1682 onwards, the same word 'guinea' is referred to as a cotton cloth material of ordinary quality. This cotton material was firstly used as trading medium amongst the peoples of coastal West Africa who were then named the 'Guineans'.

Despite the explicit mention of the word 'guinea' in his book titled The Quaternary in the Coastlands of Guinea, Davies (1964) did not attempt to explicitly explain its meaning and its spatial delimitation. However, Person (1984) attempted an explanation that is emphasized as follows (Person, 1984: 301):

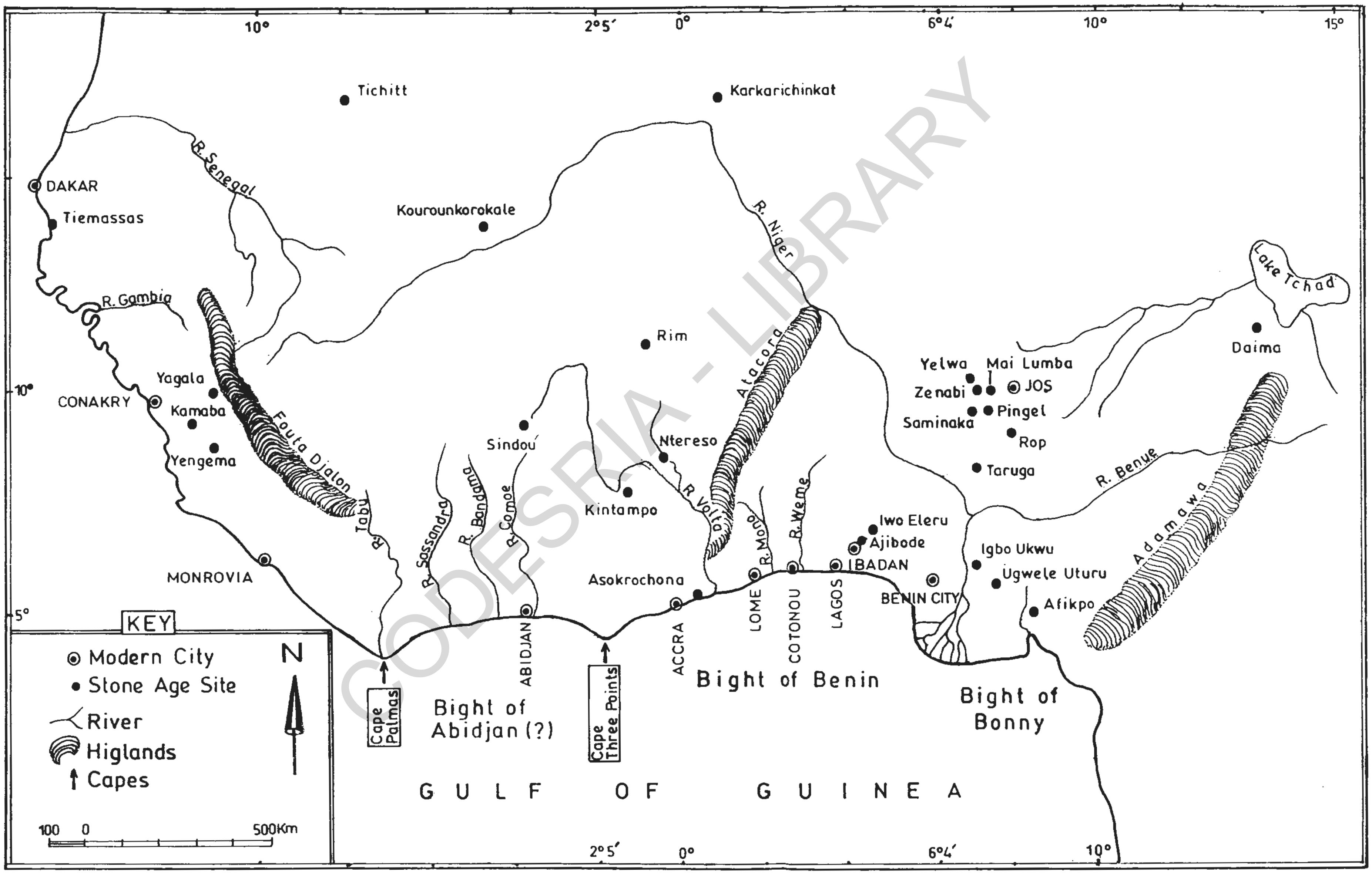
> The term Guinea refers to the western coast of Africa from the mouth of Gambia to the Niger Delta. This was the term – synonymous with 'Ethiopia' or the 'country of the blacks' – commonly used by the first Portuguese navigators to write about the area (…).

According to Person (1984), the lands and peoples eastwards from the Niger Delta (i.e. the Bight of Bonny/Biafra), or those westwards from the mouth of River Gambia, do not belong to the geo-historical space of Guinea. This is a controversial viewpoint as is referred to below.

Considering all the aforementioned historical information on, and definitions of the term 'guinea', there is the need for continuous research and discussion in order to obtain more relevant geographical and historical explanations. This is because the geographical concept of Gulf of Guinea was of late derived from the term of 'guinea'.

As a West African sub-regional land mass, the Gulf of Guinea (Fig. 1) is divided into three distinct coastal indentations. Moving from the west to the east, the first covers between Cape Palmas and Cape Three Points, whilst the second and third correspond respectively to the Bight of Benin and the Bight of Bonny/Biafra. In this study, the western unit is proposed to be referred to as the Bight, or the Bay, of Abidjan (Fig. 1). On the basis of the emphasis of the entire

FIG. 1: LOCATION OF STONE AGE SITES IN THE BIGHT OF BENIN, GULF GUINEA REGION, WEST AFRICA (ADAPTED FROM SHAW, 1976; 1992; ANDAH, 1979 d; 1981 AND OPADEJI, 1998)



African physical geography (Diarra, 1992: 317; Butzer and Cooke, 1995: 21-22; Nyamweru, 1997: 31-33; Fullard, 1977: 32), as well as when looking at the West African regional scale (Mabogunje, 1976: 4; 10; Andah, 1979b: 25), any attempt to demarcate the Gulf of Guinea's coastline ought to include these three distinct bights.

In order to put the Bight of Benin in a proper geographical locational perspective, its western limit has been fixed at Cape Three Points in Southwestern Ghana, in front of the Light House Tower built in 1925 and connected with the Cardinal Points Station (Plate 1) that indicate the distance respectively to the Equator, Lagos, Cape Town, London. The Global Positioning System (GPS) readings taken at this Station on Thursday, 27th June, 2002, are as follows:

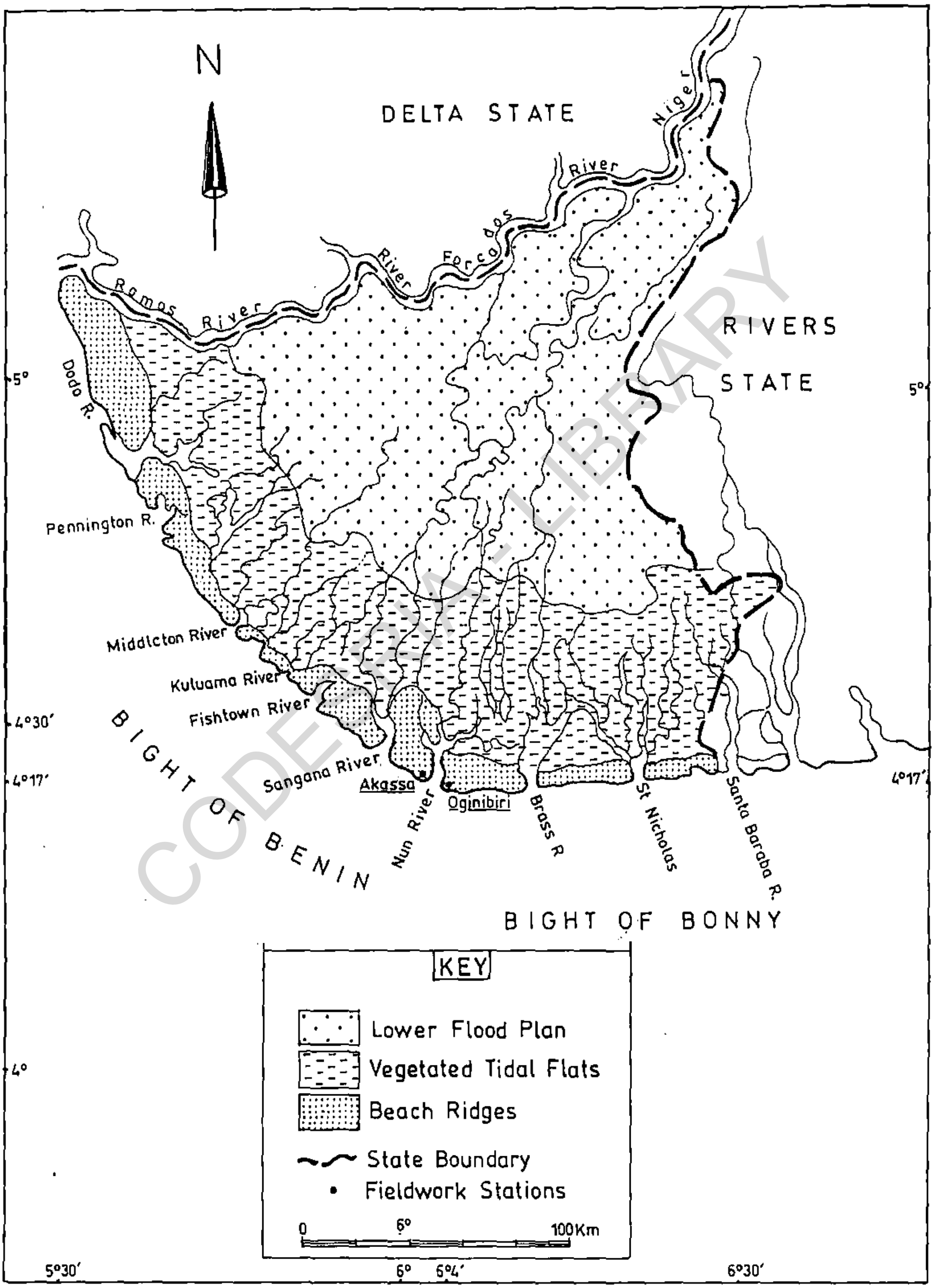
(i) latitude: 04° 44' 25"N

(ii) longitude: 02° 05' 29"W

Concerning the delimitation of the eastern limit, the first disadvantage is the absence of a station of cardinal points. Another disadvantage is the Quaternary geologic and geomorphic setting of the Niger Delta. This arcuate delta consists of numerous mouths, without capes on the coastline. Oyegun (1999: 31) called such a coastline the "arc of the Niger Delta" that describes more than 185 km of coastline and displays successive small mouths of rivers amongst which the River Nun's mouth seems to be contact point between one NWW section and another

PLATE 1 : General shot of Cape Three Points Cardinal Points Station and the Light House Tower (S.W. Ghana) : Bight of Benin's Western limit at 4°44'25"N and 2°5'29"W. (Source: 2002 fieldwork)

FIG. 2: LOCATION OF THE COASTLINE OF THE "ARC OF THE NIGER DELTA" SOUTH EASTERN NIGERIA (AFTER OYEGUN, 1999; ALAGOA, 1999 AND FANIRAN, 1986)



SSE section (Fig. 2). According to Faniran (1986: 208-209) this coastline "arc" is a "fan-shaped" type of delta. Such a geomorphic shape had led to the choice of the western point of confluence between the River Nun and the Atlantic Ocean as the eastern limit of the Bight of Benin (Plate 2). Consequently, the eastern point of confluence becomes the western limit of the Bight of Bonny/Biafra (Plate 3). The GPS readings taken on Sunday, 21st April, 2002, on the coastline at the western point of confluence, are as follows:

(i) latitude: 04° 17' 14"N;

(ii) longitude: 06° 04' 0"E.

Because of the constant erosion of the coastline, Okumbiri Beleu had been chosen as a more stable station. The village is located northwards along the western bank of the River Nun, not far from the sea, with the following GPS readings:

i) latitude: 04° 17' 12"N;

ii) longitude: 06° 04' 01"E.

As already acknowledged, previous readings were taken on Oginibiri's latitude et longitude. This village is located close to the beach, at the western limit of the Bight of Bonny/Biafra (Fig. 2). These readings obtained at Akassa (Khongo), from a local developmental programme labeled "Akassa Development Foundation" are: (a) on latitude: 04° 16' 13"N and (b) on longitude: 06° 05' 07"E.

PLATE 2 : General shot of River Nun's western confluence with Atlantic Ocean (Central Niger Delta, Nigeria) : Bight of Benin's eastern limit at 4°17'14"N and 6°4'00"E. (Source: 2002 fieldwork)

PLATE 3 : General shot of River Nun's bed and eastern confluence with Atlantic Ocean (Central Niger Delta, Nigeria): Bight of Bonny's western limit. (Source: 2002 fieldwork)

On the basis of computer exercise the readings at the centre of River Nun's bed correspond to: (i) latitude: 04° 16' 3" and (ii) longitude: 06° 04' 30".

In addition to these eastern and western limits of the Bight of Benin, the spatial delimitation from the Atlantic coastline to the inner land has been based upon climatic and vegetational attributes (Fig. 3). Thus, from this Atlantic coastline the northern gross limit of the Bight of Benin is proposed in this study to diagonally range between latitude 8° N in the West and 7° N in the East. This suggestion is also made in accordance with the demarcation of the Gulf of Guinea as shown in Fig. 1.

Sometimes, on the basis of economic criteria (Wilson, 1975; Verger, 1976; Person, 1984; Unesco, 1985; Law, 1991; Gayibor, 1990; Law and Strickrodt, 1999) the Gulf of Guinea is divided from the west to the east into:

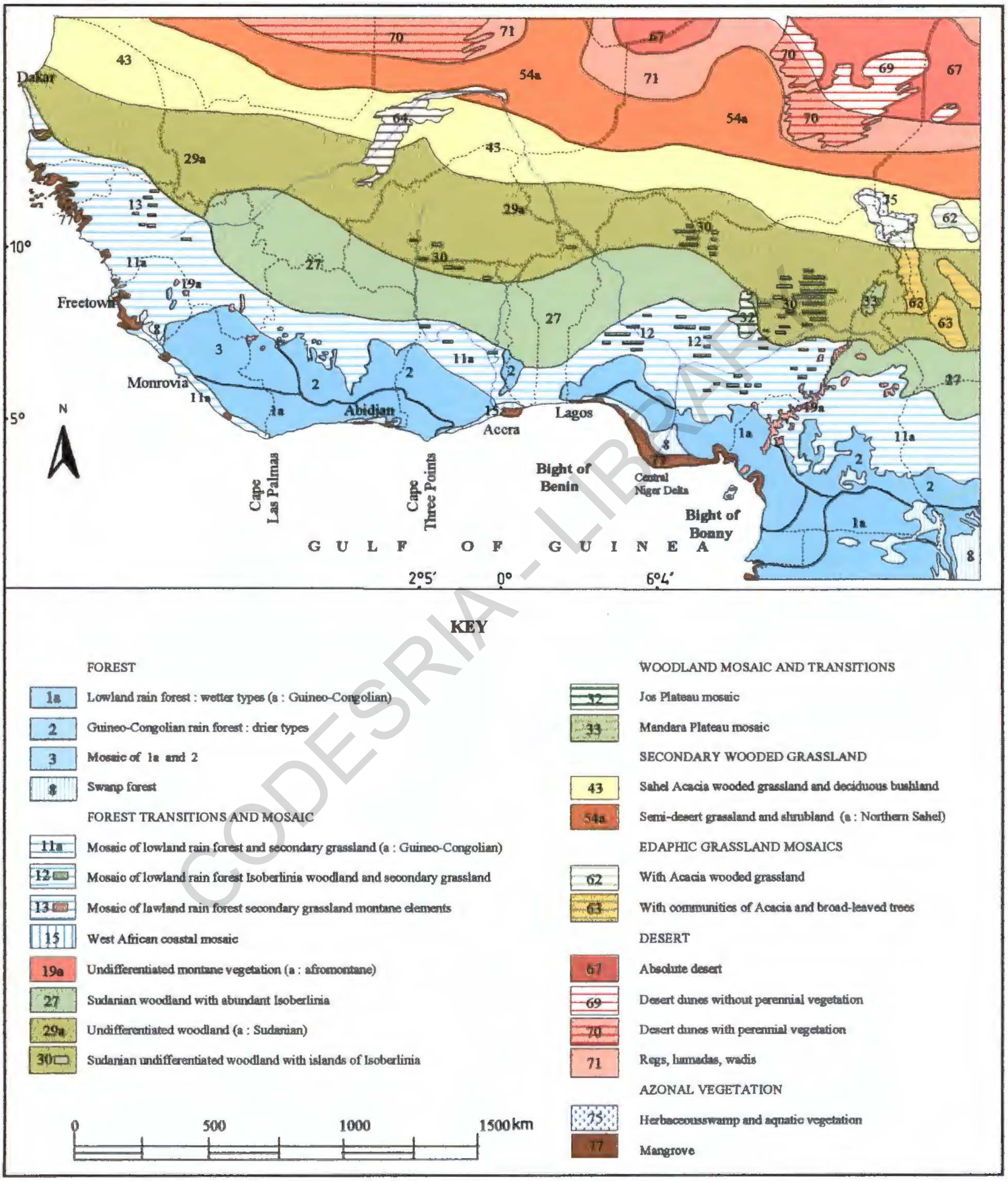
(i) an ivory coast or a coast of Quaqua (Person, 1984: 333) which is proposed above (cf. Fig. 1) as the Bight of Abidjan;

(ii) a gold coast, i.e. the western part of the Bight of Benin, corresponding to the present-day Republic of Ghana;

(iii) a slave coast, i.e. the central part of the Bight of Benin, equivalent to the both current Republics of Bénin and Togo; and

(iv) an oil coast (or oil rivers), i.e. the both extreme eastern part of the Bight of Benin and extreme western part of the Bight of Bonny.

Fig. 3 : Vegetation Map of West Africa (After White, 1986)



From this oil coast in the Niger Delta, the Bight of Bonny then extends eastwards up to Cape Lopes in Republic of Gabon. With such a location, Cape Lopes forms a common eastern boundary point of both the Bight of Bonny and the Gulf of Guinea. Westwards from Cape Lopes up to Cape Palmas in Liberia but adjacent to the Liberia/ Côte d'Ivoire border, the Gulf of Guinea in its spatial extension draws the two Bights of Bonny and Benin, and outlines a third bight in the Southern Côte d'Ivoire Republic. The Gulf of Guinea thus appears as a distinctive physical region with specific attributes within the West Africa broader region as shown in Figs. 1 and 3.

2.2 PRESENT ENVIRONMENT

As emphasized above, the Bight of Benin Region is the geographical central part of the Gulf of Guinea. Its past and present environmental setting is thus referred to with a view of providing the necessary background information in relation with the Stone Age Settlement Archaeology.

This research is not basically environmentally-oriented. Archaeology has much to do with environment, ecology, eco-system or landscape as emphasized in Chapter One (Section 1.2.3). Many archaeologists no longer have reservations to explicitly accept their discipline as a both timely and spatially "human ecology" (Butzer, 1994). This is particularly the case when an archaeological study is focussed on subsistence-settlement patterns. In this regard the Bight of Benin Region presents a very interesting picture. The region appears generally as a flat land both in latitudinal and longitudinal extent. The mean altitude is less than 400 m; except for the SW-NE oriented Akwapim Hills and Togo-Atakora Mountain which are commonly known to range between 600 and 800 m respectively from southern Ghana to northern Togo and Benin Republics (Fig. 1). In terms of climate and vegetation (Figs. 3 and 4), the changes are more progressive than contrasting from south to north, as well as from west to east. Except the SW-NE peculiar "Dahomey Gap Scrub" (Fig. 5), the demarcated nuances are the mountain azonal attributes and the eastwards rainforest in Niger Delta as shown in Figs. 1 and 3. The regional environmental setting seems to be generally in favour of human settlement and subsistence, in the present-day times (Fig. 3), and this may have also been the case during those of the Stone Age Periods (Figs. 4 and 5).

In the study of the Palaeolithic Settlement Archaeology, the environmental setting of the Bight of Benin Region is considered with particular focus on the following:

(i) the "Dahomey Gap" area that extends from Cape Three Points to Benin/Nigeria coastal and inland borderland; and

Fig. 4 : Location of the West African lowland rainforest during the Middle Holocene : ca 7500-2500 BP (Based on Tossou, 2002)

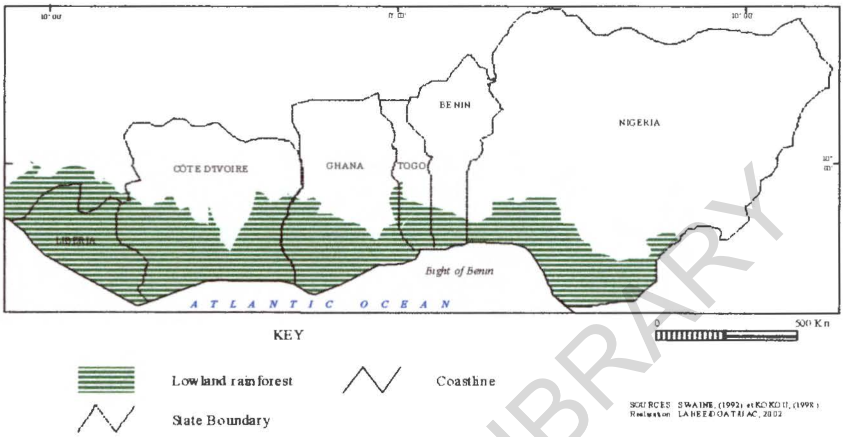


Fig. 5 : Location of the Dahomey Gap Scrub since the Upper Holocene : ca 2500 BP to present (Based on Tossou, 2002)

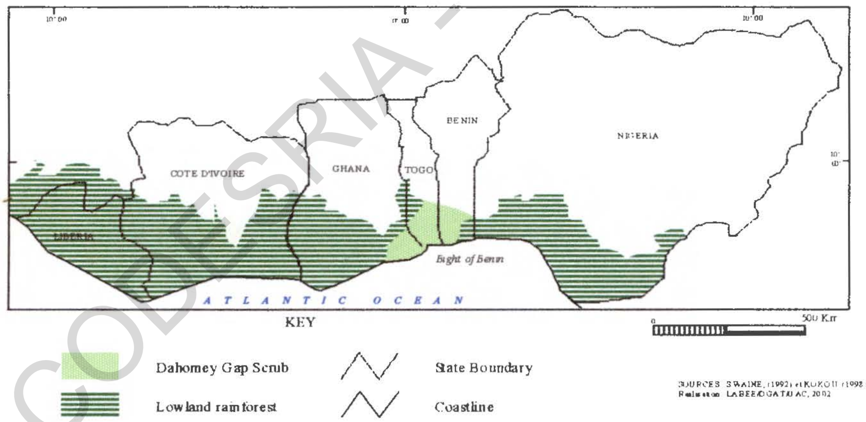
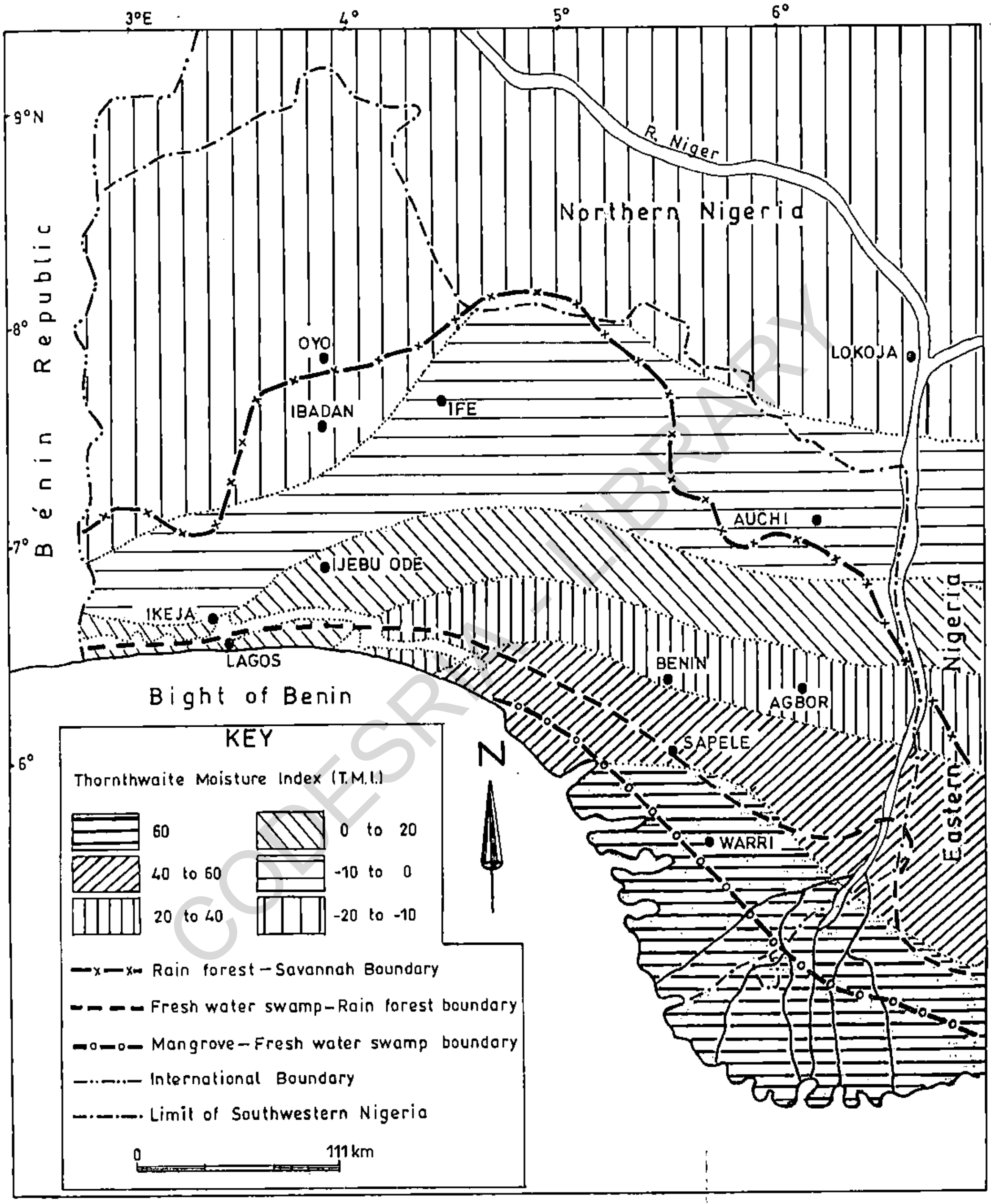


FIG. 6: LOCATION OF THE ZONES OF THORNWAITE MOISTURE INDEX IN SOUTH-WESTERN NIGERIA (BASED ON ANDAH AND AJAYI, 1981)



(ii) the "Ibadan Metropolitan Region" in the broader environmental context of Southwestern Nigeria up to the western Niger Delta rainforest area (Fig. 6).

2.2.1 The Dahomey Gap current environments

The intention here is to attempt a broad overview of the current environments of the Dahomey Gap, not as a whole, but on the basis of selected parts that have been archaeologically investigated, from the settlement standpoint. These selected areas are the Accra coastal plain in Southern Ghana and the eastern Lower Mono Basin in Southern Bénin Republic.

On the Accra plain is located the well-known Asokrochona Stone Age Site. Very little archaeologically-based information is provided on the site's present environments from Nygaard's and Talbot's (1976) preliminary report and later expanded report (Nygaard and Talbot, 1984); on the contrary to Andah's two parallel reports (1979a; 1993).

Nygaard and Talbot (1976: 13-19; 1984: 19-38) located the site from Accra at 10 km east of Tema and bout 10 km inland from the coast. In addition, they mentioned that the area is covered with short grasses and is dotted with thickets and termite mounds. The presence of Mokwe and Sakumo Lagoons was also mentioned. The hill which separates the two lagoons is about 500 m wide from east to west, and 300 m from north to south, with an altitude which ranges from 25 m to 21 m. According to Nygaard and Talbot (1976: 13), the site is located at about 5° 36' N and 0° 03' W. A 732 mm mean annual precipitation is reported, as well as a vegetation "characteristic of the present dry savanna and semi-arid Sahel zones" while "a mixture of open grassland and thicket woodland is suggested" for the past times (Nygaard and Talbot, 1984: 19-20). During a half-day visit to the site on Saturday, 29th June, 2002, (Plate 4), precise GPS readings of 05° 36' 41'' N and 0° 02' 59'' W were recorded for the site.

Andah (1979a: 47-85; 1993: 90-104) reported twice on the site with more detailed and concise information on the current environmental setting. According to him, the site is located on a narrow coastal plain of southern Ghana known as the Accra plain (Plate 5) lying from the north east by the River Volta. There are two separate dry seasons, the first being from December to February, and the second from August to September. Mean temperatures are high, 29°C in August and 34°C in March, and the mean annual rainfall is of 736.5 mm.. So, this coastal plain is more arid than the coastal stretch to the West (e.g. Takoradi, Cape Three Points). It is even drier than the Ghanaian northern savannas. The two principal vegetation bands consist of the strand and mangrove zone and the coastal savanna. The present inhabitants are mostly Ewe. 'Sacouma', the name of their village, meaning "the back of the river". 'Asokrochona' on the other hand is a Ga word

PLATE 4 : General shot of Asokrochona Site: Messrs J.A. Quansah and O. Bagodo standing at Nygaard's and Talbot's excavation point, at 5° 36' 40" N and 0° 2' 51" W. (Source: 2002 fieldwork)

PLATE 5 : General shot of Asokrochona Site: Messrs J.A. Quansah and O. Bagodo standing at Andah's excavation point, at 5° 36' 41" N and 0° 2' 59" W. (Source: 2002 fieldwork)

meaning mangrove forest. The village is primarily a fishing and farming settlement. However, it is inhabited mainly because of the availability of fish (Andah, 1979a: 49; 55; 1993: 90-91).

Within the Dahomey Gap, the eastern lower basin of River Mono, in Southern Bénin Republic, constitutes the second selected area where archaeological field investigations have been carried out successively from 1990 to 1991 and from 1993 to 1995. Details of the story, the results and the constraints of this archaeological reconnaissance are presented in Chapter Three (Section 3.3). The present environmental setting of this area is not significantly different from that of the Accra plain. River Mono (Fig. 7) flows in a north-south direction, as a 85 km boundary line between Benin and Togo Republics before emptying its water into Atlantic Ocean. Upstream from the north, it runs on a 300 km course through the Togolese territory. During the 1990-1991 and 1993-1995 fieldwork exercises, appropriate partitioning of the river's course into upper, middle and lower sections was adopted. Thus, following series of field and discussion sessions, it was agreed upon (Bagodo, 1993: 26; 1994a: 157) (Fig. 8):

(i) the whole Mono basin stretches from longitude 1° 30' to 1° 55' E, and from latitude 6° 20' to 9° 2' N; and

(ii) the lower basin extends from longitude 1° 30' to 1° 55' E, and from latitude 6° 20' to 7° N which corresponds to the northern

FIG. 7: LOCATION OF RIVER MONO (BAGODO, 1993; 1994 a-b)

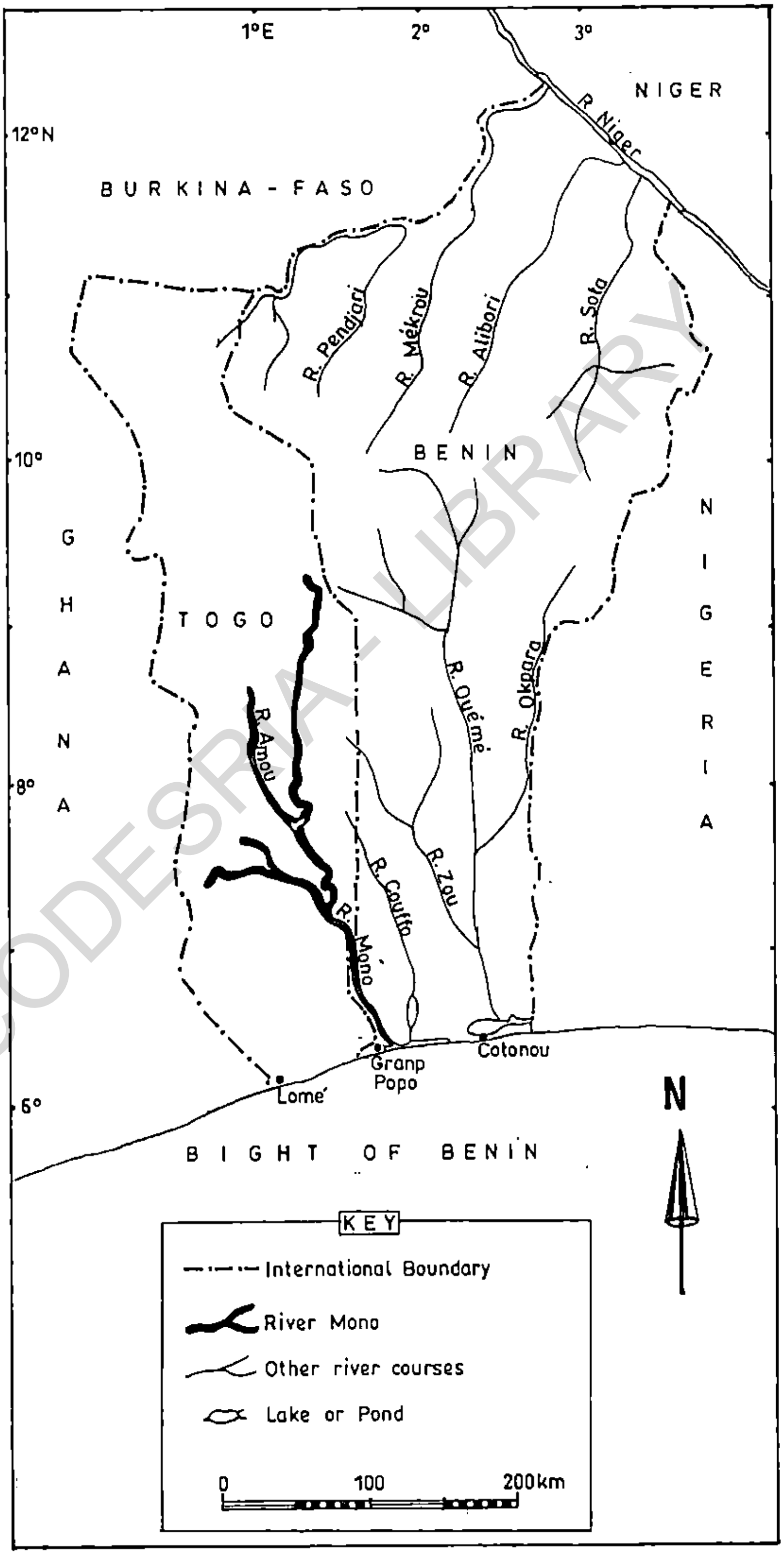
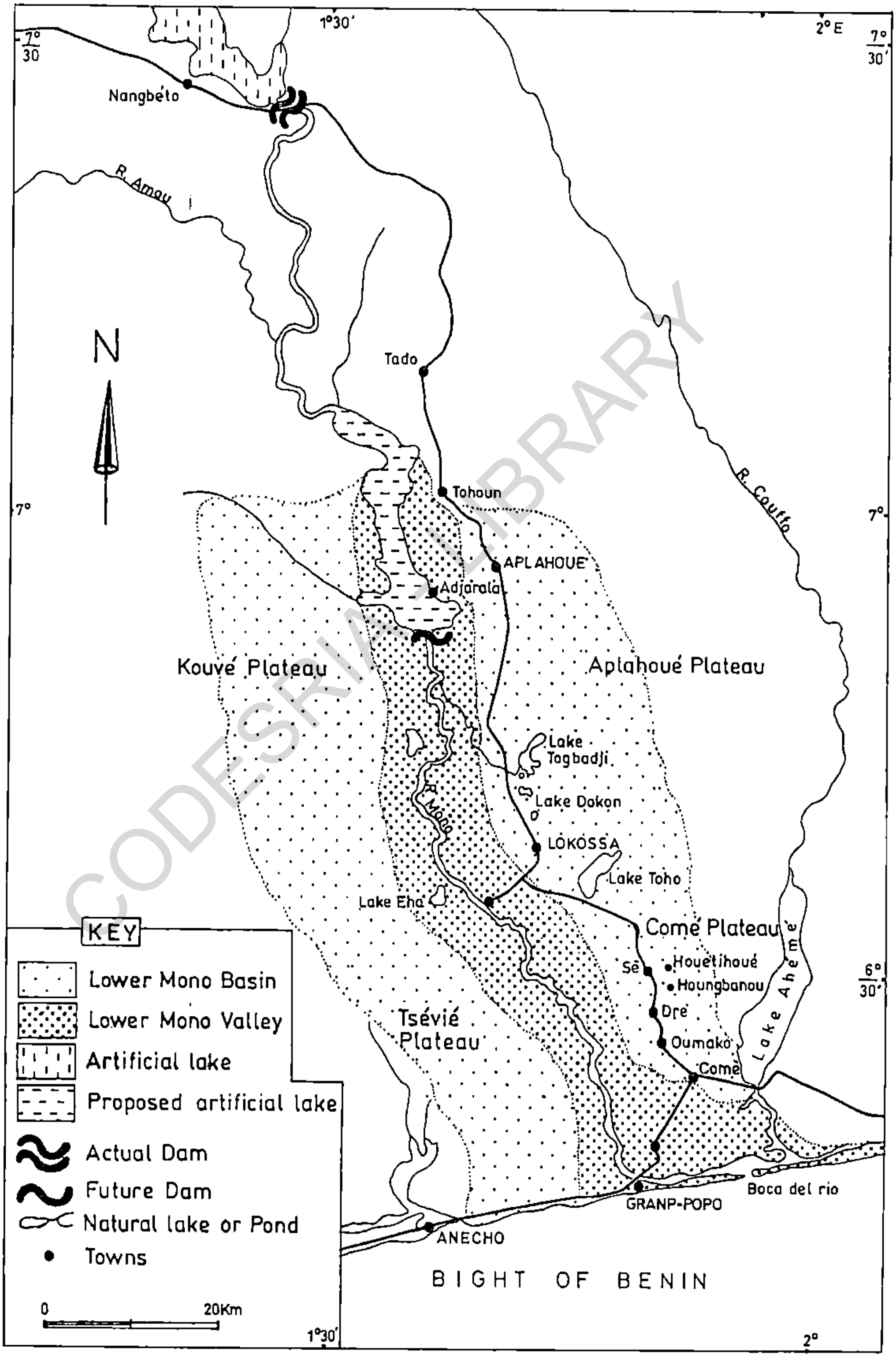


FIG. 8: LOCATION OF LOWER MONO VALLEY AND BASIN (BAGODO, 1993; 1994a-b)



limit of the Coastal Sedimentary Basin in Southern Bénin and Togo Republics (Slansky, 1962; Oyédé, 1991).

The geomorphic units of the Lower Mono Basin (in Chapter Three) consist of about a 5 km corridor of coastal plain with a mean altitude of less than 10 m. The river flows into the sea through a lagoon at Grand Popo. To the north is a plateau unit with a varying altitude from south to north: 10-15 m around Bopa alongside Lake Ahémé, 30-40 m at Sé, 80 m at Lobogo. The "Lama Depression", with a E.N.E.-W.S.W. median orientation, a maximum extension of 25 km and an altitude ranging between 20 m to 60 m, cuts the plateau unit into north-south oriented fluvial and lacustrine drainage system which is actively reshaping the present topographic scenery. This drainage system is connected with the Lake Ahémé, the tributary Rivers Couffo, Zou and Onin, and the Grand Popo Lagoon as the final reservoir flowing into the Atlantic Ocean. Both of these fluvial and lacustrine drainages make a flooding plain (Slansky, 1962: 13-176; Oyédé, 1991: 26-55; Houndagba and Bokonon-Ganta, 1994: 101-130).

With regard to climatic and vegetational attributes (Mondjannagni, 1969; Bokonon-Ganta, 1987), the average annual temperatures are 22-24°C minima in August, and 30-32°C maxima in February and March. The annual rainfall in Southern Bénin Republic and Togo ranges from a minimum of 900 mm to a maximum of 1,300 mm. According to Bokonon-Ganta (1987: 58-65), Togo and

Bénin southern lands correspond respectively to 1,100 mm and 1,200 mm isohyets. Concerning the Dahomey Gap as a whole, he suggests that 1,200 mm isohyet be regarded as the reference annual mean rainfall. He reports that there has been a variation of annual rainfall from 1957 to 1987: e.g. 878.4 mm being the lowest recorded at Lomé-Airport and 1,529.7 mm as the highest recorded at Sèmè Station at the fringe of Bénin/Nigeria southern border. These temperature and rainfall characteristics have resulted in the creation of four annual seasons. These are: (a) a major dry season from November to March; (b) a longer rainy season from April to July; (c) a short dry and cool season in August; (e) and a shorter rainy season from September to October.

As a combination of the topographic and climatic factors, there is the formation of the following three distinctive vegetation belts (Mondjannagni, 1969: 59-162; Paradis, 1976; Bokonon-Ganta, 1987: 25-25):

(i) on the coastal plain there is a heterogeneous vegetation made of Cyperus maritimus, Remirea maritimus, Diospyros tricolor, Chrysobalanus icaco, Paspalum vaginatum, Typha autralis, Rhizophora racemosa, Avicennia Africana, Borassus aethiopum, Lophira lanceolata, Elaeis guineensis;

(ii) on the "Lama Depression" and on the tops and bottoms of the adjacent southern and northern plateaus, are isolated moist or semi decidous forests of Triplochiton seleroxylon, Terminalia superba, Elaeis guineensis, Melaleuca leucadendron, Symphonia globulifera, Anthocleista vogelii. There are also savanna species such as Adansonia digitata, Parkia biglobosa, Lophira lanceolata;

(iii) on the valleys of both lower River Mono and its tributary or confluent courses, are derived forests of Pterocarpus santalinoids; while on the hills are forests of Uapaca togoensis.

In the Lower Mono Basin and the neighbouring areas, as well as in the whole southern Bénin and Togo Republics, the present-day inhabitants are mostly "Ajatado" (Gayibor, 1985) or "Gbe" peoples (Capo, 1988). From the Atlantic beach to the lagoons and nearby the lakes, the rural peoples are more fishers than farmers; whilst the opposite situation is observed on the plateaus and the 'Lama Depression'. The inhabitants of the cities are mainly involved in administrative and commercial activities.

2.2.2 Ibadan Metropolis Area in the Context of Present-Day Environments of Southwestern Nigeria

Southwestern Nigeria (Fig. 6) extends from the western Niger Delta to the Nigeria/Bénin Republic border (Andah and Ajayi, 1981: Fig. 2a-b-c-d). As part of Southwestern Nigeria, "Ibadan Metropolitan Region" is situated at about 7° 26'N and 3° 50'E, and 150 km from Lagos city alongside the Atlantic coastline and is covered by the Nigeria 1: 50,000 Sheet (i.e. N.E. topographical map) (Faniran, 1994: 28).

According to Akintola (1994a) and (Faniran, 1994), banded gneiss covers over three-quarters of the area, outcropping and making up three prominent geomorphological features. These are Oke-Aremo, Mokola-Oremeji and Premier Hills. The highest elevation is at about 235.2 m a.s.l.. The relief and drainage scenery is dominated by hills, plains and river valleys. The plains, with an elevation of between 180 m to 210 m a.s.l. are the more extensive features. These are found between the hill bases and the valley bottoms. The valleys are usually incised. The general drainage layout consists of a dendritic pattern, with trellised patterns at places where quartzitic and gneissic bands are interposed. The land surface around Ajibode has pediment plains and three confluent streams – the Lalewan, Yamoje and Orogun – which are tributaries of River Ona that flows in a north-south direction emptying its water into Lake Eleyele. The present flood level of the river is 180 m above the sea level. Different terraces have been formed over time, at the current indicative heights of 195 m, 210 m and 225 m (Andah and Momin, 1993; Andah, 1995a; Momin, 1995). A tentative synopsis of these terraces' formation is presented in Chapter Four (Section 4.1).

As assessed by Oguntoyinbo (1994: 58-71), Ibadan Metropolitan climatic characteristics depend on the West African monsoonal climate, with a rainy season between March and October marked by the influence of the moist maritime southwest monsoon winds flowing inland from the Atlantic Ocean. The dry season occurs between November and February marked by the dry dust-laden winds blowing from the Sahara Desert. For the period 1953-1988, a mean annual temperature of 26.6°C was recorded. For the period 1911-1988, the mean annual rainfall was 1258.36 mm: the highest annual rainfall of 1981.2 mm was recorded in 1968, while the lowest value of 786.4 mm was recorded in 1983 (Oguntoyinbo, 1994: 64-66). During the same period 1911-1988, the fluctuating rainfall has resulted in some droughts and floods. Droughts occurred in the years 1914, 1936, 1942-1943, 1948, 1956, 1958 and 1982-1983. The metropolitan area has been affected by the 1968-1973 Sudano-Sahelian catastrophic drought. More than the droughts, the floods are accepted as having more influence on the metropolitan daily life. From 1956 to 1980, four floods occurred. The flood of 31st August 1980 is reputed to be the worst in the current historical times of Ibadan City (Oguntoyinbo, 1994: 66; Akintola, 1994b: 254).

According to Udo (1994: 8-17), with a comparatively low annual rainfall of 1220 mm, Ibadan is drier than the northwards cities of Ilorin (1260 mm), Kaduna (1303 mm) and Minna (1354 mm). Despite such a relative dryness, Ibadan is at the fringe of the forest-grassland of Southwestern Nigeria, while Ilorin, Kaduna and Minna are less humid than Ibadan, and are located at the savanna grassland areas. The word 'Ibadan' is derived from 'Eba-Odan', a Yoruba word which literally means 'near the grassland'. The term is used to reflect the city's location on the fringe of the forest zone near the savanna (Ikporukpo, 1994: 1; Udo, 1994: 8).

According to Areola (1994: 103-105), the boundary between the savanna and the secondary forest in Nigeria is generally believed to have stabilized. The southwards advance of the savanna is checked by the more humid climate and richer and more moisture-retentive soils. In Ibadan area, human pressure on land has reduced the positive effects of these natural factors on the forest vegetation in favour of the savanna-type vegetation. Thus, Ibadan vegetation pattern presents a patch work of broken forest, savanna woodland, dense thickets and large tracts of forb vegetation dominated by Chromolaena odorata (Siam weed), as well as regenerated forests mixed with tree crops such as cocoa and kola. The vegetation is also characterized by Cassia sp. pl., Anogeissus leiocarpus, Parinari curatelliofolia, Vitellaria paradoxa, Burkea africana, Lophira lanceolata, Adansonia digitata, Adenia cissampeloides, Alchornea cordifolia, bamboo and Akoko trees, spear grass (Imperata cylindrica) goat weeds (Ageratum conyzoides).

The local population (Afolayan, 1994: 129-130) basically consists of Yoruba groups (95%) inclusive of the Ibadan, the Ijebu, the Ijesha and the Ondo. The other groups (5%) include the Ibo, the Hausa, the Igbira, the Urhobo. The rural communities are mostly farmers whilst urban people are mainly in administrative and commercial activities. With regards to present-day agricultural and livestock production (Gbadegesin, 1994: 145-153), the food crops include yam, cassava, maize, sugar canes, leafy and non-leafy vegetables (melon, pumpkin, tomatoes) and fruits (plantains, pawpaws). The cash crops comprise cocoa, kola-nut, palm-oil, coffee and citrus. Livestock production includes sheep, goats, pigs and others.

2.3 A REVIEW OF MAJOR INDICATORS OF QUATERNARY PALAEO-ENVIRONMENTAL CHANGES IN THE GUINEA REGION OF WEST AFRICA

2.3.1 Global Considerations

For subsistence-settlement purposes, human individuals and groups are sensitive to a sustainable presence of water, floral and faunal resources. The permanent or occasional distribution of these resources depends on climate. Climate is thus considered by natural scientists as the key factor determining the environmental setting. More and more, archaeologists and palaeo-anthropologists are adherents of such a viewpoint; and this leads to their general acceptance of the relevance of environmental, ecological or/and behavioural archaeology in connection with subsistence-settlement pattern analysis through space and time. Such archaeological approaches benefit from general theoretical guidelines on Quaternary climatic changes all over the world generally on the basis of multi-disciplinary approaches (Vrba, Denton, Partidge and Burckle, 1995; Williams, Dunkerley, Deckker, Kershaw and Chappel, 1998; Miskovsky, 1987).

These general theoretical guidelines inherited from M. Milankovich (1879-1958) are applied to local or regional reconstructions of cyclic scenarios such as the Bight of Benin in the context of the West Africa Guinea Region.

The Serbian geophysicist/climatologist M. Milankovich is remembered for his work on the cause for long-term changes in the Earth's climate. Following earlier astronomical works (e.g. Copernicus, Brahe, Galileo, Kepler), he realized that the key to past climates was the amount of solar radiation received by the Earth, and that this varies according to latitude and depends upon the Earth's orbit. He then founded the "Milankovich cycles" on the basis of which he reconstructed the classic theoretical radiation curves for the past 650,000 years.

This theory still in use is continuously assessed (Bernard, 1986; Bouvier, 1987: 1145-1157; Scott, 1997: 42-45; Vrba, 1995: 24-45; Williams et al., 1998: 73-106). It basically consists of explaining:

(i) that the Earth's orbit varies from being almost circular to being more elliptical (eccentricity) during a cycle of ca. 100,000 years;

(ii) that the inclination of the Earth's axis to the plane of orbit (obliquity) varies from 21.8° to 24.4° with a periodicity of ca. 40,000 years; and

(iii) that the direction of tilt of the axis varies through time (precession so as to sweep out a come about every 21,000 years).

Thus, since the 1920s, "Milankovich cycles" became a worldwide established "Astronomical Theory" (Bernard. 1986: 30). Scientists then have continued improving research methods. As a result, other factors like the level of CO_2 in the atmosphere have been recovered and accepted as contributing to the orbital variations and ice age formation. Thus, from the 1960s to 1970s, studies of air bubbles trapped in polar ice cores gave information on CO_2 levels related to variation in temperature and volume of oceans over the last million years. Over the same period, CO_2 has varied by up to 30%. But, in spite of such a hardly scientific knowledge in atmosphere as well as oceans' past changes, a complete theory of the factors is admitted to be complex, and good models not yet available. Such a complexity is clearly shown by the multidisciplinary emphasis adopted in books such as <u>Paleoclimate and Evolution, with Emphasis on Human</u>

Evolution (Vrba et al., 1995) and Quaternary Environments (Williams et al., 1998).

Bernard is aware of this fact of complexity in attempting to reconstruct an African regional model that he published in a book entitled Théorie astronomique des pluviaux et interpluviaux du Quaternaire africain (Bernard, 1962). The book is said to be that of the first application of Milankovich's "Astronomical Theory" to the tropical zone, particularly to Africa (Bernard, 1986: 29). While studying the African Quaternary evolution in relation to this astronomical theory, Bernard (1986: 17) relates the global palaeoclimatic changes to four cycles, viz. (a) a cosmological cycle that encompasses a billion years; (b) a geological cycle that ranges from 10 to 100 million years; (c) an astronomical cycle, from 10 to 100 thousand years; (d) a historical cycle, from ten to one thousand years. He favours the astronomical cycle as the relevant in the study of the African Quaternary palaeoclimatic evolution on a worldwide perspective (Bernard, 1986: 19). Such African Quaternary astronomical cycles are determined by the oscillation of the "Calorific Equator" on the "Geographic Equator" (Bernard, 1986: 29).

According to the current state of the global "Astronomical Theory", the Earth's obliquity marked at 23° 35' is intermediate between its extreme position, and the axis' alignment leads our planet Northern Hemisphere summer to be farthest from the Sun (at aphelion) and the Southern Hemisphere summer closest to the Sun (at perihelion). About 100,000 years ago, the Northern Tropic was at 24° 30' and the Northern Hemisphere summer at perihelion. As a result, tropical Northern Africa received about 7 percent more solar radiation in June, July and August than it does now; and 7 percent less in December, January, and February. Consequently, summer temperatures in Africa north of the Equator would have been higher than now, and the monsoonal inflow of moist air would have been correspondingly greater. This monsoonal inflow created more rain than at present and caused lake levels to rise. On the other hand, between 20,000 and 13,000 years ago, carbondioxide concentrations in the atmosphere were lower than now, and the surface of the tropical Atlantic was 3° C or 4° C cooler. Evaporation from the oceans and the moisture load of the monsoon were reduced, thereby causing greater aridity north of Equator. In the 1960s radiocarbon dating of carbonates and shells from deposits in the Lake Chad basin, the valley of the White Nile upstream of Khartoum, and in the Kenya Rift Valley showed that at the end of the Pleistocene and in Early Holocene, lakes in closed basins in the regions had been larger than at present. Analysis of the pollen in a core from Lake Bosumtwi in eastern Ghana indicates the disappearance of the forest between 20,000 and 15,000 years ago, and the rainforests are believed to have been reduced to refuge areas (Grove, 1997: 36-37).

In relation to such a state of the theory, generally more implicitly than explicitly, there is a large amount of literature on many aspects or variations in the West African Quaternary. This relatively abundant literature is mostly oriented on the geomorphic and palaeoclimatic basis; the specific emphasis on palaeo-environmental/human interactions being few.

The major concern of our study is not an exhaustive overview of the entire West African Quaternary literature. In view of the fact that the different lines of arguments are more consenting or complementing rather than diverging or contrasting, emphasis is deliberately placed on a selection of some previous substantive and topical contributions (Burke, 1970; Burke and Durotoye, 1970; 1971; Whiteman, 1970), and on more recent assessments (Petters, 1991; Ofomata, 1993; Dupont and Weinelt, 1996; Sowunmi; 1993; 1998; Tossou, 2002); with occasional reference to continental or global statements (Petters, 1987; Butzer, 1994; Butzer and Cooke, 1995; Nyamweru, 1997; Grove, 1997; Scott, 1997; Faniran and Jeje, 2002; Thomas, 1996).

2.3.2 Syntheses from Natural Scientists

Biological and associated fossil remains in normally stratified and preserved contexts are direct and valuable indicators of Quaternary palaeo-environmental changes (Butzer, 1994). Archaeological and palynological studies are amongst the disciplines that provide such indicators (Sowunmi, 2001a-b). In our study area such studies are yet few but relevant and informative (Sowunmi, 1986; 1993; 1998; Dupont and Weinelt, 1996; Tossou, 2002). Sowunmi's (1986) study spatially covers the Niger Delta only, whilst Sowunmi's (1993 and 1998) statements are focussed on the whole West Africa and are consequently more appropriate for our regional review. The syntheses from Dupont and Weinelt (1996) and Tossou (2002) are focussed on the Dahomey Gap in the broader context of the Guinean rainforest, and they are appropriate too for our regional review, particularly for the Palaeolithic Subsistence-Settlement Pattern Analysis in Chapter Six.

Sowunmi's (1993) assessment is made basically on the following three lines of evidence (Sowunmi, 1993: 12-13):

(i) biogeographical features that reflect the present-day distribution of both animals and plants, extent of endemism and degree of species' diversity; areas with high degrees of endemism and species' diversity being admitted as "refugia" for plants and animals during periods of adverse climates;

(ii) geomorphological data that witness climatic alternating changes:

(a) periods of lake levels and soil formation as evidence of warm and wet climates that maintain, re-establish and expand vegetation communities; (b) while low lake levels, sand dune formation, sea regression and salt deposition are considered as witnessing aridity no suitable for the existence of vegetation communities; and

(iii) archaeological data that are considered as indirect line of evidence, to be used not solely on their own, but while corroborated by direct palaeobotanical evidence.

After such preliminary consideration, the author accordingly agrees with others that there is yet very little direct botanical evidence in a view of the history for West African (Late Tertiary and) Quaternary vegetation. Thus, this history is tentatively made from Upper Tertiary to Present as follows (Sowunmi, 1993: 13-16):

(i) that the appearance, expansion, contraction or extinction of plants were a consequence and therefore a reflection of climatic and geomorphological variations. During Upper Tertiary and Quaternary periods, the arid phases were characterized by the formation of sand dunes, canyons, pediment gravels and river terraces (Sowunmi, 1993: 13);

(ii) that from Upper Tertiary to Early Quaternary periods: (i.e. ca. 26 to 2 million years BP), along a coast considered to be about 100 km further in the north than today, most of the present rain forest area was submerged by the ocean and recorded plants include Bomba, Berlinia and Symphonia all characteristic of Guinea swampy forests and rain forests. Rhizophora, Nymphaea, Lygodium, Ceratopteris and gregarious palm were present while Typha became extinct later (Sowunmi, 1993: 13-14);

(iii) that the period from Early to Late Quaternary (ca. 2 million to 65,000 BP) started with a receded coast to about 50 km south of its present position indicating a sea regression and a probable much drier climate than in the preceding period; the only available data depict Sudan and Sahel savanna with Combretum, Adansonia digitata and Phoenix (Sowunmi, 1993: 14); and

(iv) that from Late Quaternary to Present (ca. 65,000 BP to Present):

(a) there were between ca. 65,000 and 40,000 BP freshwater forest components including many of present-day species such as Uapaca spp and Calamus daeratus, lowland rainforest first open and later more dense with ferns and trees like Khaya ivorensis and Myrianthus arboreus, as well as riverine forests; a surprising absence of evidence of a savanna vegetation as to indicate the limitations of reconstructing past vegetations;

(b) between ca. 40,000 to 30,000 BP, due to a marine transgression (i.e. Inchirian), there were inundated and reduced swamp forest, established Rhizophora swamp forest, northwards extended rain forest and probably pushed further north savanna;

(c) between ca. 24,000 and 12,500 BP, there was a very arid period (i.e. Ogolian regression) with ergs and sand dunes blocking the mouth of River Senegal, forests drastically reduced to small "refugia" evidenced by Holoptelea grandis and Canthium subcordatum. The dry/open savanna moved up to about 300 km southwards of its present southern limit. The second half of the period was more arid and the Sudan and Guinea savanna was replaced by a reduced Sahel savanna;

(d) between ca. 12,000 and 10,000 BP, there were wetter conditions that re-established Rhizophora swamp and rain forest components like Elaeis guineensis, Pentaclethra macrophylla, Canarium schweinfurthii and Musanga cecropioides; the climate was not as wet as today, the sea level was 63 m below today's, the regenerated rain forest was drier one than today, Guinea savanna increased and River Senegal resumed its flow to the ocean;

(e) between ca. 8,500 to 5,000 BP, Rhizophora swamp forest expanded with a peak at the maximum phase of the Nouakchotian transgression marked by an invasion of the sea all over the lower valleys of the major rivers; a richer rain forest developed and extended northwards to its limit of ca. 40,000 to 30,000 BP;

(f) between ca. 5,000 and 3,000 BP, onset of a final arid phase; by 4,200 BP a lowering of sea level to -3.56 and -0.5 m, mangrove and rain forest species decreased and aeolian sands deposited in south-east Ghana; later by 3,500 to 3,000 BP increase of the both forests and Guinea and Sudan savannas, while Sahel savanna extended to its present limit and most of the vegetation communities assumed their present extents; and

(g) from ca. 2,800 BP, human impact on the natural vegetation through farming activities is evidenced by a sharp rise of Elaeis guineensis associated to the weeds of waste places of cultivated land such as Aspilia sp and Borreria verticillata (Sowunmi, 1993: 14-15).

Such a wet versus arid alternating vegetational pattern of the Quaternary in West Africa is, five years later, re-assessed and re-modelled in terms of "Ecological Archaeology" (Sowunmi: 1998). Among other observations, the following are notable:

(i) that the generalised palaeo-environments are usually reconstructed from: (a) geomorphic data (i.e. fossil terrestrial, marine and freshwater sediments; (b) palaeobotany (i.e. fossil pollen, spores, leaves, sees, fruits and wood); (c) palaeozoology (i.e. fossil bones, shell and teeth);

(ii) that for the Quaternary palaeoenvironmental reconstructions in West Africa evidence before Holocene times is very scanty and often without chronometric dates (Sowunmi, 1998: 66-67);

(iii) that the Quaternary chronological frame is contracted on the whole, as well as in periods:

(a) undated Plio/Pleistocene Period during which Sahel zone lakes dried up by early Pleistocene with presumed subsequent reduced terrestrial and aquatic fauna supposed to be like of current Southern Guinea savanna with gallery forests; the coastline moved seawards following a sea regression;

(b) Early Pleistocene (ca. 1,300,000 to 800,000 BP) conditions as today; and

(c) Late Pleistocene starting some time prior to 40,000 BP as an arid period with environmental features mentioned above, continuing from ca. 40,000 to 30,000 BP as a wet period in contrast to the prior one. From ca. 30,000 to 13,500 BP succeeded a very dry period with formation of Sahel and Sudan dunes southwards up to 350 km, a fall in sea level to a minimum of 110 m and related vegetation. The Holocene period that ranges from ca. 13,500 BP to the Present and is characterized by a notable environmental change related to warmer and wetter climate, and is pictured by vegetational restoration and expansion from the prior refugia as evidenced by palynological and micro fossil botanical data from Republics of Côte d'Ivoire and Ghana. There were rather local fluctuations back to drier conditions from the middle Holocene with fall in the levels of Lake Chad (7,000 to 5,500 BP) and Lake Bosumtwi (8,000 BP).

> From ca. 4,500 till 3,500 BP in southern and eastern parts of the region, and till ca. 2,000 BP in the northern and western parts, there was an abrupt onset of dry conditions (Sowunmi, 1998: 67-71).

In conclusion, Sowunmi (1998: 71-92) calls on archaeologists to place their present and future investigations in an ecological context in order to ascertain "Man's complex and dynamic interaction with his physical and biological environment" and on the other hand to highlight in West Africa, from Stone Age times to the Present, Man's knowledge and utilization of natural resources, and his impact on it. Her final reflections on an "Ecological Archaeology" are broadly emphasized below in Chapter Six in consonance with a scenario of Middle Stone Age/Middle Palaeolithic Settlement Patterns.

Both Sowunmi's (1993 and 1998) assessments are primarily and chiefly devoted to biological aspects of the regional Quaternary environmental changes. Because of such an approach, unavoidable gaps of relevant information have to be filled on geological and geomorphic perspective. That is why she rightly deplores the spatially and temporally scarceness of samples, dates and proofs on one hand, and on the other calls for interdisciplinary attempts in order to undergo such Quaternary investigations. From a geological and geomorphic standpoint, the studies are fortunately undergone at more places and by more numerous experienced specialists (Burke, 1970; Burke and Durotoye, 1970; 1971; Whiteman, 1970; Petters, 1987; 1991; Ofomata, 1993; Faniran, 1986; Faniran and Jeje, 2002). Ofomata's (1993) and Petter's (1991) statements are hereby selected in order to illustrate and balance the lines of arguments. Their contributions, as well as those from Burke (1970), Whiteman (1970), Burke and Durotoye (1970; 1971), Faniran (1986) and Faniran and Jeje (2002) are archaeologically emphasized in the next Section as well as in Chapter Four (Sections 4.1 and 4.5).

In attempting a review of the "Geomorphic and geological evidence of the Quaternary in West Africa", Ofomata (1993: 1) firstly warns that there is a large amount of literature on the topic even during the short period from 1969 to 1983 only. His synthesis consists of three sections, namely, Early Quaternary, Late Quaternary and Coastal regions.

Examining the Early Quaternary, Ofomata (1993: 1-3) mentions the following points. The period being characterized by weathering and the formation of superficial indurations, a study of the related ironstone concretions is essential for a proper understanding of the chronostratigraphy, even relatively. Humid conditions are said to be necessary for the formations of these superficial deposits in encouraging chemical rock weathering. Since such geochemical phenomenon is common during most of the Quaternary in West Africa, even in areas currently arid or semi-arid that are supposed to have been more humid in past times than in present-day ones. In most of the region, these ironstone concretions are said to be generally thick and compact and usually formed by the concentration of iron in situ; their surface on the intermediate relief and the Continental Terminal had been cut and eroded in parts giving slopes which were later covered by new ironstone concretions often containing detrital materials from the older indurations. These secondary indurations are generally thinner than the older ones and their importance in the early Quaternary would appear to diminish southwards. The ironstone concretions are identified as laterites or lateritic concretions. As a conclusion, Ofomata (1993: 3) states that:

> One major problem which still limits our full understanding of Early Quaternary events over West Africa is that of chronology. We are still far from establishing an absolute age for various events of the Early Quaternary in the areas of geomorphology and geology (...). Some fairly successful attempts have been made towards establishing relative ages for the relevant events through proper correlation (...), (...) most of the known ironstone indurations ("laterites") in Nigeria are Pliocene-Pleistocene in age.

Dealing with the Late Quaternary (i.e. Upper Pleistocene and Holocene) he (Ofomata, 1993: 3-6) adopts the usual explanatory scenario consisting of humid versus arid climatic fluctuations as emphasized above by Sowunmi (1993; 1998). He specifies that unlike the situation in the former period, the Late Quaternary has been provided with Carbon 14 dating for most of its events for the last thirty to thirty-five thousand years. According with the usual regional alternating climatic changes' scheme, he mentions in the Chad basin the occurrence of an arid climate before the Gazalian humid phase from 40,000 to 20,000 BP, an arid period from 20,000 to 12,000 BP, a relatively more humid climate after 12,000 BP up to 8,000 BP, a near total drought between 7,500 and 7,000 BP, a progressive fall of Chad's level from ca. 5,5000 till dryness from 4,000 BP to 2,000 BP when climate became drier than today in the west of Sénégal and in Mauritania. On the impact of these events on landform evolution, they are said to have had remarkable influence, especially with regard to the formation of river terraces and the development of dry valleys. He (Ofomata, 1993: 3-6) is of the viewpoint that the terraces were formed under alternating climatic phases, viz:

(i) a wet or "pluvial" period in which chemical weathering was predominant and when fine elements were transported and subsequently deposited;

(ii) a dry or "inter-pluvial" phase of dominant mechanical action, with dissection of previously deposited materials and the removal, through gullies, and redistribution of coarse elements;

(iii) each terrace level is to be interpreted as corresponding with a dry phase; the occurrence of these river terraces make the climatic variations as factors to account for the incidence of soil erosion;

(iv) many of the present gullies were already initiated during a dry phase by strongly incised valleys which favoured the concentration of run-off. Since man's activities increased the run-off, these are to be seen as mainly aggravating and complicating an already existing situation, rather than initiating it;

(v) the formation of dry valleys would mean that the water table was continued to fall, letting the area become drier; and

(vi) the valleys could have resulted from local or regional uplift, but no evidence of rejuvenation as would be the case if such uplifts were important.

On the geomorphic Quaternary events in the Coastal Regions, the same author (Ofomata, 1993: 8-10), in accordance with some of his predecessors, indicates the subsequent presence of a series of marine deposits covered by continental terminal sandstones in Sénégal, Mauritania, Côte d'Ivoire and Bénin Republic. In Côte d'Ivoire, for instance, a former level sea at 110-154 m probably reflects the maximum of the last regression, while from the Flandrian transgression up to date a sandy covering and organic deposits have continued to build up. Some of the deposits have been dated between 15,000 and 10,000 BP. Since the Nouakchottian, sandy coastal bars have favoured the formation of a series of lagoons.

This evolution is said to resemble that of the coastal region of Bénin Republic (cf. Chapter Three, Section 3.1). The overview mentions many additional illustrative cases in Ghana and Nigeria, among others. Finally, his concluding remark seems to be at once a warning and a call for improving scholarship and collaboration (Ofomata, 1993: 10):

> (...) some gaps still exist in out knowledge of the Quaternary geomorphology and geology of West Africa, perhaps the greatest need is to try to harmonise our chronologies and attempt the use of common methodologies.

Concerned with the same methodological and theoretical problems, Petters (1991: 647-649) suggests to firstly consider the geomorphic and climatic factors in order to properly examine the Quaternary sedimentary successions throughout Africa. Accepting that "the present is the key to the past", Petters (1991: 647) emphasizes that the contemporary physical and climatic features of the continent are not radically different from the Quaternary physical geographical setting. This is why the present geography and climate constitute the base line against which to understand, explain and assess the Quaternary palaeogeographic and palaeoclimatic setting. Thus, in West Africa, the current geomorphic and climatic setting has specifically produced four distinct types of Quaternary sequences, namely (Petters, 1991: 650-657):

(i) the coastal sequence known under different names in different countries (e.g. the Benin Formation in Nigeria, about 200 m thick). It consists of cross-bedded sands, kaolinitic clays and lignite beds. It includes recent deposits and its base is ill-defined in the subsurface (Petters, 1991: 651);

(ii) the sequence overlying the Guinea basement in the rainforest and savanna zones (e.g. the Bodija Formation, about 8 m thick in south-western Nigeria). Its origin and lithological sequence are said to be well-known by geomorphologists, geologists, soil scientists and archaeologists, all facing the problems of dating, correlating and interpreting the laterites (i.e. the highly leaching residual superficial deposits). This sequence contains little or no datable materials and the sequence of events cannot (or hardly) be reconstructed. It is generally an incomplete sequence in which may have been preserved only deposits of the Late Quaternary pluvials and interpluvials. Only in Sierra Leone that well exposed alluvial sequence in mining excavations had been observed as a basal diamond and corrudum-bearing gravel overlain by a clayey alluvial sand layer, with loamy sandy clay at the top. Embedded fossil wood gave dates ranging from, respectively, 36,000 to 20,000 BP, 12,5000 to 7,800 BP, 3,300 to 1,750 BP and 1,000 BP to Present (Petters, 1991: 651-653);

(iii) the savanna-Sahel sequence (e.g. on Jos Plateau). Jos Plateau's sequence is well exposed also in mining excavations. Its base consists of laterised and very weathered Plio-Pleistocene fluvio-lacustrine sands and clays, unconformably overlain by basalts and three fining-upward fluvial cyclothems. The beginning of each cycle is marked by laterite or tin-bearing gravels which contains Neolithic artifacts of the Nok culture (Petters, 1991: 653); and

(iv) the Saharan sequence (e.g. the Chad Formation which is up to 600 m in Nigeria). It corresponds to well exposed Late Pliocene-Holocene lithologic sections in fluvial lake beds in Western Niger, Northern Mali and Western Sahara. The Chad Formation in Nigeria comprises fluvio-lacustrine clays and sands with diatomites. Its Plio-Pleistocene boundary is said to be known (Petters, 1991: 653-654). Fortunately, as referred to in the next Section as well as in Chapter Six (Section 6.1), ages of three and six million years are already established since the mid-1990s (Brunet, Beauvilain, Coppens, Heintz, Moutaye and Pilbeam, 1995; Brunet, Beauvilain, Coppens, Heintz, Moutaye and Pilbeam, 1996; Brunet, 1999; 2001).

2.3.3 Suggestions from Archaeologists

With regard to the search for a "chronological frame" for the West African Quaternary, Davies (1964: 5) was one of the first archaeologists to explicitly refer to the "Astronomical Theory" as "(…) the first attempt at an absolute chronology of the Pleistocene (…)"; but in calling into question the relevance of the then Bernard's (1962) "(…) table (…) as an independent chronological clock". Also in an attempt to obtaining this "chronological frame", Davies (1964: 11-18) broadly referred to the "African pluvials", and specifically to those in "West Africa north of the Equator". Finally, for the same purpose of chronological sequences, he (Davies, 1964) carried out field investigations in topics such as "(…). West African Beaches compared with those elsewhere" (Davies, 1964: 22-44), "West African River-Terraces. Formation of river-terraces (…)" (Davies, 1964: 45-68) and "Soil-Profiles and Laterisation" (Davies, 1964: 69-79).

Some five years later, archaeologists and geologists from the Universities of Ibadan, Ife and Lagos, and the Federal Department of Antiquities (Lagos), organized on April, 7th 1969, "a dialogue on the role of stratigraphy in geology and archaeology" which report has been published under the title of Stratigraphy.

<u>An Interdisciplinary Symposium</u> (Daniels and Freeth, 1970). The methodological and chronological concerns emphasized above by geologists (e.g. Ofomata, 1993; Petters, 1991), have been discussed at the symposium.

The participants attempted to answer the fundamental question on the theoretical bases warranting the application of geological stratigraphic practice to archaeological problems as follows:

(i) with regard to the archaeological field research, this geological practice is a valuable tool to an archaeologist as a "palaeo-historian" concerned with reconstructing sequences of events against a chronological framework. It is less relevant to an archaeologist as a "palaeo-sociologist" involved in identifying patterns and regularities in the cultural relationship of material cultural assemblages (Daniels and Freeth, 1970: 42);

(ii) on the utility/significance of stratigraphic units to archaeological purposes, it is agreed that rock-stratigraphic units are important to archaeologists working on Quaternary Period, while they seem to be valueless for Iron Ages and later periods (Daniels and Freeth., 1970: 42);

(iii) the bio-stratigraphic unit as corresponding closely to cultural assemblage, is of considerable relevance to archaeologists working in all periods (Daniels and Freeth, 1970: 42-43);

(iv) the erection of type sections for rock-stratigraphic units, fundamental in geology, is of little general value in archaeology, except when the "types" are in the realm of bio-stratigraphic units (Daniels and Freeth, 1970: 44); and

(v) archaeologists view with concern any authoritarian imposition of rules for procedures and classification; but stratigraphic Codes are less absolute than consent rules (Daniels and Freeth, 1970: 44).

According with these general concerns of the participants in the Symposium, archaeologist Shaw (1970: 16-17) in particular warned against the danger of circular argument in dating a deposit by the embedded stone artefacts. Shaw (1970: 17-18) also warned against the risk of having greater rate of mixed deposits in archaeological strata than in geological strata. Shaw (1970: 20-22) then stated that archaeologist is interested in stratigraphy in order to establish cultural sequences and chronological framework.

One year later, Shaw (1971) unequivocally related the study of "The prehistory of West Africa" to "climatic changes" in emphasizing that the "climatic and vegetational circumstances" are means both of allotting relative ages to stone artefact-assemblages, and of understanding the environment in which man lived at the time (Shaw, 1976: 39). While assessing the same topic, "The Prehistory of West Africa", in the early 1980s, Shaw (1992: 611; 615-617) repeated the same emphasis in specifying that "We have no reliable geological and geomorphological information on West Africa bearing upon climatic change earlier than the period of the last glaciation in Europe" (Shaw, 1992: 616).

Obviously very concerned with the methodological key points emphasized by the 1969 Symposium (Daniels and Freeth, 1970) and Shaw (1970; 1976; 1992), as well as with those matched with Davies's (1964) book, Andah, tried, from 1976 to 1995, to critically scrutinise the problems of the geologic and geomorphic toposequences and chronosequences (Bakker, 1967a-b; Burke, 1970; Burke and Durotoye, 1970; 1971) in relation to the both studies of West African Stone Age Archaeology and Quaternary. On such perspectives, Andah (1976; 1979a-b-c; 1995a-c) authored and co-authored (Andah and Ajayi, 1981; Andah, 1987) articles and special book issues. Andah did so in constantly:

(i) questioning the natural scientists' procedures of establishing chronological sequences;

(ii) warning researchers to be aware of the customary trends and practices of spontaneously trusting and following the already established general scenarios and chronologies of wet/dry climatic oscillations in the region; and

(iii) recommending to specifically going from local to regional area, with systematic interdisciplinary attempts, in order to relevantly conclude on the regional Quaternary past and present setting.

Andah's suggestions and recommendations received positive echoes from younger archaeologists (e.g. Tubosun, 1995). Of course, both Andah and followers know very well that geomorphic and climatic evidence are integral part of archaeological Quaternary investigations. They are aware of the worldwide, African continental and West African regional relevance of the climatic "Astronomical Theory" as emphasized above in Section 2.3.1.

Andah (1976: 1-11) started by critically reviewing the Quaternary studies in West Africa through the case of the Ghanaian Volta Basin Development. In analyzing earlier syntheses on the present landscape, the formation, evolution, age and number of the Volta terraces, he (Andah, 1976: 1) summarised his standpoint as follows:

> (...) Sometimes studies have yielded interesting results, but they have rarely been comprehensive, geographically or geologically. Not surprisingly the sequence of development and exact provenance of river terraces, pediments and other alluvial features related to the Quaternary history of West Africa's principal rivers remain very much matters of guesswork and speculation (...).

A few years later, he expanded his overview to cover the Quaternary of the wider Guinea Region, with special focus on the geomorphic evidence (Andah, 1979b: 9-46). He emphasized on what he styled "climatic geomorphic thesis" as consisting of accounts of histories of alluvial and regolith stratigraphies related to alternating dry and wet climatic changes. In the southern Guinea of West Africa regional syntheses are said to be made on the basis of extrapolated Saharan/Sahelian chronologies. The artifacts contained in some of these sequences (e.g. Ásejire and Odo Ogun in Southwestern Nigeria, Asokrochona in the Accra coastal region) are placed generally into the Late Pleistocene and Holocene. Referring to these climatic and geomorphic stratigraphic sequences, Andah (1979b: 19-20) raised warning remarks such as:

(i) the fact that there is no convincing demonstration that late Pleistocene and Holocene crusts in various parts of West Africa constitute primary and regional rather than local formations;

(ii) that not all lateritic formations are reliable indicators of ancient land surfaces, and those that are soils developed in situ, form under quite diverse climatic conditions and do not necessarily reflect an alternating dry/wet rhythm;

(iii) that morphogenetic phenomena cannot be correlated a priori with climate types or climate areas alone for any part of the tropics except such correlations be demonstrated;

(iv) that field experience suggests that while climate is no doubt very important in the system, seldom do the climatic factors of precipitation and temperature solely determine the resultant land forms; there are situations where factors or gradient rock type, or vegetation are overriding;

(v) that before justifiably correlating local morphogenetic phenomena with climatic changes, one needs to demonstrate that the climatic factor overrides other factors in the area being investigated;

(vi) that the principal landscape features in the Guinea Region, namely pediments, residual and river valleys reflect erosional and weathering forces, while the superficial deposits, old buried soils and crusts reflect deposition and subsequent modification by physical, chemical and biotic forces; and

(vii) that it has not been demonstrated that both types of features in (vi) reflect regional climatic phenomena, and the stone artefacts found were in fact properly associated within the sequences.

Such methodological reservation and precaution are based upon his conviction that geomorphic aspect of the Quaternary research in West Africa "is by far the most problematic aspect and yet the one from which a lot of hypothesis and speculations have derived" (Andah, 1979c: 1). Such a viewpoint is illustrated in referring to specific case studies of pediments, multiconcave valley profiles, laterites, stone lines, in the view of highlighting the problem of the time relationship between sequence of deposits in different parts of the Guinea Region (e.g. Table 1).

For instance, on laterites, Andah (1979b: 30-33) pointed out that the evidence of laterites in support of the idea that arid phases occurred in the Guinea zone would mean that these laterites are necessarily formed only where seasonal fluctuation of the water table occurs, especially under savanna or semi-arid climates, and where long periods of aridity alternate with long period of humidity. In other words, all laterites in the forest zone must be relict. In response to this he explained that laterite soil formation is determined by factors including availability of parent minerals rich in alumina and iron oxide, the parent rock's granularity, abrasion, pH values, ironic potentials and weatherability, as well as

Table 1: A Tentative Correlation Table of the Quaternary and Superficial Deposits in Nigeria (After Durotoye, 1986, in Ofomata, 1993: 35)

		CONTINENTAL DEPOSITS									
		Pediment Deposis					Alluvial Deposits				
Time YBP	Climate	Northern plains	Lullemmeden Basin	Jos Plateau	Chad Basin	S.W. Nigeria	S.E. Nigeria	Lower Niger and Benue Valleys	S.W. Nigeria	Jos Plateau	GUINEA COAST
1×10^4	Recent wetter	Drift	Drift	Pediment wash	Lake clays and diatomite	Pediment wash	Pediment wash	Thick Alluvial Deposits	Thicks and on lower parts of large rivers	Sands gravels older Sands	Younger Suite Deposits Transgressive
	Drier	? Detrital laterite	Fossil Dunes Detrital Laterite	Detrical Laterite	Fossil Dunes sands	Loose pediment gravel	Loose Pediment at low sea level Alluvial terrace sands Erosion	Incision at low sea level 4m. river gravels upstream	Incision Tin bearing sands and grit	Erosion	Pre-Older sand Continental deposits of regressive phase Benin Formation - Top-set beds Agbada Formation Fore-set beds Akata Formation - Bottom-set beds.
2×10^4	Wetter										
1×10^6	Drier Wetter	? Secondary Laterite	? Secondary Laterite	? Secondary laterite	Chad formation	Cemented pediment gravel	Cemented pediment gravel	Alluvial terrace sands	20m. cemented river gravels upstream	Gritty sand and tin bearing gravels	
Pleistocene											
Villa-Franchian 3×10^6	Wetter conditions alternate with drier conditions		Formation	Chad							
Pliocene	Wet/Dry	Higher Plain Crust	Higher level Crust	Fluvio volcanic Crust	Buried Laterite Crust	Watershed laterite Crust & Abeokuta Laterite Crust	Nsukka Laterite Crust				

by soil permeability, local topography and drainage, vegetation and the pH value of the environment. Laterite formation in the West African region is thus not always nor necessarily dependent on the existence of a marked dry season, or an absence of tropical humid forests. It is rather dependent on fluctuation of water content of soil, which may or may not be due to seasonal climatic fluctuations. Seasonal climatic fluctuations appear however to be important for the formation of lateritic crusts that are dependent on capillary action. The final point made by Andah is that, despite all the evidence of the relationship between duricrusts and climate, their use as indicators of past climates must be seriously examined. Only when other stratigraphic evidence, such as basalt flows dated by K-AR method is available can duricrusts be related to a specific time, and possibly, to a specific environment.

Through the stone lines formation at local and regional levels, Andah (1979b: 33-41) understood the natural scientists to be interested in getting some chronological markers (e.g. Table 1); but not in the manner to accept any circular argumentation capable of providing valueless solution. The relict hypothesis is only one of the several possible explanations, and hardly the most plausible in the circumstances. Presenting the stone lines in the Guinea zone as very localised rather than regional phenomena, Andah (1979b: 33-41) issued such concluding remarks as:

(i) that, at present, what is known of Quaternary formations in the Guinea region of West Africa raise as many problems as they solve. If pediments, crusts, stone lines and other related features are direct or indirect products of climate, they may reflect distinctive local climatic phenomena rather than regional climate;

(ii) that first of all one must discover sequences in localities and study these properly and not with any preconceived notions or schemes. Such local sequences have to be studied through their lithology and their organic, inorganic and artefactual content in a bid to ascertain the nature of environment, and particularly climate under which each unit was formed, and its date of formation. After this, it is possible to compare and correlate the local sequences with dates or chronologies obtained through standard methods; and

(iii) that radiometric dating of both organic or inorganic carbon contained in buried soils and weathered profiles in the Guinea Region will not be simple, as different humus fraction will be of different age, there will be constant recycling and more recent carbon will be added by filtration.

These methodological recommendations for an innovative study of Quaternary sequences in the Guinea Region have been sometimes applied to field investigations (Andah and Ajayi, 1981), or theoretically re-assessed (Andah, 1995a-b-c). Some younger archaeologists have adopted and applied such suggestions and recommendations in field investigations. For instance, Tubosun (1995; 1997) did so in carrying out geo-archaeological research in parts of River Benue Basin (Nigeria), and in consequently emphasizing (Tubosun, 1995: 7-35) that a major observation of the previous and present Quaternary palaeo-environmental studies in West Africa is the fact that off-site situations have formed the major points of focus while little or no efforts have been made to explore the micro-sequences present at archaeological sites within these settings. It is necessary and crucial to put in their properly dated context the macro off-site sequences for a proper understanding of the Quaternary climatic history.

CHAPTER THREE

ARCHAEOLOGICAL RECONNAISSANCE OF SELECTED PARTS OF THE BIGHT OF BENIN REGION

3.1 THE 1990 TO 1995 OFF-SITE RECONNAISSANCE IN EASTERN LOWER MONO BASIN

3.1.1 The Eastern Lower Mono Basin: Location and Past Quaternary Environmental Setting

The Lower Mono Basin is presented as a geographical concept in the Section 1.3.3 of Chapter One. Both in Chapter One (Section 1.3.3) and Chapter Two (Section 2.2.1) River Mono and its lower basin have been located (Figs. 7 and 8) as extending from the Atlantic coastline on about latitude 6° 20' to 7° N. Field investigations were carried out only in eastern part of the lower basin because of political crisis in Togo. The topographic and geomorphic units of this eastern part are as follows (Fig. 9):

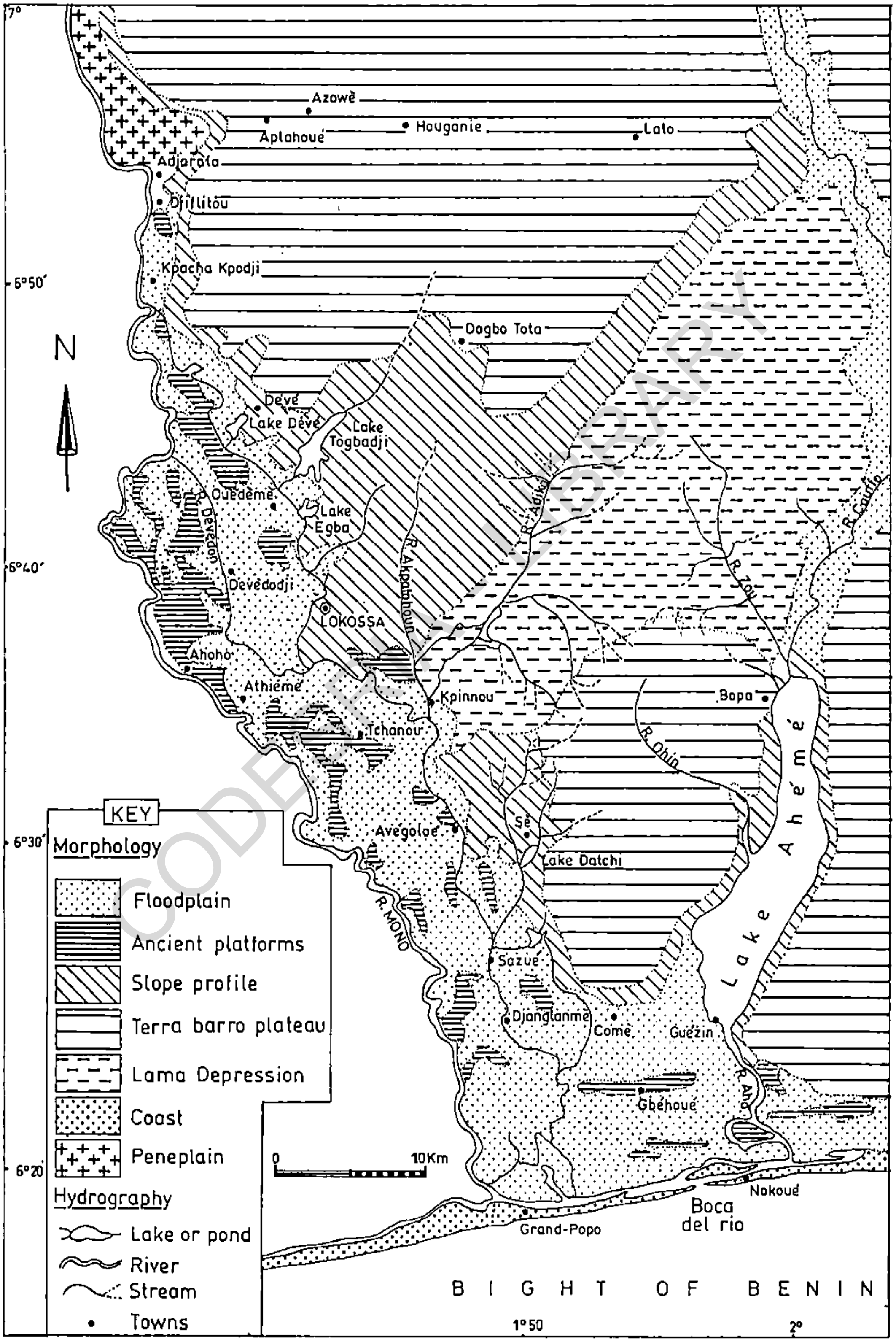
(i) a coastal plain that consists of about 5 km east-west corridor, with a mean altitude of less than 10 m. It extends between the Atlantic Ocean shoreline and the southern edge of the Bopa (or Comé) Plateau. From south to north, the coastal plain is made of beach, an earlier marine sandy landform with crude and poor soils, a series of marshes and Grand Popo Lagoon. On the coastal plain, Lower Mono

course is directed to the Sea through a mouth known after the Portuguese christening of "Boca del rio" (i.e. River's Mouth);

(ii) a southern plateau unit which is variously named Bopa Plateau (Slansky, 1962: 151-154; Houessou and Lang, 1978: 53; Agbahoundo, Iheta, Houessou, Kirov and Schipper, 1984: 5-6; Houndagba and Bokonon-Ganta, 1994: 105), or Comé Plateau (Oyédé, 1994: 92). The mean altitude of less than 100 m notably changes from south (e.g. 10-15 m around Bopa) to north (e.g. 30-40 m at Sé and 80 m at Lobogo). The entire plateau is characterized by ferralitic, thick and rich soils called by the Portuguese "Terra barro" (i.e. clayey soil). These soils are very suitable for agriculture;

(iii) the "Lama Depression", christened after the Portuguese word "Lama" and meaning the mud. It has a N.E.N./W.S.W. medium orientation and a maximum extent of 25 km. The altitude changes from 20 to 60 m. Its hydromorphic, dark, thick and very rich soils are suitable for agriculture; and

FIG. 9: LOCATION OF EASTERN LOWER MONO BASIN: A GEOMORPHIC AND TOPOGRAPHIC OUTLINE (ADAPTED FROM HOUNDAGBA AND BOKONON-GANTA, 1994)



(iv) a northern plateau unit which is named Aplahoué Plateau (Slansky, 1962; Houessou and Lang, 1978; Houndagba and Bokonon-Ganta, 1994; Oyédé, 1994). The altitude gently slopes up from the "Lama Depression" northwards. Thus, Aplahoué Town is at 150 m and on around latitude 6° 55'N. The plateau's sandy-clayey soil of reddish-brown colour is suitable for agriculture. On the plateau's southern part, lateritic crusts are sometimes exposed.

These major topographic units are matched with the geologic setting. In particular more consideration is taken into the Quaternary geologic setting, with regard to the whole Bénin/Togo Coastal Sedimentary Basin as it is currently known (Slansky, 1962; Houessou and Lang, 1978; 1979; Houndagba and Bokonon-Ganta, 1994). On the basis of the different studies referred to above and in accordance with other studies (Oyédé, 1991: 28-31; 1994: 95-97; 1996: 30-33), the lithostratigraphic sequences from the post-Eocene to Present (Plates 6 and 7; Figs. 9 and 10; Table 2) are as follows:

(i) the "Continental terminal" stricto sensu is accepted as a Formation made of post-Eocene deposits of continental origin. It constitutes a distinctive lithologic facies with well defined lower and upper layers. The age of the sediments ranges from middle-Eocene to pre-Quaternary (Lang, Kogbe, Alidou, Alzouma, Dubois,

PLATE 6 : Close up shot of a quarry section showing the thickness of the "Terra barro" layer overlying the "Continental Terminal" upper layer (West of Oumako, Bénin Republic) at 6°26'28"N and 1°50'12"E. Standing from left to right Dr Jean C. Houndagba, Messrs Christophe Kpatchavi (the quarry's owner) and Phillippe Kpatchavi (the junior brother) (Source : 2001 fieldwork)

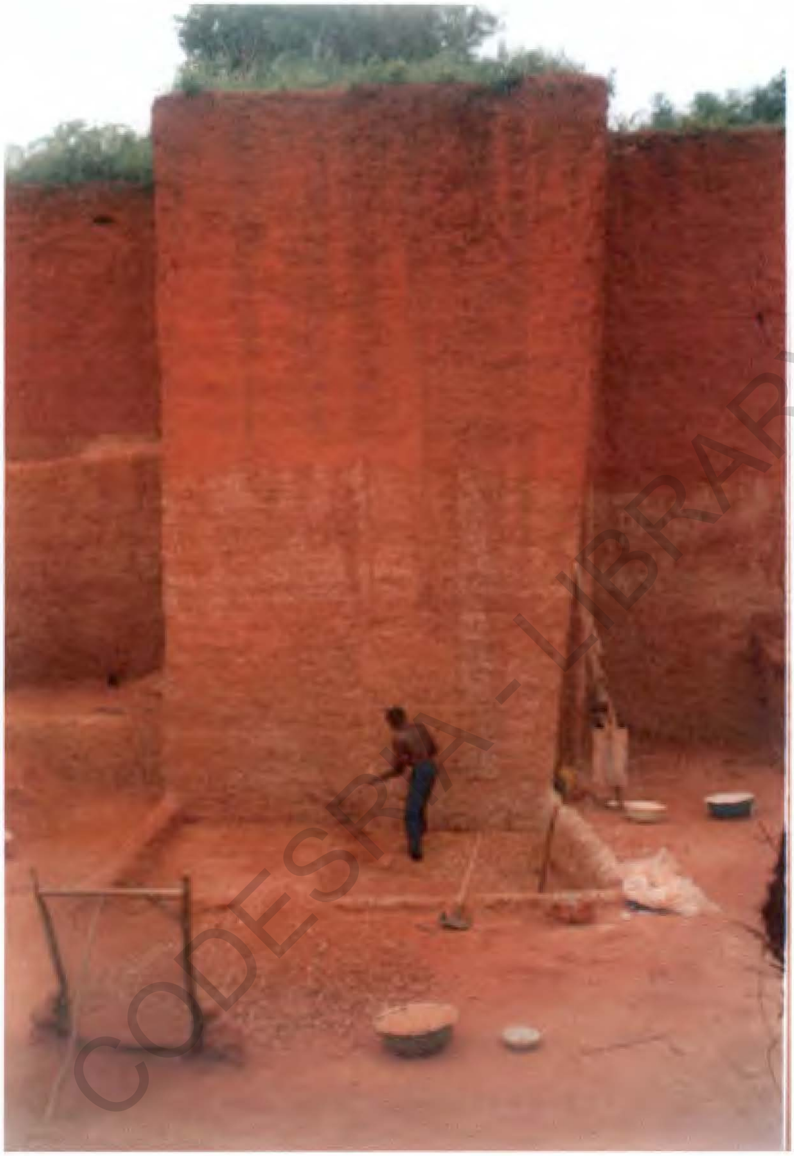


PLATE 7 : Close up shot of another section of the same quarry showing the contrasting colour and texture of superposed "Terra barro" and "Continental Terminal" layer section. (Source 2001 fieldwork)

Houessou and Trichet, 1986). It is well-established within the Coastal Sedimentary Basin in Southern Bénin which eastern Lower Mono Basin is part of. It consists of a siderolithic facies of clayey-silty-sandy coating which contains fragments or blocks of flint, and polished and homometric pebbles. Its thickness can get a maximum of 8-10 m. Its sedimentologic and mineralogic characteristics are close to these of the overlying "Terra barro" (Houessou and Lang, 1978; Slansky, 1962: 140-160);

(ii) the Terra barro" (i.e. "Terra de barre", in French) is defined as a Quaternary ante-Holocene Formation. It is a siderolithic reddish-clayey-sandy sedimentologic facies (Houessou and Lang, 1979; Tastet, 1977). Its thickness of a maximum of 30 m does not exceed 2-4 m in eastern Lower Mono Basin (e.g. at Comé, Dré, Oumako, Sé and Houngbanou locales, Fig. 11; Plates 6 and 7). Its depositional contact with the underlain coating of gravels and pebbles is not mostly evident (e.g. at Comé and Houngbanou) (Fig. 12). It is occasionally visible, as it is the case at Sé and Oumako (Plates 6 and 7) where the quarries show figures of erosional channels that suggest a probable unconformity in the sedimentary process. Thus, the Formation is seen as of early Quaternary

FIG. 10: A CHRONOSTRATIGRAPHIC SEQUENCE OF THE BENIN-TOGO COASTAL SEDIMENTARY BASIN (AFTER LANG, KOGBE, ALIDOU et al., 1986; OYEDE, 1996)

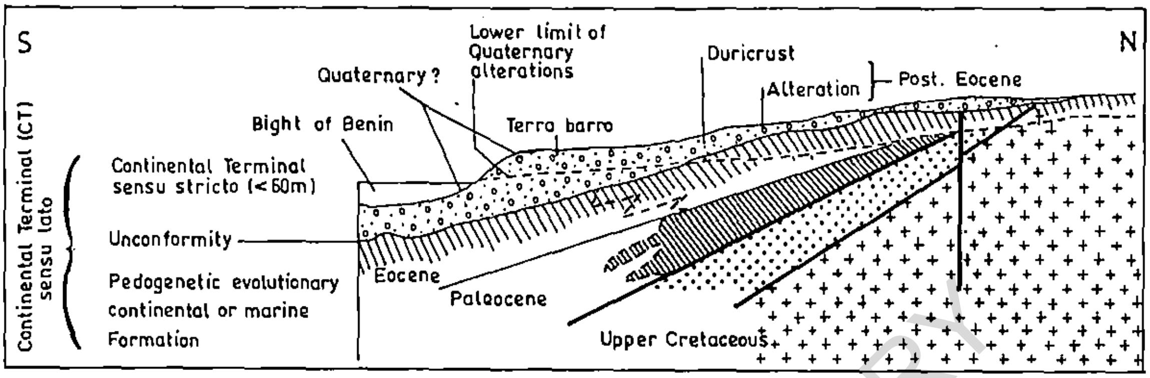


FIG. 11: CORRELATION OF COME, DRE, SE AND HOUNGBANOU STRATIGRAPHIC SEQUENCES WITH AND WITHOUT ARTEFACTS IN THE "TERRA BARRO" LAYER IN EASTERN LOWER MONO BASIN

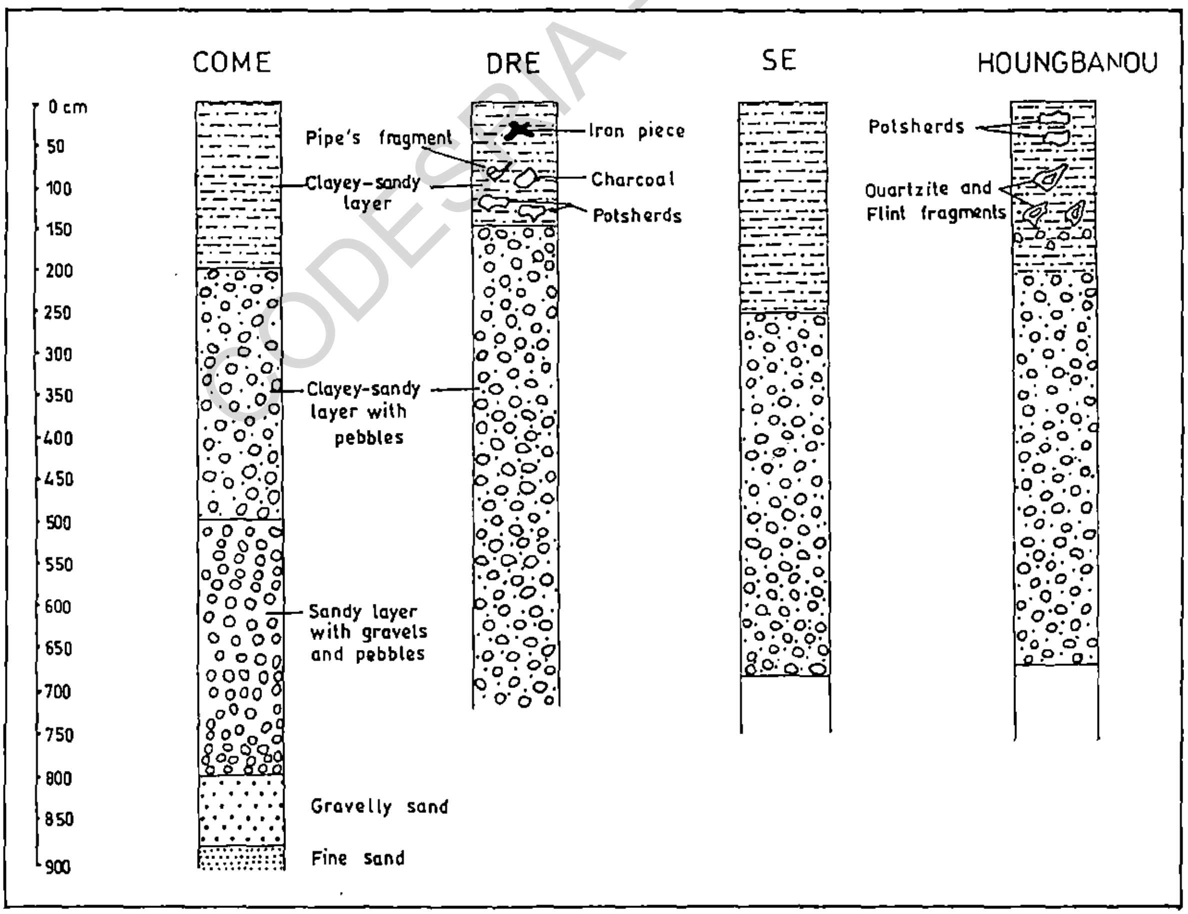


Table 2: A Tentative Composite Correlation Table of the Chronostratigraphic Sequences in Eastern Lower Mono Basin (Adapted from Oyédé, 1991; 1994; 1996; 1996; Houndagba and Bokono-Ganta, 1994)

Sites / Period	Coast and Lower Valleys	Sé	Houngbanou	Observations
(10) Present	Deposit of current brown sands	Deposit of colluvium and clogging of shallows	Deposit of colluvium and clogging of shallows	Sub-humid period
(9) Upper Holocene	Deposit of grey and white offshores bars	Reshaping process of sediments	Reshaping process of sediments	Dry period
(8) Middle Holocene	Reshaping of Inchirian offshores bars and deposit of 2nd generation terraces, isolation of lakes by onset barriers	Deposit of colluvium and clogging of valleys	Deposit of colluvium and clogging of valleys	Humid period. Sea high level (Holocene: 6-5000 BP)
(7) Ogolian	Deposit of both clayey-sandy layer and peats in depressions	Renewal of erosion	Renewal of erosion	Dry period. Sea low level (20-19000 BP)
(6) Inchirian	Formation of both 1st generation terraces and older barriers isolating lakes at the bottom of plateaus	Deposit of colluvium (break of valley's incision)	Deposit of colluvium (break of valley's incision)	Humid period. Mono high level corresponding to sea high level (40-30000 BP)
(5) ?	?	Deep incision reaching the bottom of thinner parts of the pebble layer	Deep incision reaching the bottom of pebble layer at Houngbanou station (after well's section)	Onset of topographic inversion observed at Sé and Houngbanou
(4) ?	?	Deposit of sandy clayey "Terra baro"	Deposit of "Terra baro" in conformity with intermediate sediment	Humid period
(3) ?	?	Break of pebble deposit, with less consolidated erosion surface	Continuation of sedimentation with intermediate granulometry	More or less dry period
(2) ?	?	Unconformity deposit of pebbles with more thickness in the depressions	Unconformity deposit of pebbles with more thickness in the depressions	Reduced size of pebbles from north to south, with more and more sandy deposit
(1) ?	?	Silty-clayey ante-pebble erosion surface	Silty-clayey ante-pebble erosion surface	Generalized erosion

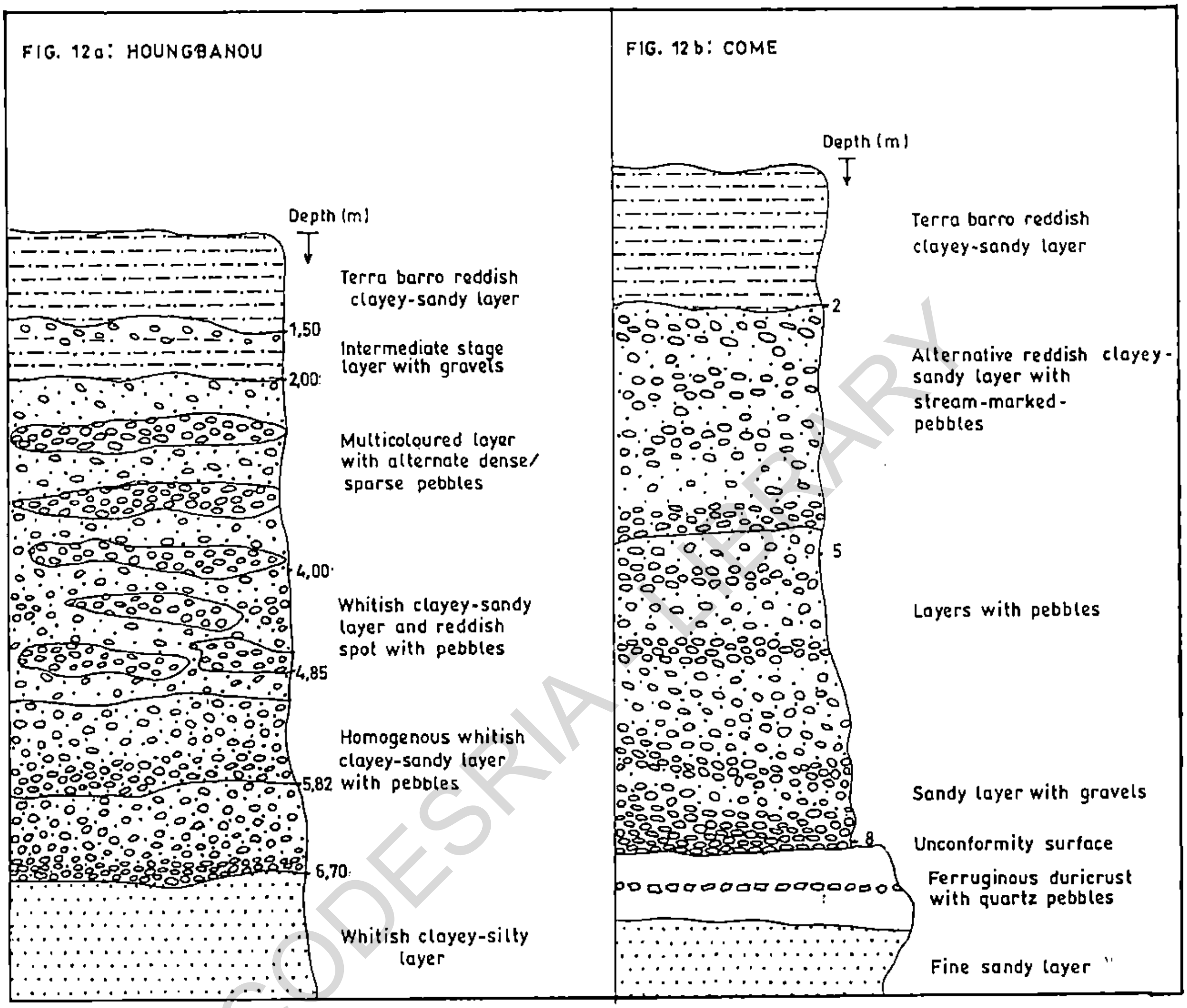
pedogenetic processes with later morphoclimatic modifications (Oyédé, 1991: 242; 1994: 92; 1996: 33; Houndagba and Bokonon-Ganta, 1994: 122-124). This Formation shows sparse presence of flint and quartzite pebble fragments (Fig. 11) amongst which some have been presented as products and by-products of stone-tool-making process (Moutari-Mahamane, 1992). Such a view based upon the typological attributes of the materials (and may be hastily expressed and liable to controversy) has not been ascertained by any clear stratified archaeological 'horizon' or layer (Bagodo, 1994b: 31-33; 1995; Moutari-Mahamane, 1992); and

(iii) a superficial sedimentary facies that consists of Holocene yellowish sands and current brown or white sands.

3.1.2 The 1993 to 1995 Off-Site Reconnaissance

On the basis of the research aims, objectives and strategies as presented in Chapter One (Section 1.1), the 1993 to 1995 off-site reconnaissance was carried out in eastern Lower Mono Basin. The field observations were made as a follow up of the results and conclusions of the 1990 to 1991 ARSAVAMO Project field sessions which aims, objectives and strategies are emphasized in the first section of Chapter One. As one of the major results of the 1990 to 1991 ARSAVAMO

FIG. 12: CORRELATION OF HOUNGBANOU AND COME STRATIGRAPHIC SEQUENCES IN EASTERN LOWER MONO BASIN



Project field sessions in the Lower Mono Basin, 28 quarry trenches were mapped, divided into 23 "red" pebble quarries, 3 "sand" quarries, and 2 "white" pebble quarries. The lithostratigraphic description was based upon the observation and drawings of the sections of some key quarry trenches. The lithostratigraphic description was also made after the stratigraphic description of the ARSAVAMO Project's two test-pits at Drè and one test-excavation at Houngbanou, both carried out in 1991 with a view to throwing more light on the local micro-chronostratigraphic problems (ERAB/ARSAVAMO, 1991b; Bagodo, 1993: 33-35; 1994a-b-c; 1995).

In accordance with previous results and conclusions, our 1993 to 1995 off-site reconnaissance highlighted the following:

(i) the pebble and gravel quarries' trenches at Comé, Drè, Oumako, Sè, Houétihoué and Houngbanou (Figs 11 and 12) have shown one type of red (lateritic) context and the other with white sedimentary matrix (Plates 6 and 7). Some of the trenches were more than 6 m deep and exposed stratigraphic units containing pebbles, sometimes broken and interpolated by sandy deposits. Near Houétihoué and at Houngbanou farms, microlithic flaking-like evidence was noticed in the pebble refuse, and the quarries were accepted as capable of offering a key to a proper understanding of the Quaternary stratigraphy of the Lower Mono Valley, and possibly also to an understanding of the emergence and the evolution of human subsistence-settlement patterns in the area;

(ii) at the Adjarala Dam Extension Site (Figs. 8 and 9 in Chapter Two) the bedrock's degradation is going on, and pegmitite-quartzite blocks presented by archaeologists as looking like axes have been strongly considered by geologists as eroded blocks. The geologists insisted about the possibility of making tools from such non-homogenous raw materials;

(iii) the stratigraphic section at Drè showed a 100 cm depth, archaeological units that contain local as well as imported potsherds and fragments of pipes which all date relatively from the end of the 16th century to the 18th. These well-known ceramic materials that indirectly overly the pebble and gravel layers represent a reliable chronological marker of an unconformity phenomenon in the lithostratigraphic processes as shown by the local quarry sections (Figs. 11 and 12). As shown in Fig. 10, this unconformity phenomenon in the local chronostratigraphy was previously observed by geologists and geomorphologists (Slansky, 1962; Tastet, 1977; Houessou and Lang, 1978; 1979; Oyédé, 1991).

(iv) the stratigraphic sections at Houngbanou, both from the excavated trench and the quarry sections (Figs. 11 and 12) showed the absence of distinct archaeological levels or 'horizons'. The pebble top level and the lower ceramic units are separated by "Terra barro" deposits that contain disperse pebbles amongst which some are broken and have been presumed and hastily presented as of microlithic tool assemblages (or Late Stone Age?) (Moutari-Mahamane, 1992; Bagodo, 1995).

In relation to previous sedimentologic studies of both the "Continental terminal" and "Terra barro" chronostratigraphic features, as well as to the Holocene and Present vegetational picture referred to in the context of the Southern Benin and Togo Coastal Sedimentary Basin, the 1990-1991 and 1993-1995 off-site archaeological reconnaissance in the Lower Mono Basin revealed the following:

(i) evidence of unconformity phenomena was confirmed both between the top of the "Continental terminal" and the bottom of the "Terra barro", and at the bottom of the "Continental terminal" (Figs. 9 and 10);

(ii) the Holocene and the later part of the "Ante-Holocene" toposequences appeared more clearer (Fig. 10; Plates 6 and 7);

(iii) on the contrary, the exact duration of the whole Quaternary evolutionary morphogenetic setting remains questionable (Oyédé, 1994: 95-98; Houndagba and Bokonon-Ganta, 1994: 122-124; Adandé, 1994: 68-70; Bagodo, ; 1994a: 167-168; 1994b: 42-46). The recent palynological highlights are focussed on the Holocene to sub-Present times (Tossou, 2002; cf. our Chapter Two, Section 2.2.1 and Figs. 4 and 5, and Chapter Six, Sections 6.2 and 6.3).

3.2 THE 1996/97 ON-SITE SURVEYS AT AJIBODE AND ENVIRONS

3.2.1 Ajibode in Ibadan Regional Context: Past Quaternary environmental setting

In Chapter Two (Section 2.2.2), the present-day environmental setting of Ibadan Metropolitan Region in the context of Southwestern Nigeria is succinctly presented. The past Quaternary environmental setting of this area is underlain by the Precambrian Basement Complex superficial weathering. In Akintola's (1994a: 18-21) study of the geology and hydrology of Ibadan area, the Basement Complex rocks are presented as mainly made of the metamorphic types Precambrian age, with a few intrusions of granites and porphyries of Jurassic age. These are grouped into major rock types such as quartzites, banded gneisses, augen gneisses and migmatites, and minor rock types such as pegmatites, quartz, aplite, diorites, amphibolites and xenoliths. Both types are covered in many places by weathered regoliths, and outcrop in few places (the minor as intrusions in some major types). Amongst the major rock types, 75% are of banded gneisses, and 25% of both granite gneisses and quartzite. The quartzites form the prominent topographic features as ridges (e.g. Oke-Aremo, Mokola-Oremeji), but they seldom outcrop very well. The Banded gneisses are always found close to the quartzite ridges and they very rarely outcrop. The augen granite gneisses outcrop mostly in the northern sector and are segmented into large boulders by a well developed joint system (Plate 8, Ajaiye Hill: cf. below in Section 3.2.2). The general strike is N.N.W./S.S.E. direction in the area.

In studying the "Relief and Drainage" of Ibadan Region, Faniran (1994: 29) presents the hills, plains and river valleys as the three major landform units. The hills that mainly consist of quartzite ridges and gneissic inselbergs cover less than 5% of the total area. The plains (Faniran, 1994: 31) with a general elevation of between 180 m and 210 m are estimated to represent about 80% of the total surface of the area. They cover the land parts between the hill bases and the entrenched valley bottoms, and are said to be etched surface in contrary to other views (e.g. Burke, 1970) that present them as pediment surfaces. Over the concept of pediment surface (i.e. pediplain) that of etched surface is preferred in relation to the regional plain topography that associates such topographic units as dissected and undulated surfaces, and thick regolith with varied depth from place to place. The weathering phenomenon is presented as being extensively studied in yet the area; but it is locally observed that the phenomenon can vary from nothing to over 30 m. Ironstone concretions (i.e. duricrusts) have been observed at many locations including the tops of low interfluves and the breaks of valley-side slopes. As the third land form/facet (Faniran, 36-37), the river valleys are narrow but not the least extensive. The conspicuous incision of the rivers and streams into the flood plain reaches the bed rock in many places (e.g. the Orogun stream through the Ibadan University Botanical Garden). Burke and Durotoye (1971) have related such incision to a recent drop in the sea level. The drainage system conforms to a dentritic pattern with trellised patterns in detail. Thus the drainage branches in all directions, with tributaries from all angles. This is the case in Ajibode area with River Ona and its Orogun and Yamoje tributaries that show gullies and meanders (Fig. 13). The morphometric analysis of the relief (Faniran, 1994: 40-42) shows that the mean height is 230 m above sea level (a.s.l), with clustering around certain heights such as 160-175 m, 190-205 m, 220-240 m and 250-270 m. From this clustering, Faniran (1994: 40) concludes as follows:

> (...), it seems possible to establish some four commonly occurring levels, perhaps equivalent to erosion surfaces of some sort. These, according to

> some workers in this field, may be correlated with past geological episodes, particularly period of climatic changes. However, information on superficial deposits, structural details, etc, does not confirm so many erosion surface and geological episodes.
> Nevertheless, a detailed study of the absolute elevations over the study area suggests that there is a pattern or trend. The lowest areas are along big valleys, especially to the southwest of the area. From there, absolute elevation increases to the northeast, i.e. to the local watershed (...).

Such a viewpoint on absolute trend conforms to both the 300 m (a.s.l) Gbanda Hill is quoted with, and the general north-south direction of the stream drainage (Fig. 13). The relation of the four (or less) erosion surfaces to past climatic changes is to be emphasized below in terms of fluvial terraces at Ajibode area in the context of Ibadan regional Quaternary sequence.

The Ibadan regional Quaternary sequence known as the Bodija Formation (Fig. 14) is seen by Petters (1991) as containing little or no datable materials, and as an incomplete sequence in which may have been preserved only deposits of the Late Quaternary palaeoclimatic changes. Petters' opinion is expressed without ignoring the fact that since the 1970s (Burke, 1970; Burke and Durotoye, 1970, 1971) the Bodija Formation is outlined as a Quaternary superficial deposit which litostratigraphic succession is summarised and divided into three members (Table 3). The three members are described from the upper to the lower as follows (Fig. 14 and Table 3):

FIG. 13: A SKETCH MAP OF SITE LOCATION, ALTIMETRY AND DRAINAGE IN AJIBODE AREA (AFTER ANDAH AND MOMIN, 1993; MOMIN, 1995)

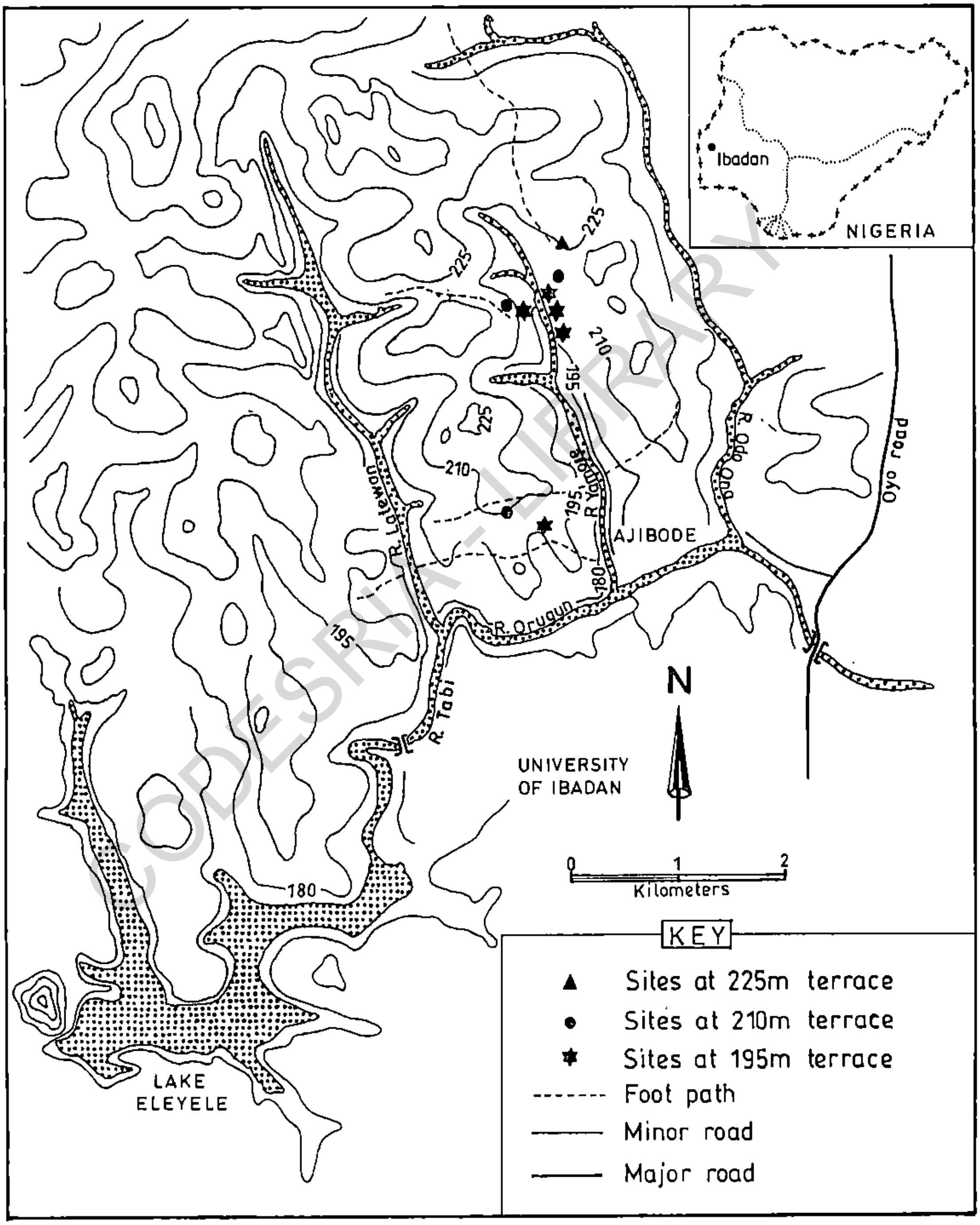


FIG. 14: THE BODIJA FORMATION: STRATIGRAPHIC SECTION IN THE BODIJA RAILWAY CUTTING, IBADAN (AFTER BURKE, 1970)

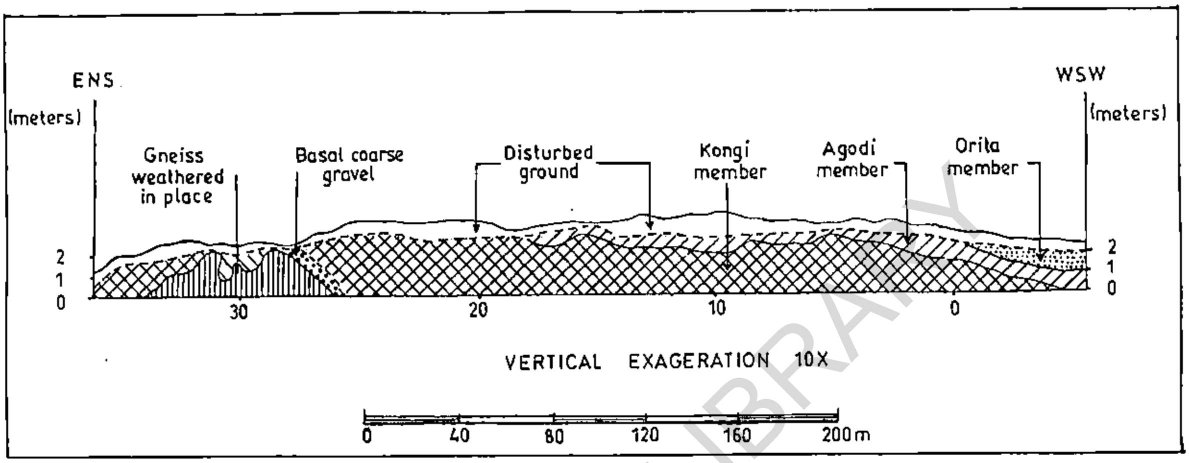


TABLE 3: THE BODIJA FORMATION: A CHRONOSTRATIGRAPHIC SEQUENCE (AFTER ANDAH AND AJAYI 1981 BASED ON BURKE AND DUROTOYE (1970; 1971)

Stratigraphic Units in Meters	Thickness	Postulated	Age
Orita Member (silty sand)	0 — 4	Wet	Holocene
Agodi Member (uncemented gravel	0 — 2	Dry	Late Pleistocene
Minor unconformity Kongi Member			
Pediment (cemented gravel)	0 — 2	Wet/Dry	Middle Pleistocene
Pediment phase		Dry	
Major unconformity Weathered Crystalline	0 — 50		Precambrian

(i) The Orita Member made of sand, silt and clay, with generally less than 1 m thick over the pediment surfaces. It is said to largely originate from material transported from the weathered bedrock to the surface mostly by earthworms and termites. Its development is related to the "current humid phase";

(ii) The Agodi Member made of uncemented gravel that consists of mixed 2 mm to 2 cm angular fragments, less than 1 cm round ironstone pebbles, few angular gneiss and feldspar fragments, and a matrix of sand and silt similar to those of the Orita Member. It is coarser at the base, and rarely up to 1 m thick. Its natural exposures are confined to the break of slope at the foot of residual hills and at the edge of rejuvenated valleys. It almost covers entirely the pediment surfaces. It is said to be a pediment gravel formed in a dry period and the absence of iron cementation is related to the non occurrence of desiccation since the gravel was formed;

(iii) The Kongi Member of more than 2 m thick gravel that overlies red weathered gneiss. Its base is made of 30-50 cm coarse gravel, and its upper main bed is a homogenous gravel with 2 mm to 2 cm fragments of quartzite and vein quartz in general, of rare feldspar, gneiss and ironstone. The main bed is cemented by red and black ironstone. It is presented as produced by sheet flood and mass wasting from residual hills, and spread over the pediment surfaces at a time when the climate was much drier than now. After the formation of the pediment gravel the cementation is related to seasonal wet and dry conditions. Before the deposition of the Agodi Member there must have been considerable erosion that had led Agodi Member's gravels to sometimes be laid on weathered crystalline rocks (cf. unconformity phenomenon on Table 3 and Fig. 14).

According to Burke (1970), and Burke and Durotoye (1970 and 1971), the three members of the Bodija Formation are formed in situ as distinct lithostratigraphic units (Fig. 14) characterized as pediment surfaces or pediplains. Faniran (1994: 31) rightly emphasizing that pedimentation and pediplanation are topical to arid/semi-arid climatic contexts and processes, has favoured the concept of etched surface. Collins Dictionary of Geology (Lapidus, 1990: 197) states that "Etching is particularly significant in areas of diverse rocks that exhibit extreme contrast in their weathering rate (…)". On the other hand, the etch-plain is defined as a "(…) broadly horizontal land surface produced by processes of denudation under tropical climatic conditions in which there is marked dry season (…)" (Whittow, 1984: 180). Thus, the formation of the basal pediment surface (e.g.

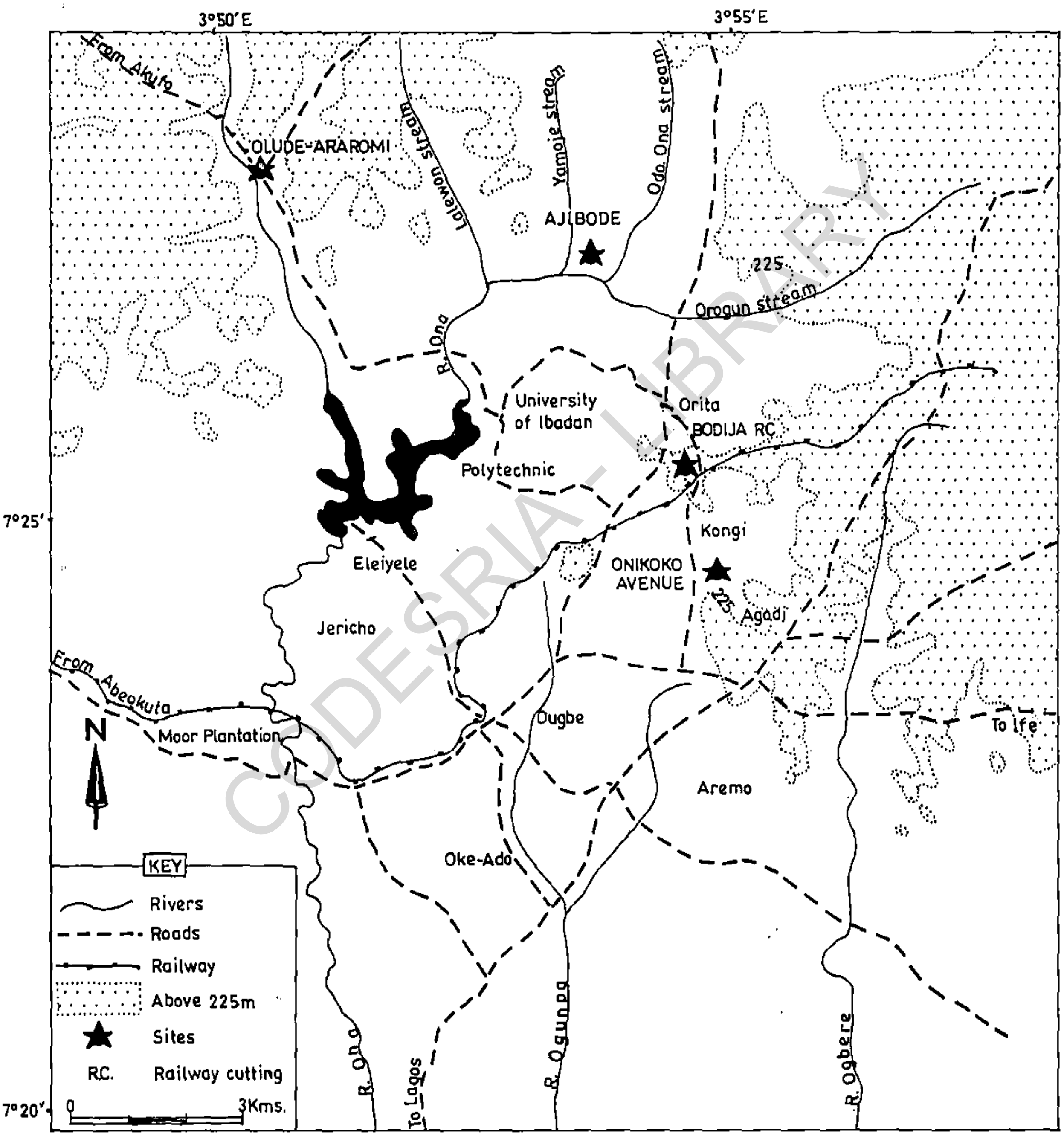
Agodi Member) is related to a past arid climate by both Faniran (1994) and Burke and Durotoye (1970; 1971).

On the contrary, Andah and Ajayi (1981) carried out geoarchaeological field investigations at Olude-Araromi in Ibadan northern environs (Fig. 15) with a view to critically assessing the relevance of these different geologic and geomorphic explanations in the Guinean regional context of West Africa. Their questions, reservation and suggestions are in the ambit of those previously emphasized by Andah (1979b) and earlier referred to (Chapter Two, Section 2.3.1). Their data and lines of arguments in this context are taken into account in explanation of our observations at Ajibode during our 1996/97 on-site archaeological surveys.

3.2.2 Ajibode 1996/97 On-Site Surveys

Detailed on-site surveys were carried out at Ajibode in three successive phases. Frist from 18th to 24th, December, 1996, then from 20th to 25th, January 1997, and from 3rd to 4th, March, 1997. The exercises were preceded by a discussion session on December, 18th, 1996 during which there was a consensus to concentrate more efforts and attention on both Ajaiye Hill (Plate 8) and the upper Yamoje stream drainage landscape (Fig. 16).

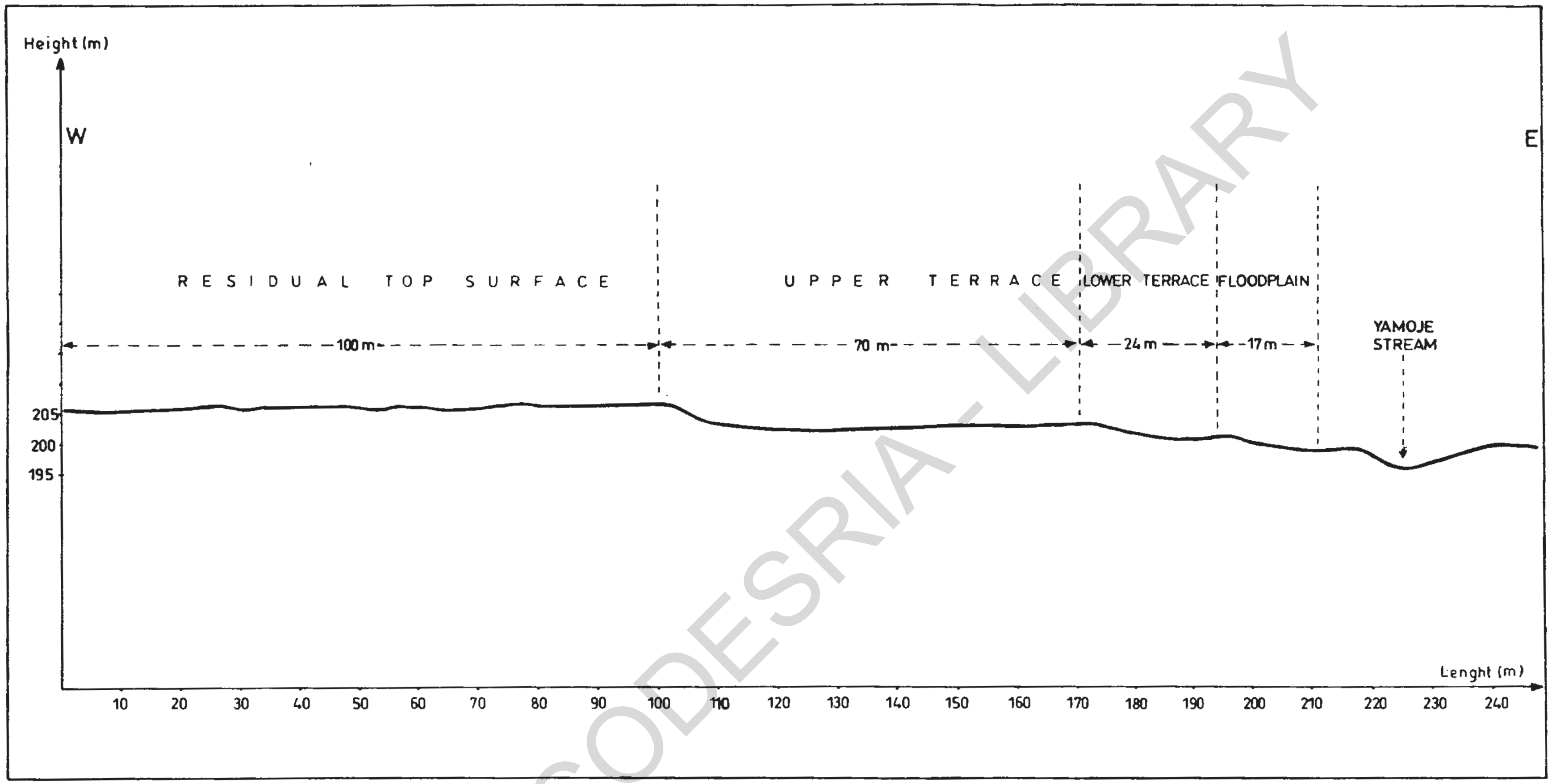
FIG. 15: SKETCH MAP OF THE SITE LOCATION AND DRAINAGE IN AJIBODE, BODIJA AND OLUDE ARAROMI AREAS, IBADAN (BASED ON ANDAH AND AJAYI, 1981; AYENI 1994; MOMIN, 1995)



At and around Ajaiye Hill, Orogun and Odo-Ona streams jointly drain the landscape, respectively in east-west and north-south directions. From the hill's top (Plate 8), the eastern flank down to River Odo-Ona bed presents a profile of gentle slopes that reveals platforms or terraces; while the western flank has straighter profile without adjacent terraces. From the same top point down southwards to R. Orogun bed the stepped profile also shows terraces. Surface collections around the hill bottom includes one chert and some stone materials.

Corresponding to the second state of detailed survey, the NW-SE oriented eastern and western banks of upper Yamoje stream have been more intensively investigated. This is because of two reasons. Firstly it is an open area that had witnessed farming activities but with no house structures. Secondly, the landscape setting and the erosional versus depositional action of the drainage have favoured the formation of lithostratigraphic units containing lateritic crusts and litters of stones that were presented as interpolating tool assemblages by the 1992, 1993 and 1994 research teams. At this survey station in 1996 and 1997, along Ajibode-Soode footpath, a traverse from Yamoje river bed westwards up to the current top platform showed a stepped profile of slopes which delineates four platforms (Fig. 16). At Umaru Farm which is located at a distance of about 40-30 m from Yamoje eastern bank, a systematic surface collection of stone materials was carried out in 1996 and 1997 in connection with the excavation exercise (cf. Chapter Four).

FIG. 16: SKETCH PROFILE OF YAMOJE STREAM TERRACE LEVELS ALONG AJIBODE SOODE FOOTPATH (1997 FIELDWORK)



Westwards and upstream, at more than 100 m from the stream bed and the current floodplain, is located 'Lawal Farm' where additional careful survey observations were carried out followed by sectioning in May 1997 (cf. Chapter Four). Around Ajibode, in particular at the bend of the central main road, erosional cutting sections showed stratified lateritic sediments containing gravels.

For the purpose of comparison, as indicated in Chapter One (Section 1.1.1), the 1996/97 survey exercises were extended to Olude-Araromi from 5th to 10th, March, 1997. On Oyegun-Agufa Road, at about 500 m southwards from Olude-Araromi village, and also in part of Agun village on Araromi-Apete Road, particular attention was paid to terraces' profile and lateritic litters. Some stone materials were collected from surface.

As highlighted in both Chapters One and Four, during the 1996/97 systematic surveys, as well as during those carried out previously in 1992 and 1994, initial research objectives such as the chronological sequences of geomorphic features like terraces and lateritic crusts, could not be satisfactorily resolved. Because of this, a complementary detailed survey at Ajibode area was conducted in April 2002. On the 12th, April 2002, the interdisciplinary team held a meeting session that was centred on the same research objectives. On the 13th and 25th, April, 2002, field exercises were executed with GPS readings taken at many places. Following east-west delineated traverses crossing Yamoje stream to

PLATE 8 : General shot of Ajaiye Hill's top from Orogun-Ajibode Road's side showing an outcropping quartzite ridge (Ibadan, Nigeria) at 7°27'45"N and 3°53'44"E. (Source: 2002 fieldwork)

PLATE 9 : General shot of western Ajibode Primary School's area, from a small bridge over Yamoje stream, at 7°27'44"N and 3°53'27"E (Source: 2002 fieldwork)

western Ajibode's adjacent Church and Primary School, attention was specifically focussed on slope's profile, succession of terraces, lithostratigraphy of incised banks of streams, and lithostratigraphy of wells or trenches. Sediment Samples were collected for mechanical and geochemical analyses. The results and interpretation of these are presented in Chapter Four (Section 4.4) and Appendices I-II-III. On the 30th, April, 2002, an evaluation session was held during which a consensus was reached about the need for a long-term research programme followed by geochemical analyses as a prelude to proper clarification and understanding of the specific toposequences of the Bodija Formation at Ajibode and its vicinity.

Amongst the immediate results obtained from this later survey, the less specific and conclusive are those that relate to the relationship between the slopes' profile on one hand and the formation and number of terrace levels on the other. Contrary to the suggested succession of three terrace levels at ring contours 195 m, 210 m and 225 m (Andah and Momin 1993; Momin, 1995; Andah, 1995a), and that of four erosional surface levels at 160-175 m, 190-205 m, 220-240 m and 250-270 m (Faniran, 1994), both referred to earlier, the low angle numerous and successive slope breaks observed during the 2002 detailed surveys were considered as terrace levels. Such a standpoint could be hastily expressed and

PLATE 10 : Close up shot in western Ajibode Primary School's area showing a section of cemented lateritic crust containing pebbles and gravels above cemented lateritic crust containing gravels only, at 7°27'44"N and 3°53'19"E. (Source: 2002 fieldwork)

liable to controversy as shown in both Chapter One (Section 1.3.4) and Chapter Four (Sections 4.1 and 4.5).

Some GPS readings were recorded at many of the visited and observed points. Amongst these recorded readings are the following:

(i) at Ajaiye Hill: (a) on the top: latitude: 07° 27' 45"N

longitude: 03° 53' 44"E;

(b) on the bottom (i.e. on Orogun-Ajibode Road):

latitude: 07° 27' 40"N;

longitude: 03° 53' 53"E;

(ii) from this top hill straight to western Ajibode at the bridge on Yamoje stream, the readings relate to Plate 9 (i.e. 07° 27' 44"N and 03° 53' 27"E);

(iii) close to the Primary School and the Church, two superposed lateritic cemented crusts were seen exposed, the older and lower without pebbles but gravels and the younger and upper containing both pebbles and gravels: the readings are related to Plate 10 (i.e. 7° 27' 44"N and 03° 53' 19"E);

(iv) at the point of intersection of Yamoje stream bed and Ajibode-Soode footpath, and from that point westwards along a traverse that draws the slopes' profile up to the top surface (Fig. 16), the readings relate to those of the AJB UMF Trench D Excavation and Cutting I station (cf. Chapter Four, Section 4.2).

CHAPTER FOUR

REPORTS ON THE 1997 EXCAVATION AND CUTTINGS AT AJIBODE (AJB) UMF SITE AND EGF STATION

4.1 AJB UMF SITE RIVER TERRACES IN THE CONTEXT OF THE BIGHT OF BENIN REGION

The archaeological field investigations in Ajibode area from 1992 to 1997 have not yielded any definite statement concerning the formation, number and age of the river terrace cycles. In view of this, a short-time complementary exercise was scheduled and executed in April 2002. During this exercise, results were obtained with regard to the terrace formation. Also some light was shedded on the aggradation and breaks of the slope profiles as follows:

(i) from Ajaiye Hill top, along the eastern flank down to the bed of Odo-Ona stream, a gentle profile of slopes was observed;

(ii) from the same top point, but along the southern flank down to the bed of Orogun stream, a similar profile was observed;

(iii) westwards on Ajibode-Soode footpath, along a traverse from the bed of Yamoje stream up to the current top platform was observed a gentle profile of slopes with more spaced breaks.

The 1996/97 and 2002 field exercises revealed a general picture of gentle profile of slopes from the current residual top surfaces to Yamoje stream bed. A local toposequence of similar nature is clearly illustrated by a picture drawn on the basis of levelling exercise in January 1997, along the same traverse on Ajibode-Soode footpath.

During the 1991-95 archaeological off-site field exercises in Eastern Lower Mono Basin, the problem of terraces' presence or absence was also part of the scheduled objectives. As a consequence, two geomorphic sequences were located and carefully observed, at Kpacha-Kpodji and Djiflitou villages respectively both of which are already referred to in the second section of Chapter Three:

(i) at Kpacha-Kpodji, the geologic sequence (Fig. 17) along a traverse from River Mono bed up to the eastern flank of Aplahoué Plateau shows a profile of slopes that successively consists of the major bed (i.e. current bed and floodplain), two slope sections overlaid by colluvium and alluvium, the eroded eastern fringe of the plateau that exposes pebbles' layer, and the 'Terra barro' layer at the top;

(ii) at Djiflitou, the geomorphic sequence (Fig. 18) shows a different profile of slopes that successively consists of the river bed, a floodplain, a fluviatile terrace at the top, and a western down slope covered by a marshy pond that overlays the upper weathered bedrock.

FIG. 17: GEOLOGIC SEQUENCE OF KPACHA-KPODJI IN EASTERN LOWER MONO BASIN (ADAPTED FROM OYEDE, 1994)

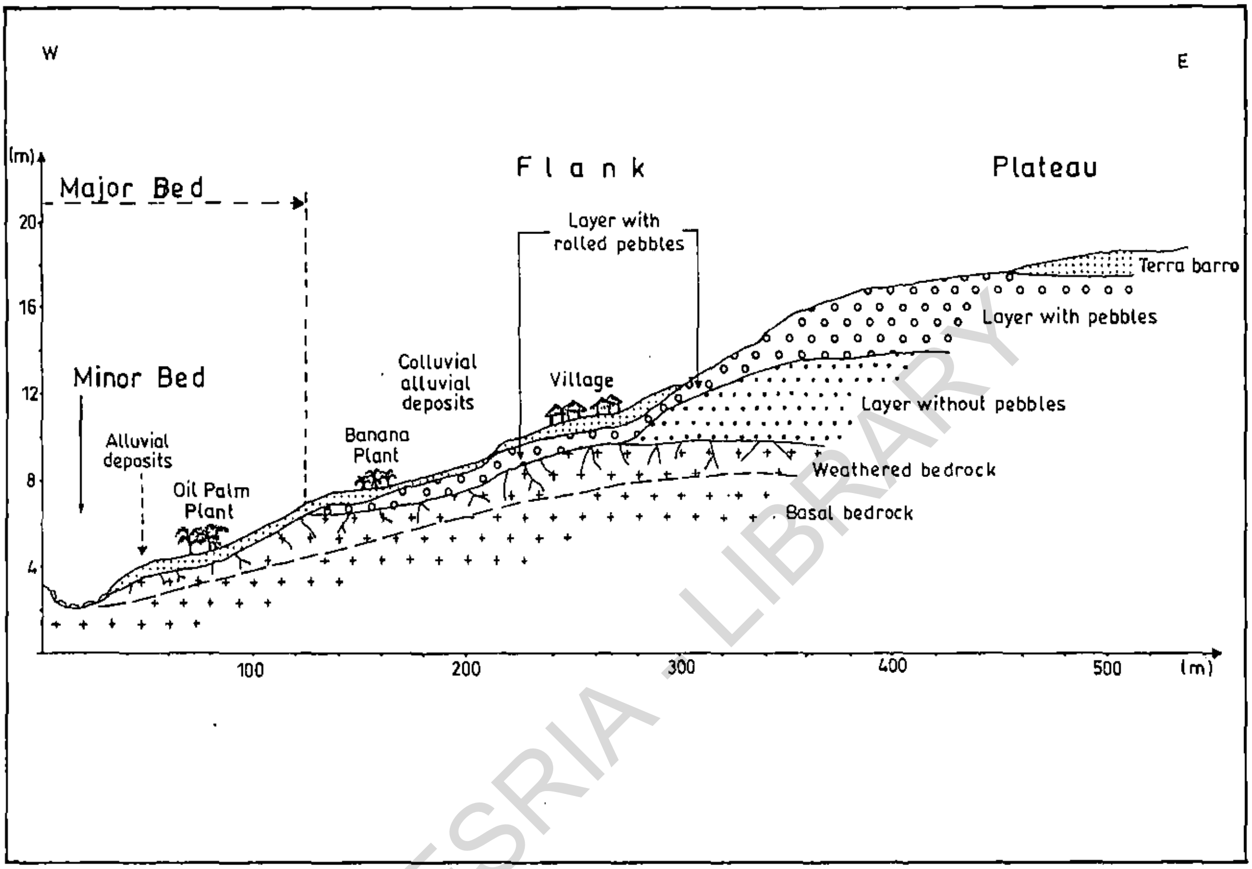
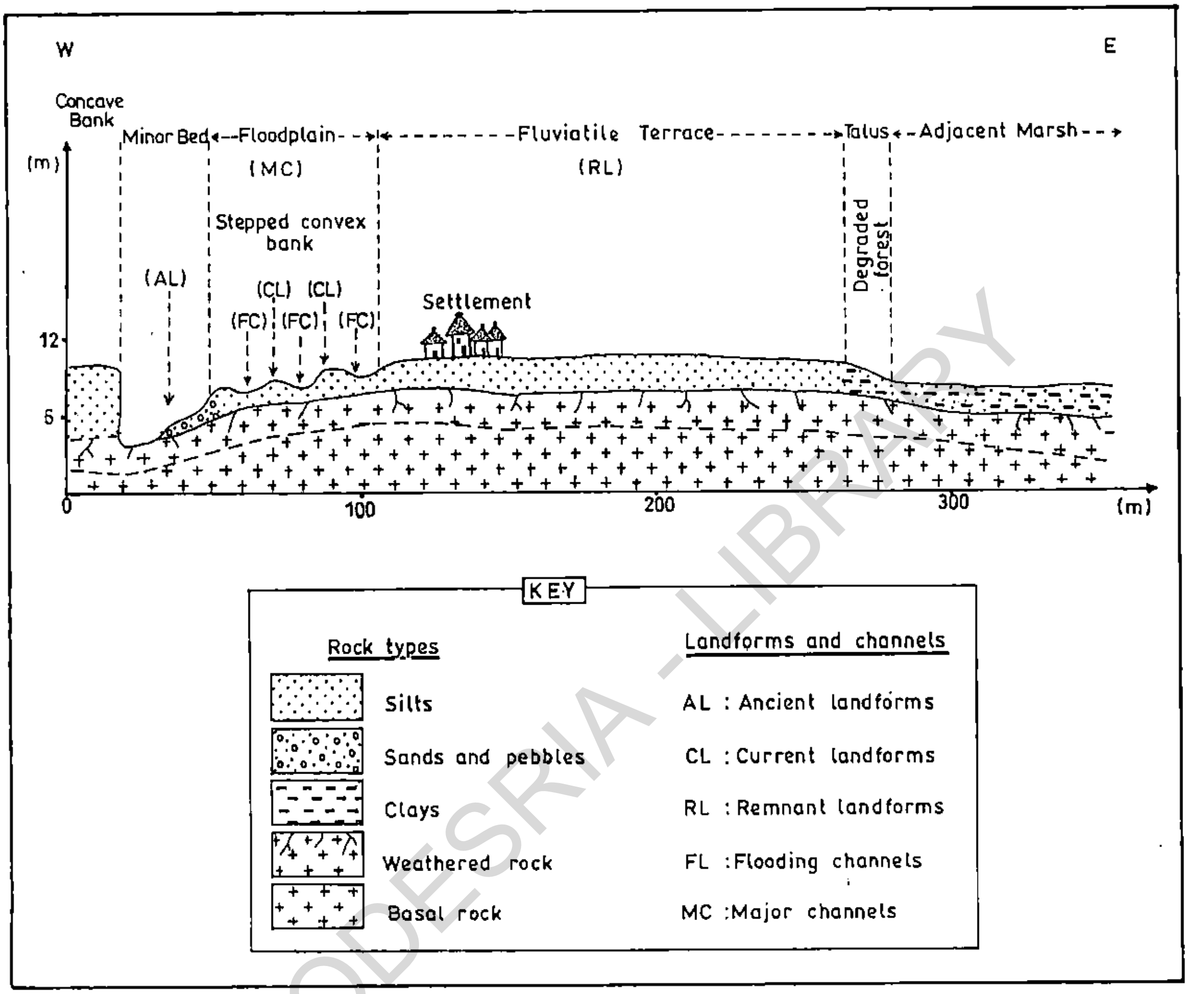


FIG. 18: GEOMORPHIC SEQUENCE OF DJIFLITOU IN EASTERN LOWER MONO BASIN (ADAPTED FROM HOUNDAGBA AND BOKONON-GANTA, 1994)



Within the Bight of Benin Region, but before the 1980s, two previous archaeological studies were devoted to the study of the terraces' build-up. The more recent of these is that on "The Development of the Ghanaian Basin" (Andah, 1976). Part of the study (Andah, 1976: 4-6; 7-9) is related to the number, age and formation of the River Volta Terraces. This terracing problem is emphasized as follows:

(i) the terraces of the Volta valley vary in height and number in different sections of the valley. They are absent in the very steep upland and in the gorge sections; four or more are reported in the coastal and lower reaches; and two to three in the alluvial fan sections on the edge of the plain (Andah, 1976: 4);

(ii) of all the studies of these terraces, only that of Davies drew up a relative cultural chronological scheme. It is obvious that not much is known concerning the age of these terraces because of a lack of type fossils (faunal, floral or artefactual) (Andah, 1976: 5-6);

(iii) the climatic hypothesis alone cannot satisfactorily explain the formation of the terraces since the sedimentation was the characteristic factor of their build up. Because of the low gradient in the Volta Basin, alluvial deposition could have been caused by a combination of such factors as a change towards aridity, river capture with the captured stream upgrading, and down-warping or

> uplift. Terrace formation at the lower reaches and the coast were influenced by both sea level changes and earth movements. A direct height/age correlation is not necessarily valid because of further complication by subsidence. Proper delimitation and correlation of these terraces must await the recovery of properly associated archaeological evidence together with more valuable dating evidence (Andah, 1976: 8-9).

As emphasized by Andah (1976), and referred to in Chapter One (Section 1.3.4), the prior archaeologically-oriented study of the terraces was made by Davies since his arrival in the Gold Coast (lately Republic of Ghana) in 1952. On the other hand, in a more recent tentative history of Archaeology in Anglophone West Africa (Kense, 1990: 143), Davies is presented as having a classicist training background, with later interests in archaeology and geology. This geological interest had a strong influence on his approach to research, such that he devoted a considerable amount of time to examining beach and river terraces in order to reconstruct the Quaternary environments in Ghana (Davies, 1964: 45-68). He (Davies, 1964) then relied heavily on road cuttings and gravel pits, with preference to work alone or with a minimal assistance from others (Kense, 1990: 143-144). On the basis of such methodological issues, Davies (1964) emphasized unsatisfactory or/and questionable assumptions, interpretations and conclusions on terrace formation and age not only in Ghana coastal region, but also in the coastlands of the whole of the Guinea Region. This emphasis was then critically and rightly reviewed by Andah (1976). Nevertheless, any present-day contributive review must consider the fact that Davies' (1964) standpoint is dated back to the early 1960s. Thus, the irrelevance of most of his lines of arguments have to be partly related to the state of ignorance on many aspects of the Quaternary morphogenetic evolution all over West Africa, as at that time. Fundamentally, since forty years, the situation has not radically and favourably changed (Ofomata, 1993; Faniran, 1986; Faniran and Jeje, 2002; Andah, 1979b; 1995a; Andah and Ajayi, 1981; Rognon and Coudé-Gaussen, 1987). So, there is the need to carry out further systematic and detailed field study and laboratory analysis before any satisfactory concluding remarks could be made on the toposequences and chronosequences of terraces at both local and sub-regional scale in the Bight of Benin, as well as in the entire West African Guinea Region. There is also the need to propose hypotheses that are subject to modification, confirmation or total rejection as new lines of evidence unfold. This is partly the rationale for the execution of excavation and cuttings in Ajibode area, on the left bank of Yamoje stream, at: (i) AJB UMF Site from 17th, March to 12th, May, 1997; and (ii) AJB EGF Station from 19th to 21st, May, 1997) respectively.

4.2 AJB UMF SITE LOCATION, GRIDDING AND SPOT HEIGHT READINGS

Ibadan Metropolis is recently presented as lying within longitudes 3° 56' to 4° 00'E and latitudes 7° 24' to 7° 27'N, and covering an area extent of about 33.16 square kilometres (Oni, 2001: 8). These coordinates do not exactly correspond to those that are widely accepted (Fig. 15 in Chapter Three, Section 3.2.1). In the case of Ajibode area, our GPS readings in April 2002 did confirm the coordinates in Fig. 15 (Chapter Three; Section 3.3.1).

As indicated in Fig. 15, Ajibode area is located on the northern outskirt of the University of Ibadan Campus. Accessibility to and around the Ajibode area is facilitated by the Orogun-Ajibode major road and many minor roads, farm roads and footpaths.

According to the same recent assessment (Oni, 2001: 15-16), the Basement complex in Ajibode area is chiefly made up of quartzite which covers about ninety-five percent (95%) of the land. This rock type is one of the hardest rocks with unfoliated or fine grained texture. The exposed quartzite outcrops are highly weathered, and the weathered quartz and mica by-product components consist of lateritic and clayey soils. Banded gneiss and augen gneiss which are coarsely foliated are said to be the other represented rock types.

The area's relief and drainage mainly correspond to a low lying plain land (80%) in accordance with the whole Ibadan's togography. The mean general elevation ranges between 180 m and 225 m a.s.l., and the current floodplain level between 180 m and 185 m a.s.l. Ajaiye Hill is one of the major outcrops and is situated at approximately less than 225 m a.s.l. Thus the less than ten percent (10%) slopes' profile are more common than slopes profile of more than twenty-five percent (25%) (Oni, 2001: 15-16).

An area map of altimetry, drainage and site location of Ajibode (Fig. 15) clearly shows a concentration of the 1992-1994 uncovered Palaeolithic sites alongside the two banks of Yamoje stream. In general, the map shows that the upper part of Yamoje stream is favoured by the sites' concentration, as eight of the ten recorded sites are located in this upper part of the stream. Five of these are on the left bank whilst three are on the right. Amongst the three latter sites, only one is located almost midway between Yamoje and Lalewan streams. Downstream, along lower Yamoje watercourse are located the two remaining of the ten sites. One of these two southern sites is close to Yamoje stream and the second is almost at midway between Yamoje and Lalewan streams. In short, eight of the ten sites totally belong to the Yamoje stream drainage system, while the westwards two sites partly belong to both Yamoje and Lalewan drainage networks.

In terms of altimetric location of the sites (Fig. 15), five are situated on contour line 195 m, three on 210 m, and two on 225 m. All the five at 195 m belong to Yamoje drainage system, as well as do two of the three at 210 m, and one of the two at 225 m. The altimetric distribution of the ten sites also shows that Yamoje stream is favoured, particularly the 195 m sites that are exclusively part of its stream drainage. Again with regard to the altimetric attributes, four of the five 195 m sites are located one close to another in upper Yamoje stream, three of the five being north-south aligned on the left bank. Finally, the altimetric location of the sites is related to the problem of the lithostratigraphic aggradation of the terraces in Ajibode area, as highlighted in the preceding Section of the Chapter. As earlier pointed out, the terrace is usually considered as a long-term built-up sedimentary. In considering the altimetric setting of the present topography and the four or less erosion surfaces at 160-175 m, 190-205 m, 220-240 m and 250-270 m, it seems reasonable to presume that the current three terrace levels have been more or less progressively eroded since the time of their respective build-up. Thus, each of them might have been of thicker aggradation at the beginning than present. Such a viewpoint could be supported by the idea of etchplanation process, as advocated by Faniran (1994: 31). With regard to the present thickness of the 195 m, 210 m, and 225 m a.s.l. terrace levels, well established geomorphic and geologic sequences coupled with appropriate sampling and analyses of soils are part of the prerequisites needed before objective specific statements could be made. The proper aggradation of the lower terrace situated at 195 m a.s.l. is shown by the stratigraphic description based on Trench D Excavation and Cutting

I (Section 4.3.1). This case is an evidence that a long-term erosion has removed the upper layers from the three terraces.

Mallam Umaru Gol's Farm (UMF) is a Palaeolithic Site that was identified in 1992 and designated (Momin, 1995: 41) as 'AJB UMF' (Fig. 19). It is located on the lower and younger terrace level, on the left bank and at some 30 m to 35 m alongside the outer fringe of the current floodplain of Yamoje stream. It is a very small farm of about 600 square metres (i.e. 20 m by 30 m). The coordinates after the GPS readings in April 2002 are 07° 28' 26"N and 03° 53' 13" E respectively.

The general planning of the AJB UMF Site (Figs. 19 and 20) is based on a Datum point located northwards from Yamoje stream bed. It is at about 2.70 m west of a tree, i.e. Vitex doniana (Plate 11). From this Datum Point the North-South primary base line (N. – S.), and the East-West perpendicular bisector and secondary base line (E. – W.) are laid out.

The grid layout extends 20 m northwards, 50 m southwards, 60 m westwards, and 15 m eastwards. Southwards and westwards, the limit of the grid layout approximately corresponds to the outer fringe of the floodplain from Yamoje stream bed. A 5 m interval was adopted for laying out the grid squares (Plate 12), as well as for the systematic surface collection of chip-like stone materials (Plate 13).

<u>PLATE 11</u> : General shot of the *<u>Vitex</u>* *<u>doniana</u>* at the left corner of Umaru Farm Excavation Station (AJB UMF'97) at 7°28'26" N and 3°53'13" E. (Source: 1997 fieldwork)

<u>PLATE 12</u> : General shot of a section of the quarried area and part of the 5m by 5m grid system at AJB UMF'97 (Source: 1997 fieldwork)

PLATE 13 : General shot of the spread of stone materials around The excavation area. (Source: 1997 fieldwork)

PLATE 14 : General shot of the mound and Trench D. (Source: AJB UMF'97, Trench D Excavation)

FIG. 19: SUPERIMPOSED SITE PLAN AND CONTOUR MAP OF UMARU FARM, AJIBODE (AJB UMF) (1997 EXCAVATION AND CUTTING)

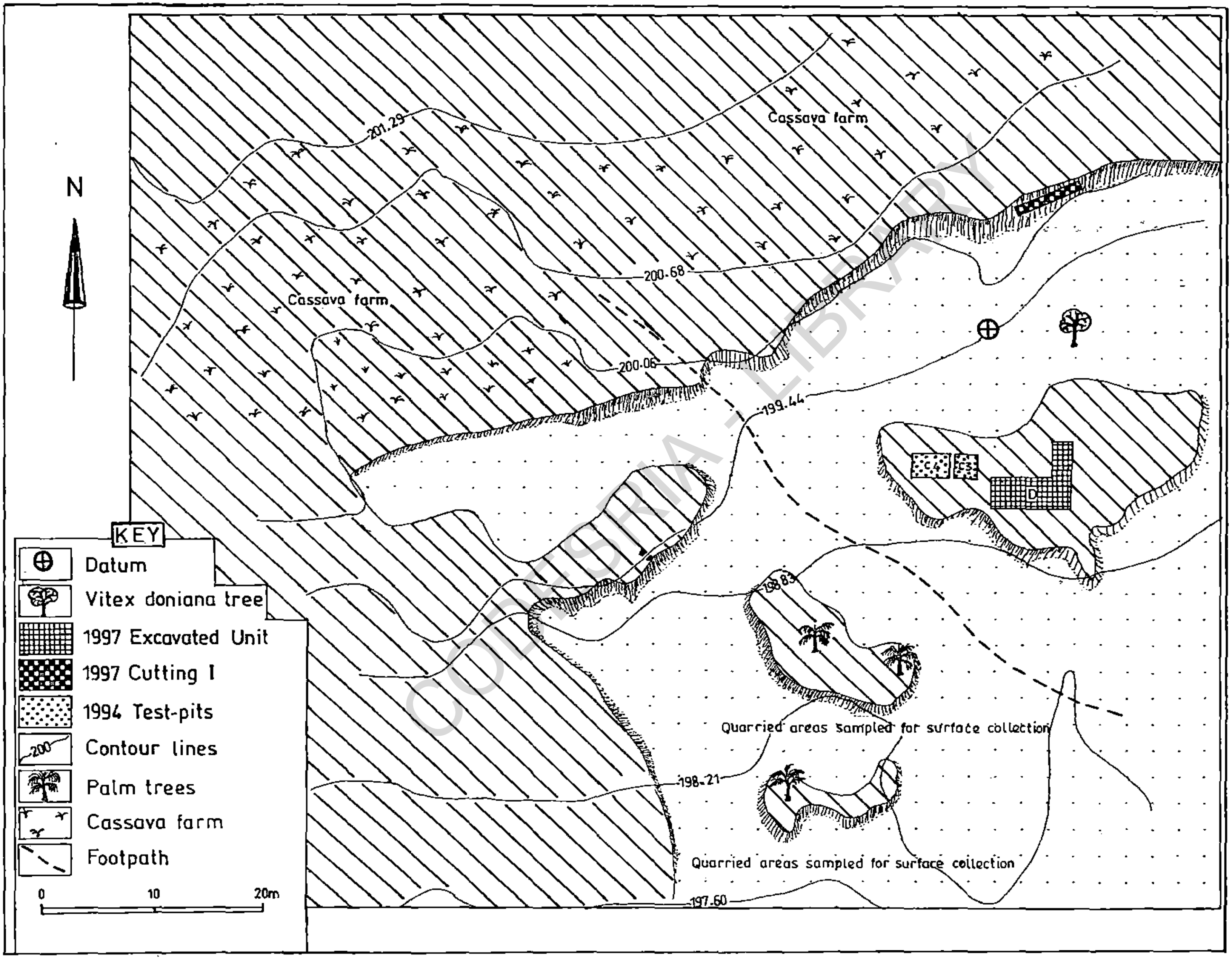
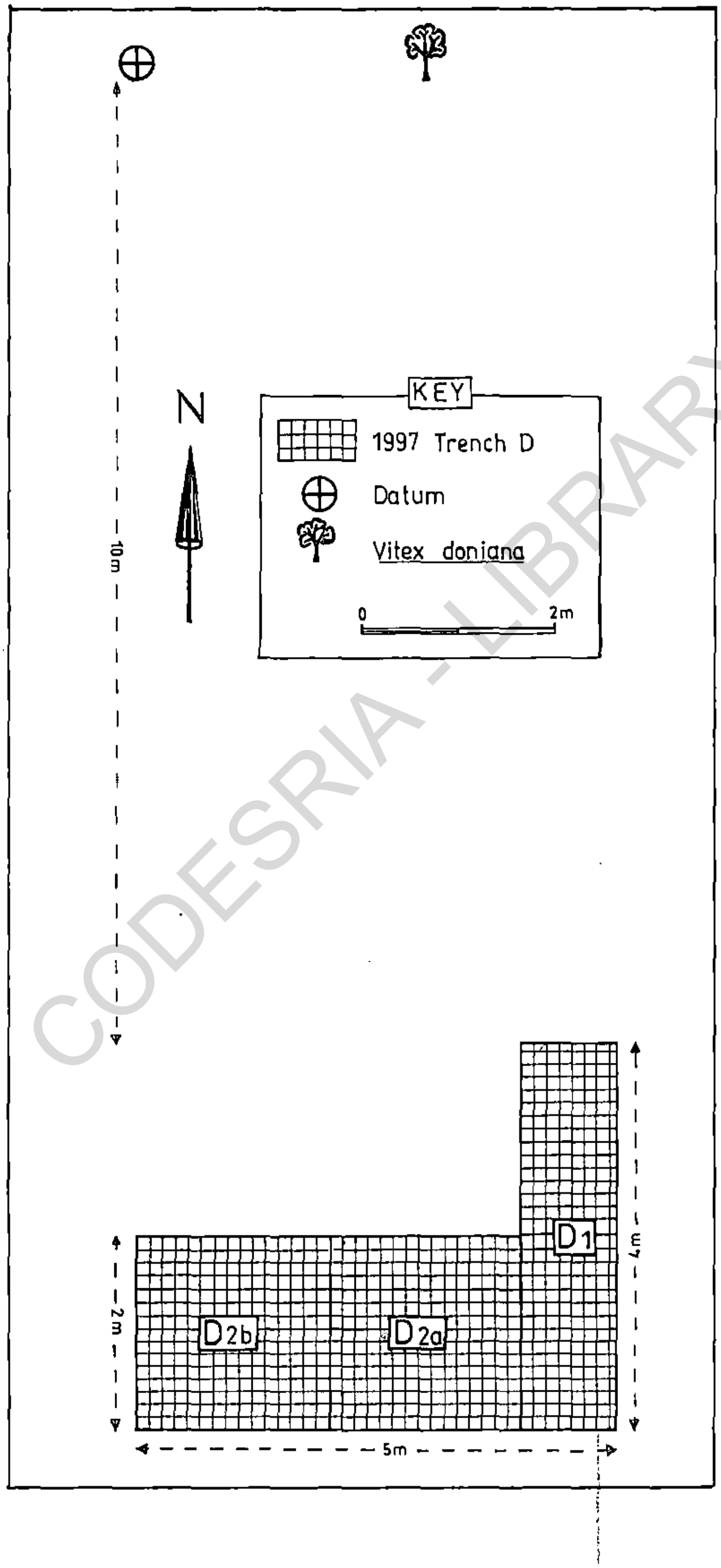


FIG. 20: A SKETCH PLAN OF AJB UMF'97 TRENCH D



The 1997 Spot Height readings over the entire grid layout revealed the following:

(i) maximum value: 651.94 feet, i.e., 198.76 m a.s.l.;

(ii) minimum value: 649.39 feet, i.e., 197.98 m a.s.l.;

(iii) difference value: 4.55 feet, i.e., 0.78 m a.s.l.;

These 1997 Spot Height readings are not significantly different from the following GPS readings recorded in 2002:

(i) at Trench D Excavation Spot (Figs. 19 to 23): 651 feet, i.e., 198.47 m a.s.l.; lat. 07° 28' 26"N and long. 03° 53' 13"E;

(ii) at Cutting I Spot (Figs. 19 and 24): 654 feet, i.e., 198.38 m a.s.l.; lat. 07° 28' 27"N and long. 03° 53' 13"E;

(iii) on Yamoje stream bed (Fig. 16 in Chapter Three): 625 feet, i.e., 190.54 m a.s.l.; (lat. 07° 28' 24"N and long. 03° 53' 14"E;

(iv) at the peak point on Ajibode-Soode footpath (Fig. 16): 726 feet, i.e., 221.34 m a.s.l.; lat. 07° 28' 16"N and long. 03° 53' 05"E.

On the opposite (i.e. left) bank of the same section of upper Yamoje stream, the GPS readings taken along a traverse from the floodplain level to the top surface are as follows:

(i) on the current floodplain outer fringe's level: 680 feet, i.e., 207.31 m; lat. 07° 28' 27"N and long. 03° 53' 09"E;

(ii) at 1997 Cutting II Spot (Egbenegu's Farm): 697 feet, i.e., 212.50 m; lat. 07° 28' 30"N and long. 03° 53' 07"E;

(iii) at the crest (i.e., Lawal's farm): 738 feet, i.e., 225 m; lat. 07° 28' 33"N and long. 03° 53' 05"E.

Both the Spot Height readings and GPS readings are grossly correlated in upper Yamoje stream area. This is done with a view of correlating Andah's and Momin's (1993) three 195 m, 210 m and 225 m a.s.l. terrace levels respectively with the 1997 Trench D Excavation Spot (at 198.47 m a.s.l.), the 1997 Cutting II Spot (at 212.50 m a.s.l.), and the current topmost at Lawal's Farm (at 225 m a.s.l.) close to and north of the watershed from which Yamoje stream takes its source.

4.3 EXCAVATION AND CONTROL CUTTINGS I-II

4.3.1 AJB UMF Excavation, Cutting I and Stratigraphic Description

4.3.1.1 AJB UMF Trench D Excavation and Stratigraphic Description

The major methodological issues raised in Chapter One, with regard to the research topic, aims, objectives and strategies, are centred around the need to adopt a problem-oriented approach in the field investigations. Thus, in that Chapter One various concepts like those of region, Stone Age archaeological subsistence-settlement patterns, off-site versus on-site archaeological reconnaissance, and river-terrace formation are critically examined. In doing so, not many preconceptions are critically reviewed, but on-site observations and case

Fig 21: A J B. UMF '97

SECTION DRAWING OF THE EAST & SOUTH WALLS OF EXCAVATION UNIT D1 AND SOUTH WALL OF UNIT D2a.

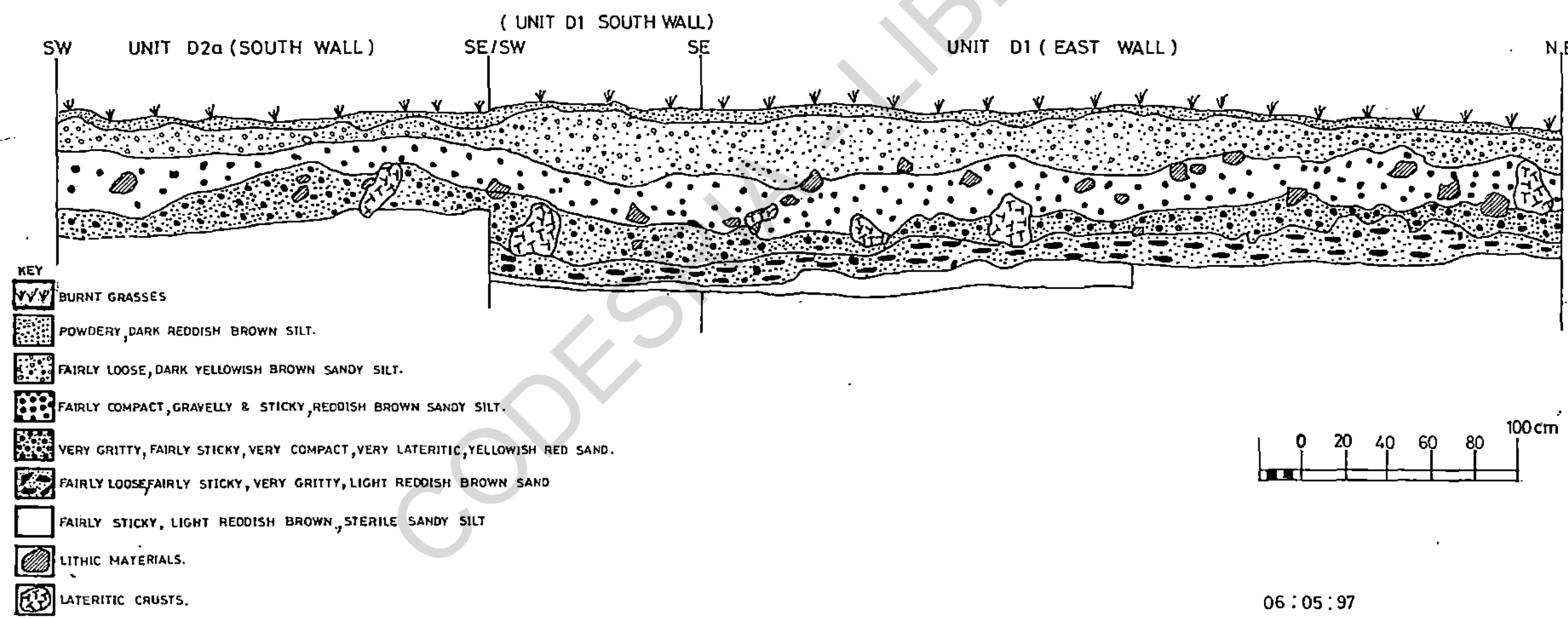


PLATE 15 : Close up shot of the surface Layer of the non-excavated Part of Trench D, on 25: 04: 97. (Source: AJB UMF'97, Trench D Excavation)

PLATE 16 : Close up shot of the surface Layer in Unit D1, on 25: 04: 97 (Source: AJB UMF'97, Trench D Excavation)

studies' illustrations are also favoured. Such a problem-oriented approach is adopted because the research is basically focussed on Ajibode area to which is attributed three terrace levels' Palaeolithic Sites. Any proper consideration of the past and ongoing debate on Palaeolithic Archaeology in the Guinea Humid Region of West Africa can not afford to ignore already established preconceptions and controversies. And in archaeology as in most other academic disciplines no research can be undertaken with total exemption from preconceptions. Even in such a specific, technical field investigation as an archaeological excavation, preconceptions are accepted as being unavoidable. This viewpoint is unambiguously advocated by Barker (1987: 43) in his book titled Techniques of Archaeological Excavation:

> (...) no excavation can be totally neutral in its approach. We inevitably enter a site with some preconceptions as to what we hope to find and we constantly formulate questions and as constantly abandon them. The evidence as it emergences will pose new questions of tactics, and may even alter the course or strategy of the whole excavation. Whatever major problems we may have uppermost in our minds we must always be prepared to encounter entirely unexpected (perhaps unwanted) evidence, which must be treated comprehensively, and not given scant attention or even swept away as irrelevant. What is more important is that the unexpected evidence may present itself an unexpected form, one with which we are not familiar or which does not fit in with our preconceptions of what might or should be there (...).

In the case of the 1997 AJB UMF Site Excavation exercise (i.e. AJB UMF '97), the major preconceptions were those of:

(i) the formation, number, lithostratigraphy, chronostratigraphy and accurate age of the terrace levels;

(ii) the correlation of these terrace sequences with Ajibode area's Quaternary environmental setting as part of the Bodija Formation;

(iii) the occurrence of Stone Age archaeological materials within such a local Quaternary terrace setting;

(iv) the identification of close or distant possible sources of raw materials for stone artefact manufacture;

(v) the long-term retrospective behaviour of Yamoje stream as part of River Ona drainage, with regard to both the entire Ajibode area local terraces' build-up and aquatic, floral and faunal resource potentials for Palaeolithic subsistence-settlement patterns.

Bearing in mind such multi-faceted preconceptions since the 1992-1994 surveys and 1994 test-pits, as well as during the 1996/97 on-site reconnaissance, the AJB UMF'97 Trench D Excavation was conducted in order to extend and complement the previous test-pitting carried out in the western part of a natural mound (Fig. 21). In 1997 the Trench D Excavation exercise covered the wider part of the mound (Plate 14). On the general Site Plan (Fig. 21) Trench D (Plate 15) was divided into D1 (Plates 16-17) and D2 units. The D2 unit was divided too into D2a and D2b (Plates 18 and 19).

PLATE 17 : Close up shot of Layer C in Unit D1, on 28: 04: 97 (Source: AJB UMF'97, Trench D Excavation)

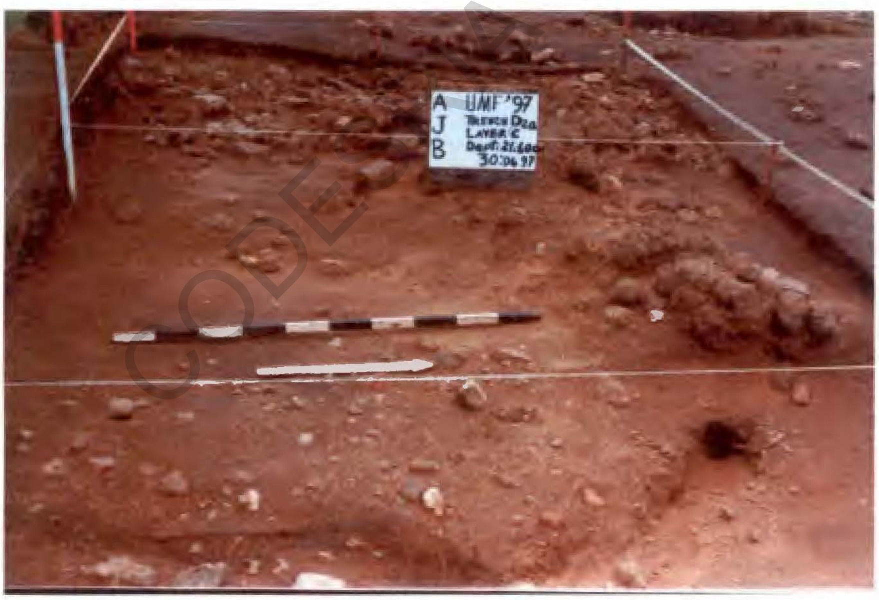


PLATE 18 : Close up shot of Layer C in Unit D_2a, at depth ca. 21.40 cm, on 30: 04: 97 (Source: AJB UMF'97, Trench D Excavation)

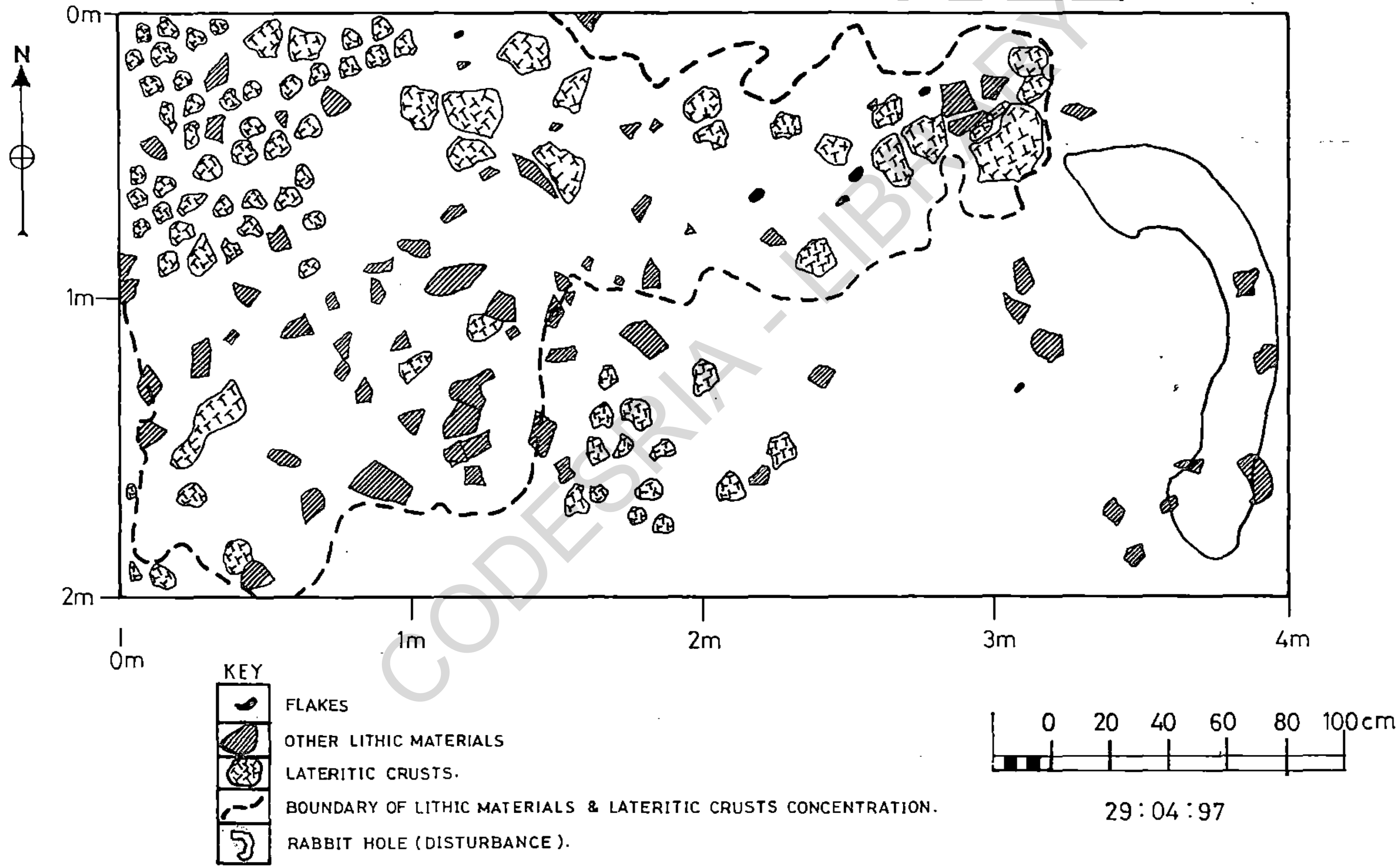
PLATE 19 : Close up shot of Layer C in Unit D_2b, at depth ca. 21,40 cm, on 30: 04: 97 (Source: AJB UMF'97, Trench D Excavation)

PLATE 20 : Close up shot of Layer E in Unit D_2a, at depth ca. 60.06 cm, on 06: 05: 97 (Source: AJB UMF'97, Trench D Excavation)

For the sake of a concise stratigraphical analysis, excavation was done by 5 cm spit levels and also according to natural layers. The colour of the soils was used to determine and delineate the different lithostratigraphic layers, while the levelling was used to determine and record the depth and thickness of each natural layer. Levelling was also used to accurately determine as much as possible the depth and thickness of the two archaeologically embedded levels. The levelling measurements were recorded respectively at the centre and the N.E., N.W., S.E. and S.W. corners of each excavation unit. After such levelling measurements successive average depth and thickness were obtained. On the basis of these procedures, five successive natural layers were identified to be present on the top of the basal sterile layer. From the upper to the lower, these five layers were described on the basis of their distinctive characteristic features such as texture, structure, colour and consistency. Section drawings of the east and south walls of the excavated D1 and D2a units (Fig. 21) were also undertaken. The distinctive stratigraphic units are as follows:

(i) Layer A: it is a thin, silty, fairly powdery deposit with mat-like formation that contains few gritty materials. It is a very loose soil with lots of rootlets. Its colour is dark reddish brown (5YR 3/4 Munsell). It lies between 0.00 cm and 12.60 cm, with an average thickness of 4 cm;

Fig. 22: AJB UMF'97 A PLAN OF EXCAVATION UNIT D2 SHOWING THE SPATIAL SPREAD OF LITHIC MATERIALS AND ASSOCIATED LATERITIC CRUSTS IN OCCUPATION LAYER C.



(ii) Layer B: it is a fairly loose, sandy silt deposit containing some rootlets. Its colour is dark yellowish brown (10YR 3/4 Munsell). Its thickness ranges from a maximum of 33 cm to a minimum of 8 cm. It is generally thicker on the east wall of D1 than the south wall of D1 and D2. Sparse stone materials are contained in it, some broken and few appearing as chipped-like or flakes-like. It lies between 12.60 cm and 33.70 cm, disconformably on the top of layer C;

(iii) Layer C: it is a gravely, sandy silt deposit. Its colour is reddish brown (5YR 4/3 Munsell). It is very gritty on the east wall of D1 and relatively less on south wall of D1 and D2 (Figs. 21 and 22). It contains lots of tiny rootlets. It is mostly very thick, with a maximum of 43 cm and a minimum of 7 cm. It sits between 33.70 cm and 42.40 cm, disconformably on the top of layer D. It corresponds to the site's upper Stone Age occupational level that is represented by lots of flaking or chipped-like, broken, waste block and other lithic materials of different size and shape associated with abundant fairly lateritic crust (Plates 17, 18 and 19);

(iv) Layer D: it is a very gritty, and very sandy deposit. It is fairly sticky. It essentially consists of a very compact and hard lateritic crust which is very cemented in some cases. It is more of a geomorphic interface between the archaeologically occupational layers C and E. It is relatively thicker on the south wall of D2 than on the south wall of D1. The cemented parts contain gravels and some pebbles. It lies between 42.40 cm and 57.40 cm with a maximal thickness of 29 cm and a minimal of 6 cm. Its colour is yellowish red (5YR Munsell 5/5).

(v) Layer E: it is a very sandy, very gritty and fairly sticky loose deposit. It is a bit mottled and contains chunks (mostly quartzite and quartz) and a relatively cemented lateritic crust at its upper section. It corresponds to the lower Stone Age occupational level on the site. The archaeological lithic features consist of flaking or chipped-like, waste, broken materials of different size and shape (as shown in Chapter Five). The lithic materials are associated with the lower section of the cemented lateritic crust (Plate 20 and Fig. 23). It is a thick lithofacies that ranges from 57.40 cm to 79.20 cm. Its colour is light reddish brown (5YR 6/4 Munsell). Its lower section sits on the sterile layer;

(vi) Layer F: it is a very sandy and gritty, fairly sticky deposit that consists of a sterile layer. It directly overlies the decomposed bedrock. It is very mottled, with a light reddish brown colour (5YR 6/3 Munsell). Its thickness ranges from 79.20 cm to 93 cm. After 93 cm of depth, Layer G starts as shown on Plate 21.

Fig. 23: **AJB UMF '97**

A PLAN OF EXCAVATION UNIT D1a SHOWING THE SPATIAL SPREAD OF LITHIC MATERIALS AND ASSOCIATED LATERITIC CRUSTS IN OCCUPATION LAYER E.

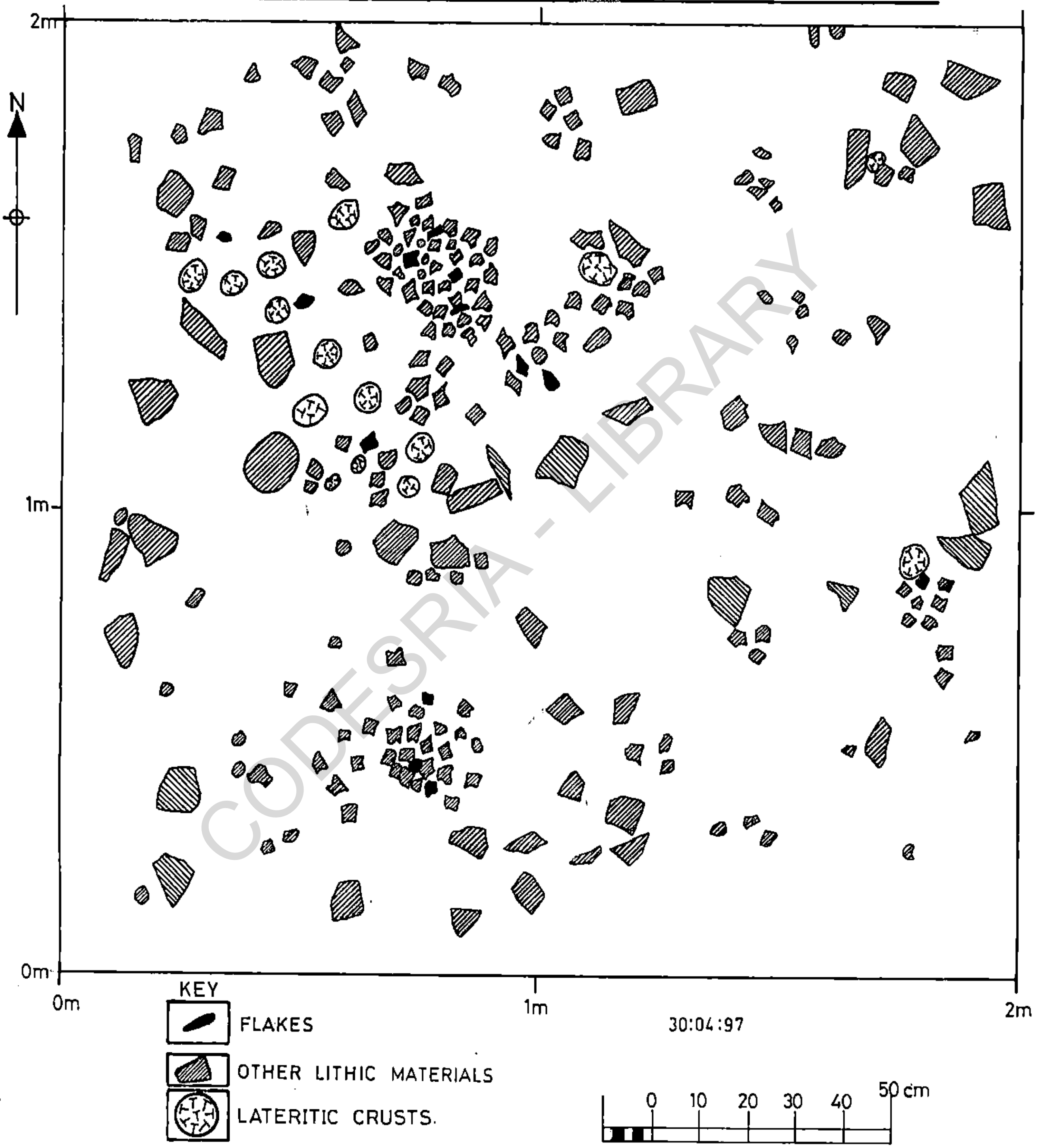
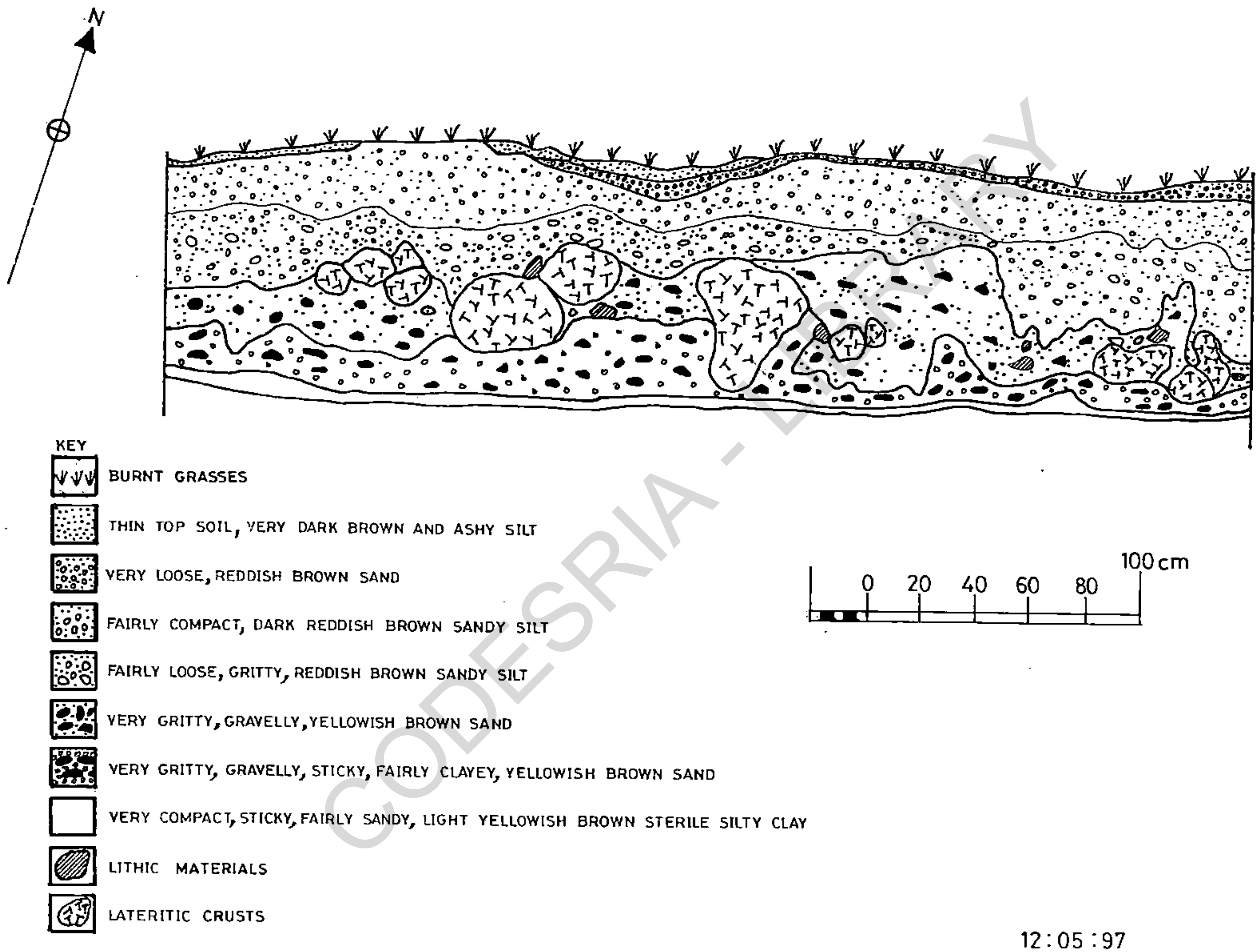


Fig.24: A.J.B. UMF '97. SECTION DRAWING OF UMF CUTTING I.



Sediment samples were collected for subsequent laboratory analyses.

4.3.1.2 ABJ UMF Cutting I and Stratigraphic Description

Before refilling the excavated Trench D, a cutting was made on the northern part of the Datum Point, and designated as AJB UMF '97 Cutting I (Fig. 24). This is done for the purpose of comparison with the picture exposed at Trench D, with a view to having a better understanding of the site's specific chronostratigraphic sequence.

From the Base line the AJB UMF Cutting I extended eastwards along 4 m. The exposed (Plate 22) and drawn (Fig. 24) stratigraphic section and the soils of the different layers were not notably different from those at Trench D. Thus, the lithostratigraphic characteristics of the successive layers from the top down to the average depth of 100 cm, were as follows:

(i) the topsoil: it is thin (1.40 cm to 2.20 cm), very ashy on the north-west flank of the section with charcoal pegs, powdery, and wet dry. Its colour varies from very dark brown (10 YR 2/2 Munsell) to dark reddish grey (5YR 4/2) while becoming more sandy and more loose;

(ii) Layer A: it is a very loose and very sandy lens (1.45 cm to 2.25 cm) with lots of rootlets and few charcoal pegs. The colour is reddish brown (5YR 4/3 Munsell);

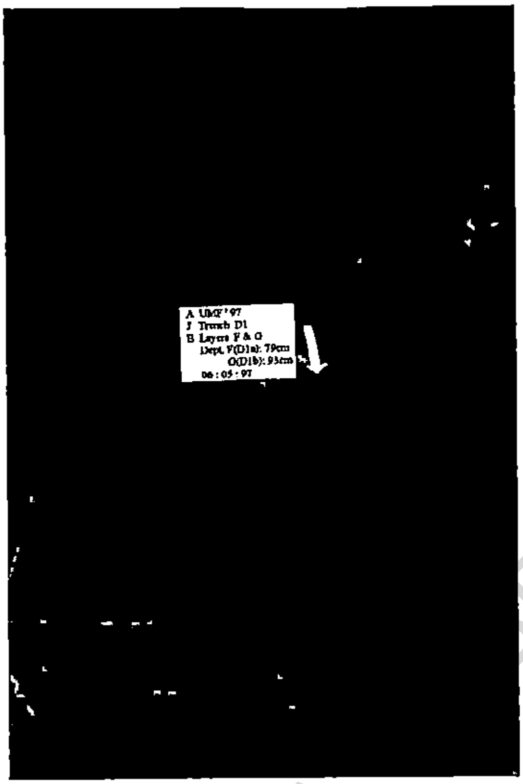


PLATE 21 : Close up shot of Layer E in Unit D_1, at depth ca. 79.20 cm, and Layer G at depth ca. 93.00 cm, on 06: 05: 97. (Source: AJB UMF'97, Trench D Excavation)

PLATE 22 : Close up shot of Control Cutting I, at depth ca.100.00 cm, on 12: 05: 97 (Source: AJB UMF'97, Control Cutting I)

(iii) Layer B: it is a thick and fairly compact sandy silt deposit which contains some abundant rootlets. It sits disconformably on Layer C with a thickness between 11 cm and 26 cm. Its colour is dark reddish brown (5YR 3/4 Munsell);

(iv) Layer C: it is a fairly loose and very gritty sandy silt deposit that contains few rootlets. It is fairly gravely with some lateritic chunks and lithic materials associated with chipped-like and flake-like artefacts. It lays discomformably on layer D with a thickness of 6 cm to 32cm. The colour is reddish brown (5YR 5/3 Munsell);

(v) Layer D: it is a very gravely, gritty and sandy deposit, with abundant and very large lateritic crusts, except along the first 50 cm from the north-west. It contains very few rootlets, some stone materials and artefacts-like on the top and the bottom. With a thickness between 13 cm ad 50 cm, it sits disconformably on layer E. The colour is yellowish brown (10YR 5/4 Munsell);

(vi) Layer E: it is a very gravely and very sandy deposit, relatively less compact than D. It is fairly clayey and contains more chipped-like and flake-like stone materials. With a thickness between 7 cm and 22 cm, the deposit's colour is yellowish brown (10YR 5/4 Munsell);

Table 4: Number and Percentage of Lithic Materials from Stratigraphic Units of AJB UMF Trench D Excavation

Layers	Lithic Materials	Number	Percentage
Layer A 00-12.60cm	Average chunks and gravels	94	4.81%
Layer B 12.60-33.70cm	Gravels and pebbles	37	1.89%
Layer C 33.70-42.40cm	Large chunks Pebbles and eroded flat stones Cores and chipped-like stones Flakes and chips (waste) S/Total	22 142 189 1182 1535	 78.58%
Layer D 42.40-57.40cm	Lateritic crust	-------	--------
Layer E 57.40-79.20cm	Large chunks Pebbles and eroded flat stones Cores and chipped-like stones Flakes and chips (waste) S/Total	01 25 29 232 287	 14.69%
Layer F 79.40-93.00cm	Sterile soil (archeologically)	-------	----------
Layer G	Weathered bedrock	-------	----------
Total of lithic materials		1953	100%

(vii) Layer F: it is a very compact, clayey and sandy deposit. It is less gravely than layer E. It is archaeologically a sterile layer and its actual thickness is underminable. It is very close to the present water table, with a light yellowish brown colour (10YR 6/4 Munsell).

The colour of all the soils was also determined under wet conditions. The soils were all sampled for laboratory analyses. This cutting's layers, as well as their soils, stone materials, and artefact-like components were generally similar to those of the excavated Trench D (Table 4).

4.3.2 AJB EGF Cutting II: Location and Description of Levels

The second control cutting was executed at Egbenegu's Farm Station and designated as AJB EGF '97 Cutting II. It was situated outside of, and westwards from AJB UMF Site. The GPS readings of this Cutting II were already reported in the preceding section as follows:

(i) latitude: 07° 28' 30"N;

(ii) longitude: 03° 53' 07"E;

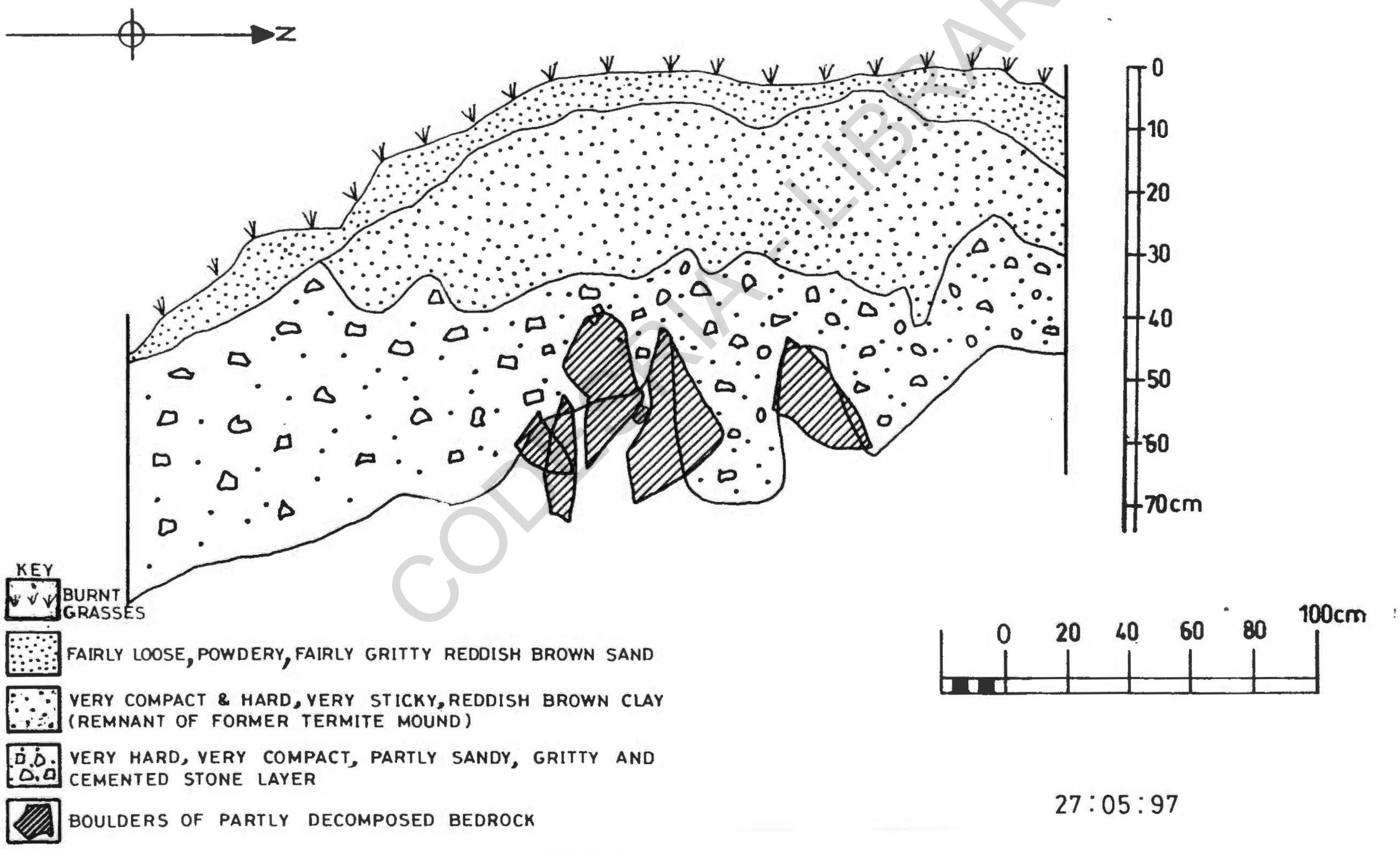
(iii) altitude: 697 feet, i.e. 212.50m a.s.l.

This second control cutting was also made in a mound. On the basis of a prior open compass traverse survey, a distance of about 207 m was determined between the Datum at AJB UMF Site and an Iroko tree (i.e. Chlorophora excelsa) Datum at this second cutting spot. This latter Datum was located at about 137 m from Yamoje stream bed. As a result, after a 5 m griddling of the site, a 3 m cutting was established at 2 m northwards from the Datum, alongside the N - S

PLATE 23 : General shot of the cleaned and plotted area of the Control Cutting II at Egbenegu Farm Station at 7°28'30"N and 3°53'7"E, on 20: 05: 97. (Source: AJB EGF'97, Control Cutting II)

PLATE 24 : Close up shot of Control Cutting II, at depth ca. 64.50 cm, on 24: 05: 97 (Source: AJB EGF'97, Control Cutting II)

Fig. 25: AJB EGF '97. SECTION DRAWING OF EGF CUTTING II.



Base Line. So that, a 15 m by 5 m (i.e. 75 square metres) excavation area was delimited and cleaned (Plate 23).

The excavation was done at 5 cm spit level (Plate 24 and Fig. 25). The stratigraphy was as follows:

(i) Level I (0-10 cm): on the area, from 1.2 cm to 3m, a 0.00 cm to 5 cm loose soil containing humus and roots, a 5 cm to 7cm transitional soil with roots, and a 7 cm to 10 cm lateritic soil with roots;

(ii) Level II (10-20 cm): it is a reddish lateritic soil with less numerous but bigger roots, and some stone chunks;

(iii) Level III (20-30 cm): it is a more compact lateritic soil that contains much bigger and fewer roots. At the bottom are laid numerous granite (bigger) and quartzite (smaller) regoliths;

(iv) Remarks: from 20 cm to 30 cm level and a bit below, the soil texture and colour were closely observed. Following careful observation of the mound, the team agreed that it was a remnant termite. A similar remnant termite was also located northwards at Lawal's Farm situated at 07° 28' 33"N, 03° 53' 05"E, and 225 m a.s.l. Soils from the two remnant termite mounds were compared and to be similar to one another. The excavation was then stopped and the trench refilled.

4.4 SEDIMENTOLOGICAL ANALYSES, RESULTS AND INTERPRETATION

For a better understanding of the lithostratigraphy and chronostratigraphy of AJB UMF Site Lower Terrace, Sediment Samples were collected from four of the distinctive stratigraphic units of both Trench D and Cutting I. The samples collected were labelled A, B, C and D, respectively starting from top to bottom. They were subsequently subjected to the following laboratory analyses viz: (i) physical tests (mechanical particle-size analysis and colour determination) and (ii) chemical analyses (the pH, the total carbon content, the phosphate content and the cation exchange capacity or C.E.C.). All the analyses were carried out in the Department of Geology of the University of Ibadan.

The layer and depth from which the four samples were collected from both Trench D and Cutting I are presented on Table 5, with their respective label.

4.4.1 Analytical Techniques

4.4.1.1 Physical Tests

4.4.1.1.1 Mechanical Particle-Size: Analytical Techniques

(i) 100g was taken from each of the four Sediment Samples designated A, B, C and D and was weighed using weighing balance.

(ii) The weighed sample was poured into a set of sieves arranged in the order of 2.8 mm – Pan in a vertical position.

(iii) The rota-machine was set and allow to shake for 15 minutes.

(iv) Each sieve was weighed again and the weight retained is noted.

(v) A tabulated table of the weighed retained is calculated to know the percentage cumulative weight.

(vi) Plot Phi values of each sample against percentage cumulative weight of each sample.

The Mechanical Particle Analysis was done on the four Sediment Samples designated A, B, C and D (cf. Table 5, Fig. 26 and Appendix I), with a view to determining the relative proportion of the sand, silt, and clay fractions in each sediment sample. This method is one of the most objective procedure of quantifying, describing and comparing sediments from archaeological sites, with a view to throwing light on the nature and processes of the depositional environments. The dry sieving method was employed to separate such loose materials (gravels and sands) that range from 1,000 to 63 microns, whilst a sedimentation test (pipette sampling and hydrometer method) was employed in analyzing the less than 63 microns more cohesive soils (silts and clays). In the case of the matrix of sediment samples that are not purely sandy or purely clayey or silty, a combine method of sieving and sedimentation was employed in the

Table 5: Correlation of AJB UMF Site Trench D and Cutting I stratigraphic units and depth of Sediment Samples A-D

No	Layers Depth Thickness	Sampled Sediments
1	Layer A: 0.00 – 12.60 cm = 12.60 cm	------------------------
2	Layer B: 12.60 – 33.70 cm = 21.10 cm	Sample A: at 23.00 cm
3	Layer C: 33.70 – 42.40 cm = 8.70 cm	Sample B: at 40.00 cm
4	Layer D: 42.40 – 57.40 cm = 15.00 cm	------------------------
5	Layer E: 57.40 – 79.20 cm = 21.80 cm	Sample C: at 73 cm
6	Layer F: 79.20 – 93.00 cm = 13.80 cm	Sample D: at 85 cm
7	Layer G: weathered bedrock	------------------------

analysis. The rare data was subsequently converted into cumulative percentage graphs (Fig. 26). From these graphs, some simple statistical variables (Skewness, Sorting and Kurtosis) were determined for each of the four samples following Folk and Ward (1967) Method (cited in Tubosun, 1995: 109).

4.4.1.1.2 Colour Determination

For an objective determination of the colour of the four sediment samples, the standard Munsell Soil Colour Chart was used. A small quantity of each sediment sample was taken one after the other and matched with colour chip in the Munsell Chart. The corresponding three major soil characteristics (the Hue, the Value and the Chroma) were subsequently recorded for each sample.

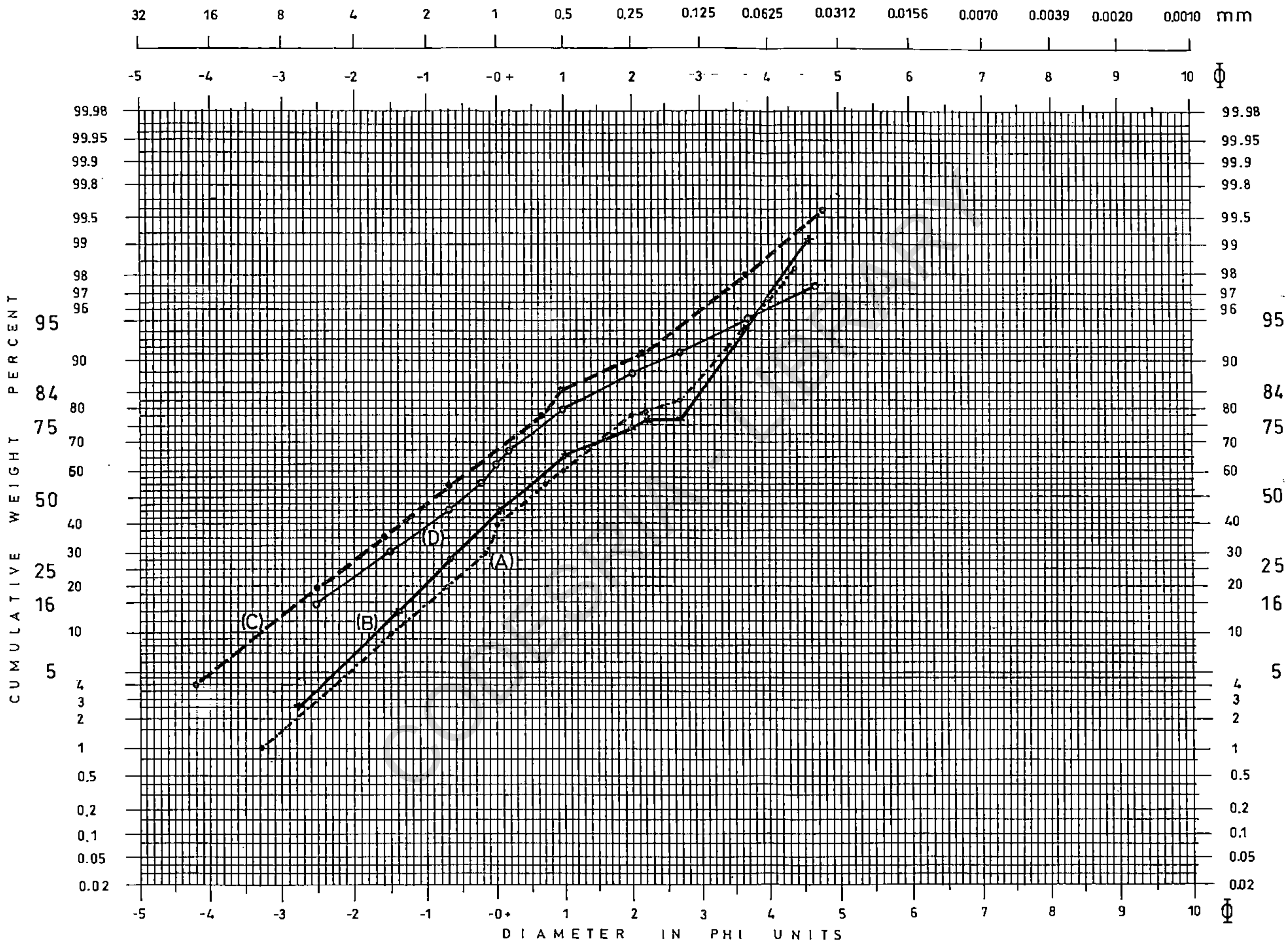


FIG. 26: CUMULATIVE PERCENTAGE GRAPHS OF SAMPLES A – B – C – D FROM AJB UMF

4.4.1.2 Chemical Tests

4.4.1.2.1 Determination of the pH

Chemical analysis of sediments is usually undertaken in order to determine attributes such as the pH, the Total Carbon Content, the Phosphate Content, the Cation Exchange Capacity (C.E.C) and the Moisture Content etc.

The pH indicates that the soil's reaction is a reflection of the relative proportion of hydrogen ion (H^+) and hydroxonium ion (OH^-). The pH scale ranges from 1 to 14. The neutral value is 7, pH < 7 indicates acidity whilst a value of pH > 7 is an indication of alkalinity. In determining the pH values of the four sampled sediments 5 g from each specimen were weighed into a beaker and dispersed in a 5 ml of distilled water. The pH of the samples was measured by a pH meter containing a buffer solution.

4.4.1.2.2 Total Carbon Content

In determining the percentage of total carbon content in each sediment sample the following Digestion Method was employed:

(i) Samples were pulverised into fine powders.

(ii) 0.2 g of the pulverised samples was weighed and poured into a pyrex flask.

(iii) 0.5 ml of Hydrofluoric Acid plus 5 ml of concentrated Chloric Acid was added and shakes vigorously.

(iv) The mixture was placed on a water-bath and allowed to boil for one hour.

(v) 5.5 ml of Lanthanum Chloride was added to another 5 ml of Boric Acid and allowed to cool.

(vi) The solution was made up to 100 ml of Distilled water.

4.4.1.2.3 Phosphate Content

The Phosphorus available in the four Sediment Samples is determined by Phosphate Tests. Many Phosphate Tests could be employed. The standard qualitative laboratory test for detecting the presence or the absence of phosphate in archaeological sediments was employed. This qualitative test consists of boiling an acid extract of the sediments with ammonium and molybdate and nitric acid. A bright canary-yellow precipitate denotes the presence of Phi compound (Schwartz, 1967 cited in Tubosun, 1995: 128).

4.4.1.2.4 Cation Exchange Capacity (C.E.C.)

Hydrogen, Calcium, Magnesium, Potassium, Sodium and Ammonium are amongst the main chemical elements that have individual ability to replace or to be replaced. This phenomenon is known as Cation Exchange Capacity (C.E.C.).

The C.E.C. is related to the soil's fine mineral particles and humus component. The determination of a soil's C.E.C. could be carried out by two major methods: (i) a method which yields results combining the values for all the elements involved, and (ii) another method that involves the summation of values obtained by individual determination of Ca^{2+} (Calcium), Mg^{2+} (Magnesium) and K^{+} (Potassium). The first method is applied to the four Sediment Samples (A-D) from AJB UMF Trench D and Cutting I. This is done in order to determine the concentration of elements in ppm as well as the percentage of elemental oxide in ppm in each sediment sample.

4.4.2 Results and Interpretation

4.4.2.1 Results of Physical Tests

The results of the Particle-Size Analysis of the four Samples A-D on Table indicate similarities between Sample A and B on one hand, and between Samples C and D on the other. These twofold similarities are shown by the nearly equivalence of percentage on the basis of the results related to the Sieve mesh from 2.8 mm to 1.0 mm, as well as from 850 microns to Pan. It is only at the Pan level that a meaningful difference of percentage is shown between C (1.8) and the three other samples having respectively the percentage of 5.2 (A and B) and 5.3 (D). So, the percentage of the total weight retained is nearly equal to 100% in

Table 6: Results of Particle-Size Analysis of Sediment Samples A-D from AJB UMF Site

Sieve Mesh	Sample A	Sample B	Sample C	Sample D
2.8mm	10.2	14.0	35.1	30.2
1.6mm	12.1	17.3	20.4	17.1
1.18mm	10.8	8.8	6.4	8.2
1.0mm	7.3	7.2	6.2	6.2
850 microns	3.1	3.6	5.1	5.4
600 microns	10.2	8.3	5.8	6.9
500 microns	5.4	5.2	5.4	5.8
250 microns	17.6	10.4	6.0	7.9
212 microns	1.2	2.1	1.2	1.0
150 microns	2.3	2.3	2.2	2.4
75 microns	14.4	15.2	4.2	3.5
Pan microns	5.2	5.2	1.8	5.3
Total Weight Retained Percentage	99.8	99.6	99.8	99.99

Table 7: Statistical Interpretation of Textural Parameters of Sediment Samples A-D from AJB UMF Site

Samples/ Depth	Mean	Standard Sorting	Graphic Skewness	Graphic Kurtosis
A-23cm	077	1.83 Poorly sorted	0.16 Fine-skewed	0.99 Mesokurtic
B-40cm	0.57	1.99 Poorly sorted	0.30 Strongly fine-skewed	0.85 Platykurtic
C-73cm	-0.87	1.97 Poorly sorted	-0.01 Nearly-Symmetrical	1.09 Mesokurtic
D-85cm	-0.20	1.59 Poorly sorted	0.89 Strongly fine-skewed	0.61 Very platykurtic

each sample (99.99 in D, 99.8 in A and C, and 99.6 in B). This shows a gross similarity amongst the four samples.

The Statistical Interpretation of the Textural pattern of each sediment based on the coefficient of Sorting and the Graphics of Skewness and Kurtosis also shows gross similarities amongst the four samples (Table 7 and Appendix II). The Standard Sorting shows that the four samples are poorly sorted. The Graphic Kurtosis indicates that Sample A and C are mesokurtic, B as platykurtic and D as very platykurtic. The Graphic Skewness shows that Sample A is fine-skewed, B strongly fine-skewed, Sample C nearly-symmetrical and D strongly fine-skewed (Table 7). The mean value is positive in A (0.77) and B (0.57), whilst it is negative in C (-0.87) and D (-0.20). The nearly-symmetrical Skewness of C corresponds to the negative value of -0.01, which is an indication of greater heterogeneity amongst the larger particles. In the contrary, the Skewness shows positive values in A (0.16), B (0.30) and D (0.89), which is an indication of greater heterogeneity amongst the smaller particles more notably in D.

Except for the thin topsoil and the weathered bedrock, the four Sediment Samples are characterized by a consistent dominance of the sand, followed by silt and clay respectively.

With regard to the determination of the colour of the sampled soils the results are as shown below:

(i) <u>Layer A:</u> is dark reddish brown (5YR 3: 4 Munsell);

(ii) Layer B: is dark yellowish brown (10 YR 3/4 Munsell);

(iii) Layer C: is reddish brown (5 YR 4/3 Munsell);

(iv) Layer D: a hard lateritic crust deposit that is very cemented in some cases. It is a geomorphic interface between C and E in colour and texture;

(v) Layer E: is light reddish brown (5 YR 6/4 Munsell); and

(vi) Layer F: is light reddish brown (5 YR 6/3 Munsell).

4.4.2.2 Results of Chemical Tests

The results of the determination of the pH are presented on Table 8. They indicate that all the selected samples are base-deficient and acidic in character soils. Sample B as well as Sample C has 6.4 pH, against 6.7 and 6.6 respectively for Sample A and D (Table 8).

The analytical results of Percentage of Carbon Content are also on Table 8. On the basis of these results, the four sediments constantly show the same percentage both for the original weight of wet samples (18.100) and the weight of dry samples at 850°C (16.475), as well as for the difference in wet and dry weight (1.625). The almost insignifiant differences is shown in C only respectively for the weight of dry sample at 850°C (16.474) and for the difference in wet and dry weight (1.626). As a consequence, the four Sediment Samples are grossly similar.

Table 8: The pH Values and Percentage of Carbon Content of Sediment Samples A-D from AJB UMF Site

Samples	pH. Values	Percentage of Carbon Content		
		Original Weight of Wet Sample	Weight of Dry Samples at 850°C	Difference in Wet and Dry Weight
A-23cm	6.7	18.100	16.475	1.625
B-40cm	6.4	18.100	16.475	1.625
C-73cm	6.4	18.100	16.474	1.626
D-85cm	6.6	18.100	16.475	1.625

The Phosphorus content of the four Samples (A-D) from AJB UMF Site is shown on Table 9 in relation to Fig. 26. On the basis of the scale of the ϕ from 5 to 95, the Table and the Figure show a closeness of Phi values and variation between Samples A and B on the one hand, and between C and D on the other hand. So, in A and B sediments the Phi is respectively -1.00 and -1.40 at ϕ 16, 0.50 and 0.20 at ϕ50, 2.80 and 2.90 at ϕ84, and 3.70 and 3.70 at ϕ95. Otherwise, in C and D a positive correlation indicates a Phi of -2.80 and -2.60 at ϕ16, -0.80 and -0.50 at ϕ50, 0.40 and 0.70 at ϕ75, and 1.00 and 1.50 at ϕ84. Two peculiarities are shown by C and D. First at ϕ95 the Phi is 2.70 in C and 3.70 in D; second at ϕ5 it is -4.00 in C and absent (or no recorded?) in D.

In general, the four samples show negative values from ϕ5 to 25. In the detail, negative values in C and D extend to ϕ50. On the other hand, the four samples show positive values from ϕ75 to ϕ95. These Phi Values present the four Sediment Samples with gross similarities.

Table 9: Phi Values of Sediment Samples A-D from AJB UMF Site

ϕ	A – 23 cm	B – 40 cm	C – 73 cm	D – 85 cm
1	-2.10	-2.35	-4.00	----
16	-1.00	-1.40	-2.80	-2.60
25	-0.50	-0.90	-2.10	-1.80
50	0.50	0.20	-0.80	-0.50
75	1.90	2.00	0.40	0.70
84	2.80	2.90	1.00	1.50
95	3.70	3.70	2.70	3.70

With regard to the concentration of Elements in ppm (Table 10) the four Sediment Samples indicate as predominant the Silicon (Si) that decreases from 9684.8 in D to 8961.6 in B, and as the less present the Phosphorus (P) that decreases from 12.02 in A to 9.22 in C. The elements that follow the Si are respectively, the Aluminum (Al) which decreases from 1446.8 in A to 1322.4 in B, the Iron (Fe) which decreases from 1398.32 in D to 1121.99 in B, the Sodium (Na) that decreases from 366.55 in A to 232.06 in C, the Potassium (K) with 241.32 in A to 130.81 in D, and the Titanium (Ti) with 1995.55 in D to 189.80 in C. After the P, the Mn, Ca and Mg are respectively the present.

As regards the percentage of the Elemental Oxides (Table 11), the four samples show that S_iO_2 is the predominant compound (72.19% in A, 65.87% in B,

Table 10: Concentration of Elements in ppm for Samples A-D from AJB UMF Site

Elements in ppm	Samples			
	Sample Depth A – 23 cm	Sample Depth B – 40 cm	Sample Depth C – 73 cm	Sample Depth D – 85 cm
Na+	366.55	338.68	232.06	346.72
K	241.32	121.62	182.47	130.81
Ca	23.20	20.32	25.62	20.21
Mg	75.128	72.208	78.886	72.220
Si	9218.2	8961.6	8975.6	9684.8
Al	1446.8	1322.4	1349.2	1466.8
Mn	23.113	20.215	20.124	18.799
Ti	198.83	192.22	189.80	199.55
P	12.02	10.15	9.22	9.35
Fe	1184.50	1121.99	1145.32	1398.32

Table 11: Percentage of Elemental Oxides in Samples A-D from AJB UMF Site

Elemental Oxide	A – 23 cm	B – 40 cm	C – 73 cm	D – 85 cm
Na_2O	3.62	3.14	2.14	2.92
K_2O	2.13	1.01	1.51	0.98
CaO	0.12	0.10	0.12	0.10
MgO	0.46	0.41	0.44	0.40
SiO_2	72.19	65.87	65.83	64.67
Al_2O_3	19.98	19.14	19.44	19.29
MnO	0.10	0.10	0.10	0.10
T_1O_2	1.21	1.10	1.10	1.04
P_2O_5	0.20	0.16	0.14	0.13
Fe_2O_3	12.37	10.99	11.20	12.45

65.83% in C and 64.67% in D). The Al_2O_3 is the second (19.98% in A, 19.14% in B, 19.44% in C and 19.29% in D). The Fe_2O_3 is the third (12.37% in A, 10.99% in B, 11.20% in C and 12.45% in D). The Na_2O is the fourth (3.62% in A, 3.14% in B, 2.14% in C and 2.92% in D). The K_2O is the fifth (2.13% in A, 1.01% in B, 1.51% in C and 0.98% in D). For the total of the ten Elemental Oxides, Sample A contains the highest percentage, D has the lowest percentage except for Na_2O, Al_2O_3 and F_2O_3. Samples B and C have the average percentages.

In conclusion, there is a correlation between the concentration of Elements in ppm and the percentage of the Elemental Oxides both at the intra and the inter sediment samples.

4.4.2.3 General Interpretation of the Results

In the light of the comparative results presented on Table 12, a characterization of the chemical and textural composition of the four Samples A – D is attempted. On the basis of this characterization, provisional palaeoclimatic inferences are drawn.

In the interpretation of the chemical elemental composition, the pH is an important indicator of the degree of acidy or alkalinity of the soils. The results of the four Sediment Samples A-D have shown that the percentage of the pH ranges from 6.4% to 6.7%. As a result, the four samples are generally acid in nature. This acidity characteristics is also reflected by the high amount of SiO_2 that ranges from 64.67% to 72.19%.

The acid amount of the four soils must chiefly result from the 95% quartzite and 5% banded and augen gneiss that the Basement Complex in Ajibode area is said to be made of (Oni, 2001: 15-16). From that 95% quartzite bedrock, weathered quartz and mica can become the major raw materials of the production of the sandy, silty, clayey and lateritic soils such as presented on Table 12. These quartz and mica parent raw materials in long-term or repeatedly pedogenetic interactions with such amount of F_2O_3 (10.99% - 12.45%) and Al_2O_3 (19.29% - 19.98%) as presented on Table 12, must have contributed to produce the reddish and brown coloration of the soils (Table 12).

On the other hand, the acidity of the sediments is a contrario confirmed by their base-deficiency as indicated by the amount of such compounds as Na_2O (3.62%), K_2O (2.13%) and CaO (0.12%) (Table 12).

Furthermore, the similar amount of Carbon (8.97%-8.98%) in the four sampled sediments could not be the determining factor that accounts for the difference between the natural soils and the archaeological sediments. However, the constant presence and amount of carbon probably suggest continuity and competence in the leaching process. The base-deficiency of the soils seems to suggest that they have been subjected to continuous and active leaching processes.

Table 12: Correlation of Physico-Chemical Characteristics of Sediments A-D and Palaeoclimatic Inferences

Physicochemical Characteristics	Layer A	Layer B	Layer C	Layer D
~~PH~~ pH	6.7%	6.4%	6.4%	6.6%
Carbon Content	8.97%	8.97%	8.98%	8.97%
SiO_2	72.19%	65.87%	65.83%	64.67%
Al_2O_3	19.98%	19.14%	19.44%	19.29
Fe_2O_3	12.37%	10.99%	11.20%	12.45%
Na_2O	3.62%	3.14%	2.14%	2.92%
K_2O	2.13%	1.01%	1.51%	0.98%
CaO	0.12%	0.10%	0.12%	0.10%
Standard Sorting	1.83% Poorly sorted	1.99 Poorly sorted	1.97 Poorly sorted	1.59 Poorly sorted
Graphic Skewness	0.16 Fine-skewed	0.30 Strongly fine-skewed	-0.01 Nearly symmetrical	0.89 Strongly fine-skewed
Graphic Kurtosis	0.99 Mesokurtic	0.85 Platykurtic	1.09 Mesokurtic	0.61 Very Platykurtic
Soil	Fairly loose sandy silt. Dark yellowish brown (10 YR 3/4 Munsell)	Gravey sandy silt- Reddish brown (5 YR 4/3 Munsell)	Little mottled, very sandy, very gritty and fairly sticky loose. Light reddish brown (5 YR 6/4 Munsell)	Very mottled, very sandy and gritty fairly sticky loose. Light reddish brown (5 YR 6/3 Munsell)
Gravel and debris	+ +	+ +	+	+
Pebbles and flat eroded stones	+	+ +	+	+
Large and average chunks	-	+	+	+
Lateritic crust	-	-	+	+ +
Key: + + : abundant + : present - : insignificant				

The generally poor sorting nature of the soils seems to indicate that they have been deposited under a medium fluvial energy situation. The dominant fine Skewness with the alternating mesokurtic and platykurtic physical presentation could probably be a reflection of alternating conditions of wetness and less wetness.

The four Sediment Samples are predominantly sandy silt in nature. This is probably as a result of complementary processes of weathering, run-off and deposition of the parent quartz and mica rocks. The changing-consistence from fairy loose in sample A, to gravely in B, and fairly sticky loose in C and D, could be a by-product of differential leaching activities in relation to changes in the flow and competence of the Ona River drainage system. The key factor in this respect is most probably climatic in association with the topographic setting and the table-water movements. This predominant climatic factor is favoured because of the following two pedogenetic features as presented on Table 12 viz: (i) the gravels/pebbles and flat eroded materials as obvious reflectors of a long-term, long-distance and competent drainage; and (ii) the lateritic crust as an end-product of laterisation.

In fact, natural scientists generally accept laterite to be an iron-rich and residual weathering product of many different rock parents under strongly oxiding and leaching conditions. The current climatic conditions that favours laterisation are humidity and temperature. From this point of view, generally palaeoenvironmentalists (Vrba et al., 1995; Williams et al., 1993; Miskovsky, 1987), particularly geomorphologists (Faniran and Jeje, 2002: 245-273; Thomas, 1996: 88-122) are of the general opinion that past laterites and duricrusts were formed under an alternation of wet and hot conditions. As already highlighted the application of this morphoclimatic hypothesis to variable local past environmental is complicated and questionable (Burke, 1970; Burke and Durotoye, 1970; 1971; Daniels and Freeth, 1970; Davies, 1964; Andah, 1976; 1979b; Andah and Ajayi, 1981; Petters, 1991; Ofomata, 1993, in Chapter Two). This complexity is more complicated in relation to the dating of these laterites and duricrusts that are generally in secondary and reshaped sedimentary contexts. Unfortunately this is the situation in the case study of the AJB UMF Site Lower Terrace stratigraphic units.

4.5 DATING PROBLEMS OF AJB UMF SITE LOWER TERRACE STRATIGRAPHIC AND CULTURAL SEQUENCES

The altimetric location of Palaeolithic sites in Ajibode area in general, and alongside Yamoje stream drainage in particular, showed that the terrace mound excavated at AJB UMF is located on an elevation of 198 m a.s.l., instead of the 195 m indicated by previous studies (Andah and Momin, 1993; Andah, 1995a; Momin, 1995). This difference in value seems to confirm our call for caution that the terrace should not be considered as being located on 195 m, or 198 m contour line, but as a depositional aggraded landform with variable thickness. In the specific case study of Ajibode Lower Terrace Sequence, the 195 m altimetric reference is to be regarded as an indicator of a previous thicker aggradation that correspond to the lower built-up terrace in Ajibode area.

This terrace sequence, as well as the two preceding terrace levels presumed to be at 210 m and 225 m a.s.l. respectively, are part of the Bodija Formation. In Chapter Two it is emphasized that (Petters, 1991; Ofomata, 1993; Andah, 1979b), the Bodija Formation contains little or no datable materials. It is particularly presented by Petters (1991) as an incomplete sequence in which may have been preserved only deposits of the Late Quaternary, and whose embedded lateritic crusts are said not to be datable.

In Chapter Three (Section 3.3.1), the presentation of the past Quaternary environmental setting of Ajibode area in Ibadan Regional Context has indicated that this Bodija Formation's lithostratigraphy has been divided into three timely successive sequences viz – Kongi, Agodi and Orita Members. Their chronostratigraphy, as shown on Table 3 (cf. Chapter Three, Section 3.2.1), is not accurately established, but repeatedly postulated since decades. Thus, the Orita Member is presented as a silty sand built-up wet Holocene phase, the Agodi Member as an uncemented gravel of dry Late Pleistocene, and the Kongi Member as a pediment or cemented gravel of wet/dry Middle Pleistocene that underlies a minor unconformity. An undated dry pediment phase is mentioned as following a major unconformity that is preceded by a Precambrian weathered crystalline bedrock.

A critical appraisal of this postulated chronostratigraphy by Andah and Ajayi (1981: 27) refers to a more spatially and timely outlined framework of postulated chronology of Late Quaternary events in Southern Nigeria and other parts of West Africa during the period between 90,000 and 10,000 BP (Table 1, Chapter Two, Section 2.3.3). In this regard Andah and Ajayi (1981: 29-45) undertook a comparative study of superficial deposits at Olude-Araromi in Ibadan Region, Northwest of Ajibode area and concluded as follows (Andah and Ajayi, 1981: 45):

> (...) Similarly the studies show that the units identifiable in the two areas are similar as regards the mineralogical composition and their derivation from acidic rock. The analyses also reveal that there may be age differences between the lithological units despite the fact they may be derived from similar source rock.
> All the units contain feldspars which indicate derivation from granitic parent material. Studies have so far shown that units at Bodija are more mature than at Araromi (...). But there is no way of telling from these studies the precise time these units were formed (...).
> (...) This problem is farther complicated by the fact that these units contain 'non pedological' laterites.

In the first section of this Chapter Four, Andah's previous critical appraisal of the dating of the terrace sequences is pointed out in the case study of the Volta Basin (Andah, 1976). His critical standpoint did not actually change since he firstly and strongly focussed it on the Quaternary of the Guinea Region (Andah, 1979b), as presented in the third section of Chapter Two. He lately attempted to throw more light on his lines of arguments (Andah, 1995a), as shown below in Chapter Six.

Also in the third section of Chapter Two, it is argued that Andah is not the only one to call into question such a framework. Certainly with less scepticism and sarcasm, geologists and geomorphologists did so. Amongst them Petters (1991), Ofomata (1993), Faniran (1986; 1994), Faniran and Jeje (2002), and Rogon and Coudé-Gaussen (1987) referred to specific dimensions of the past West African Quaternary setting. Each and all of them have a peculiar reservation or scepticism on the validity of this postulated framework.

Coming back to our specific concern on the dating problems of the Ajibode Lower Terrace Sequence and interpolated Middle Stone Age/Middle Palaeolithic Occurrences (as shown in Chapter Five) at AJB UMF Site, the following salient points should be given due consideration:

(i) at the end of the 1997 Excavation and Cutting I exercises at this AJB UMF Site, soils from the different layers were sampled with a view to comparing these with those represented by the same Bodija Formation at Bodija and Olude-Araromi cutting stations. During the 2002 further field exercise, geologist members of the team sampled again the same soils from the same layers that were and are still exposed at the ABJ UMF Site Cutting I. Results of mechanical and chemical analyses, as well as the specific and general interpretation, as presented in the preceding section of the Chapter, could not yet throw any conclusive light on the unsolved and challenging problems of accurate dating;

(ii) the on-site description of the layers clearly shows an unconformable superimposition between layers B and C on the one hand, and layers C and D on the other. Do these sedimentation gaps indicate a time break in the terrace build-up processes? And if so, of what duration?

(iii) from layer F as sterile soil, to layer A as topsoil, the sandy dominant characteristic of the deposit is constant. After the sandy soil follow the silty, clayey and lateritic components in variable proportions, from one layer to another. In the Bodija Formation, the Orita Member is usually said to be basically made of sand, silt and clay, while the Agodi Member is described as a mix of cemented gravel with a sandy and silty matrix similar to that of the Orita Member. The question then is how does the AJB UMF Site lithostratigraphic sequence correspond partly or fully to the Orita Member, or to both the succeeding Orita and Agodi Members? Further field research and laboratory analyses are needed in this regard;

(iv) the gross geochemical homogeneity of the layers of the AJB UMF Site Lower Terrace could be an encouraging factor for undertaking these suggested further researches and analyses. The specific impediment of the lateritic crust in any dating purpose of these layers could be possibly and fortunately compensated by the advantage of the geochemical homogeneity, if tireless and innovative researches and analyses are adequately scheduled and executed;

(v) for the immediate dating of the archaeological levels identified in Layers C and E, none of the analytical results of the sedimentological data could assign or suggest any suitable age for the site;

(vi) the multifaceted and multidirectional worthy critique of the attempt to use embedded artefacts in dating their host layers is repeatedly emphasized in the preceding chapters. As for now such an attempt should be considered as a mere guesswork. So, it is only on the basis of the formal and functional attributes of the exhumed and analysed artefactual evidence, that the C and E Cultural Horizons are correlated and presented in Chapters Five and Six as a Middle Stone Age (MSA)/Middle Palaeolithic facies in the West African Quaternary evolutionary context of the Bight of Benin Region;

(vii) a large scale "floating chronology", that is accepted to be liable to move up and down and to extend or to contract (Barker, 1987: 192), is referred to in the timely emphasis of the Bight of the Benin's MSA/Middle Palaeolithic subsistence-settlement lifeways in relation to palaeo-ecological changes (Chapter Six).

CHAPTER FIVE

DESCRIPTION AND IDENTIFICATION OF THE MIDDLE STONE AGE OCCURRENCES FROM AJIBODE LOWER TERRACE, LAYERS C AND E

5.1 PROCEDURE OF SORTING TYPOLOGICAL AND TECHNOLOGICAL ATTRIBUTES

At the end of the excavation exercise in 1997, all the lithic materials collected from surface as well as from the trench and cutting stratigraphic units at AJB UMF Site were systematically bagged, labelled and stored. During the collection on the site they were initially labelled respectively as big and medium sized blocks or chunks, pebbles, gravels and other flat stones, and flakes and chips (Table 13). Most of them bear lateritic crusts or patina. Some pebbles and other materials are broken. All were washed and cleaned before being restored in the laboratory. The lateritic patina was removed from most of them during the washing and cleaning.

After the washing and cleaning, the materials were sorted, counted and grouped both on the basis of their shape and size, and in relation to the presence or absence of flaking or flake scars. The process of grouping makes it possible to separate the total of 1822 lithic materials into pebbles, chunks, chipped-like

Table 13: Number and Percentage of Chunks, Pebbles, Cores and Flakes from AJB UMF Layers C and E.

Materials	Layer C	Layer E	Number	Percentage
Medium sized and large Chunks	22	01	23	1.26 %
Pebbles and eroded flat stones	142	29	171	9.38 %
Cores and chipped-like stones	189	25	214	11.74 %
Flakes and chips/waste	1182	232	1414	77.60 %
Total	1535	287	1822	100 %
Percentage	84.24 %	15.75 %	100 %	

stones, cores, flakes and chips (Table 13). On the basis of a close-up observation, hundreds of no diagnostic chips and other pieces were re-bagged and labelled as waste. The chunks were singled out as more or less thick pieces of stone with more than 2 cm in length, but without evident human manipulation. Smaller than the chunks, chips generally removed from struck stones during the preparation of cores.

The chunks that were selected as typologically diagnostic were therefore sorted into cores and tool blanks. These tool blanks were numerous and consisted of different shapes and sizes from which were made the tools that were selected, drawn, described and analysed, as shown in the following sections of the chapter.

On the technical procedure of drawing and illustration, most of the principles and conventional methods are taken into account, as they are referred to in Chapter One, Section 1.2.4. On the illustrating procedure, the liberal method is adopted, as well as it is sometimes practised by experienced and well-known archaeologists (Bordes, 1988; Clark, 1970; Isaac, 1995; Andah, 1979a) and emphasized in Chapter One (Section 1.2.4). So that, the artefacts are all drawn, the smaller preceding the bigger from the top to the bottom of each page of illustration.

Where the lateritic patina is removed, the drawing does not show it. Where the patina is hiding part of the flaked or/and retouched edge of tools, the drawing also does not indicate it. Each artefact is drawn according to its natural size. The metric system is used as it is recommended since 1965, and as it is shown by the scale on each page of illustration.

Cores, flakes and formal tools are selected and drawn. The primary and secondary flaking marks (e.g. scars, rings, edges etc.) properly display the cores' striking platforms at the top, and the flakes' and tools' butt and bulbar sections at the bottom. Butt and bulbar sections are successively followed by the proximal, medial and distal sections in accordance with the debitage axis. Sometimes the drawing constraints do not allow to lay out all the striking platforms, or the bulbar sections. Because all the materials are made of quartz or quartzite, the subsequent well-known problem of a better typological and technological analysis is accordingly taken into account.

In the following sections, the typological and technological attributes are emphasized keeping in mind technical advices from experienced archaeologists such as Bordes (1988), Hodges (1976), Tixier, Inizan and Roche (1980), Brézillon

(1980; 1983), Cahen, and Martin (1972), Assié (1995) and Deacon (1997; 2001). In so doing, the archaeological occurrences entrenched within Layers C and E of Ajibode Lower Terrace are presented as more valuable 'fossiles indicateurs' than 'fossiles directeurs' of a Middle Stone Age (or Middle Palaeolithic) facies. Previous works executed in the neighbourhood of Ajibode area are also referred to (Oyenuga and Ozanne, 1968; Allsworth-Jones, 1981; 1987; Opadeji, 1998). All the artefacts from both Trench D and Cutting I at AJB UMF are put together in order to be respectively related to Layers C and E for description and classification.

On the proper analysis of both typological and technological attributes of lithic artefacts, long-term experienced archaeologists in experimental fabrication of tools accordingly recommended to first scrutinize the surface condition and pattern attributes; so that, analysis of technological attributes can be easier and more relevant. For instance, Tixier et al.(1980: 31-35) emphasize this standpoint in considering natural and human actions that are the making factors of such surface condition and pattern attributes as cortex, patina, gloss, thermal or mechanical stigmas. With regard to the analysis of the technological attributes, Tixier et al. (1980: 35-36) are of the view that in order to identify the blank of a tool there is the need to locate and scrutinize such key technological attributes as flaking and retouch scars. They conclusively suggest the following scheme (Tixier et al, 1980: 68-69): (i) observation of the surface condition and pattern attributes;

(ii) identification of the raw material; (iii) detection of blanks that are wastes on the basis of their morphological axis and related technological attributes; (iv) diagnosis of the knapped blanks in accordance with the orientation of the debitage axis and associated technological attributes (e.g. dorsal and ventral faces; right and left edges, proximal, medial and distal parts; bulbar section, type of butts and mode of percussion or pressure on the proximal part, scars etc.); (v) specific methods of flaking; (vi) description of the retouch' s position, location, distribution, delineation, extent, angle and morphology; (vii) identification of the artefact.

Such a procedure of analysis and identification of artefacts is a model that can not be totally and automatically adopted and followed up whatever be the case. There is the necessity to know about it for the purpose of case to case adaptation. This adaptation is what Opadeji (1998) has attempted in studying the Middle Stone Age assemblages of Saminaka in central north Nigeria. His approach successively consists of (Opadeji, 1998: 67-125: Chapter V): (i) first a typological description of flakes, tools and cores; (ii) then a technological analysis of 'continuous' attributes of flakes (i.e. length, breadth, thickness) and 'discrete' attributes (i.e. striking platform, shape, raw material, dorsal surface condition and pattern); (iii) finally a study of continuous and discrete attributes of cores. For the blanks and tools made on flakes, the continuous attributes correspond to striking platform, shape, raw material, dorsal surface condition and dorsal surface pattern.

On the other hand, the continuous attributes of cores are identical with length, breadth and thickness, while their discrete attributes are equivalent to core type, number of platforms, platform preparation, presence of cortex, shape, raw material, blank type and surface (Opadeji, 1998: 79-94).

In the case of the lithic occurrences from AJB UMF Site Layers C and E, the description and identification of both the typological and technological attributes are not a duplication of any of the two methods referred to above. The approach is adopted as an outline in view of the future integral study of these occurrences. This is because the assemblages are not yet totally representative of the site's whole picture. Thus, the description and identification first consist of putting together and singling out all the discrete attributes of the tool-types of each of the two layers. Then, the continuous attributes that are standard from one to another layer, are sorted and correlated within the ambit of a dimensional analysis. On the basis of such procedure, the artefact-assemblage from both Layers C and E is characterized as a Middle Palaeolithic facies. For the future integral study of the occurrences, there is the need to take into consideration such technical analyses as the 'Microwear Analysis' or 'Traceology' as emphasized in Chapter One, Section 1.2.4.

5.2. ANALYSIS OF TYPOLOGICAL AND TECHNOLOGICAL ATTRIBUTES OF THE LITHIC ARTEFACT ASSEMBLAGE FROM AJB UMF SITE LAYER C

Table 14: Artefacts from AJB UMF Layer C, Trench D and Cutting I

Artefacts	Trench D	Cutting I	Type Number	Type Percentage
Cores	4	3	7	17.50 %
Flakes	7	2	9	22.50 %
Notched flakes	---	1	1	2.50 %
Points	9	2	11	27.50 %
Side-scrapers	1	4	5	12.50 %
Picks	6	----	6	15.00 %
Choppers	1	----	1	2.50 %
Total Number	28	12	40	100 %
General Percentage	70 %	30 %	100%	

The total of 1535 lithic pieces from AJB UMF Layer C (Table 13) include few diagnostic tools. The artefact-assemblage from the layer is of relatively greater variety and consists of cores, flakes, notched flakes, side-scrapers, points, picks and a single mini-chopper (Table 14). Their typological and technological attributes are respectively and correlatively analysed below.

Fig. 27 : AJB UMF'97. Artefacts from Layer C, Trench D: (1-9) nine points; (2,4,6,7) broken points; (4,5,7) with patina; all quartz.

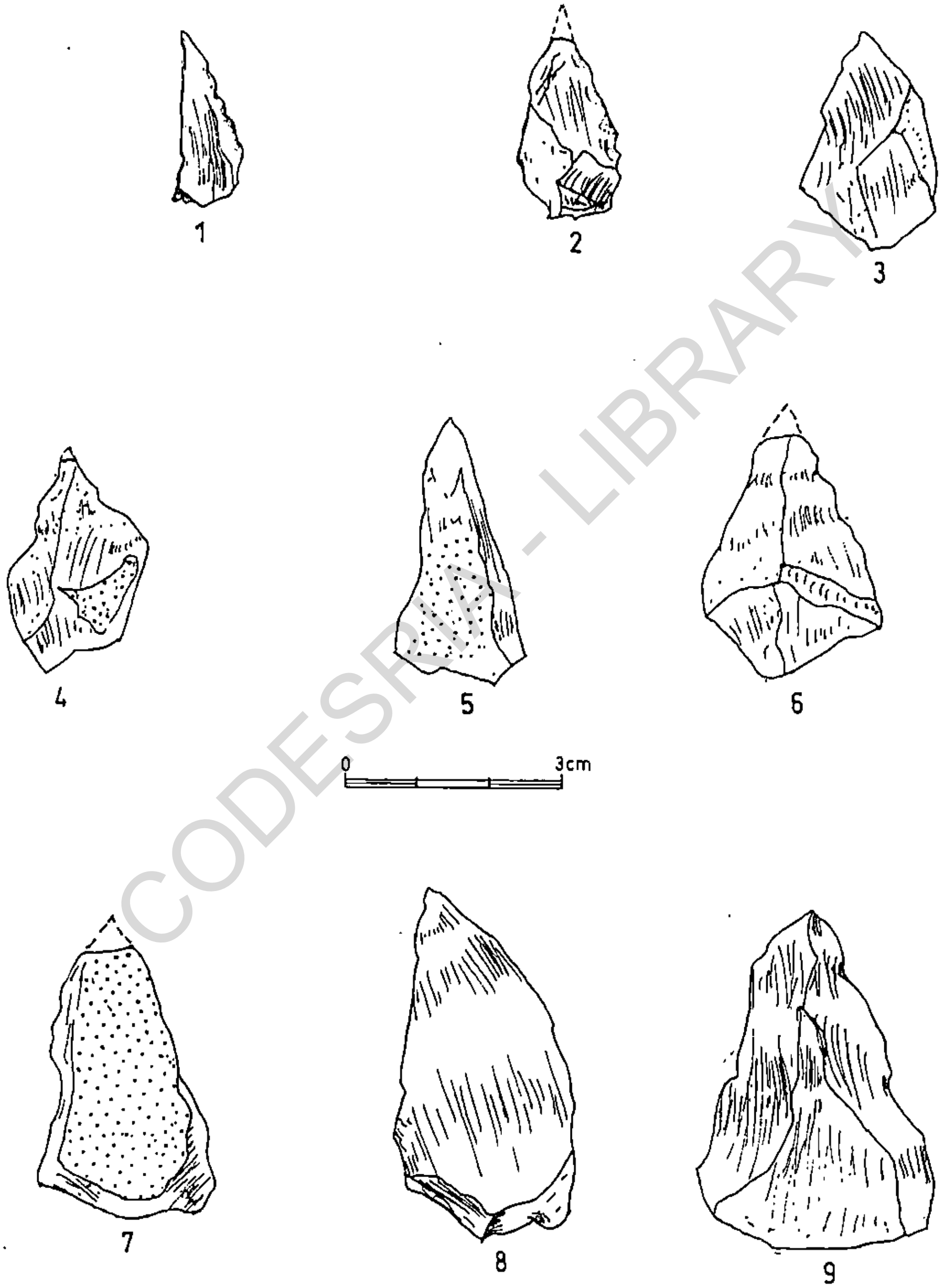


Fig. 28a: AJB UMF'97. Artefacts from Layer C Trench D (1-4) four small picks; (1) quartz with patina; (2-4) quartzite.

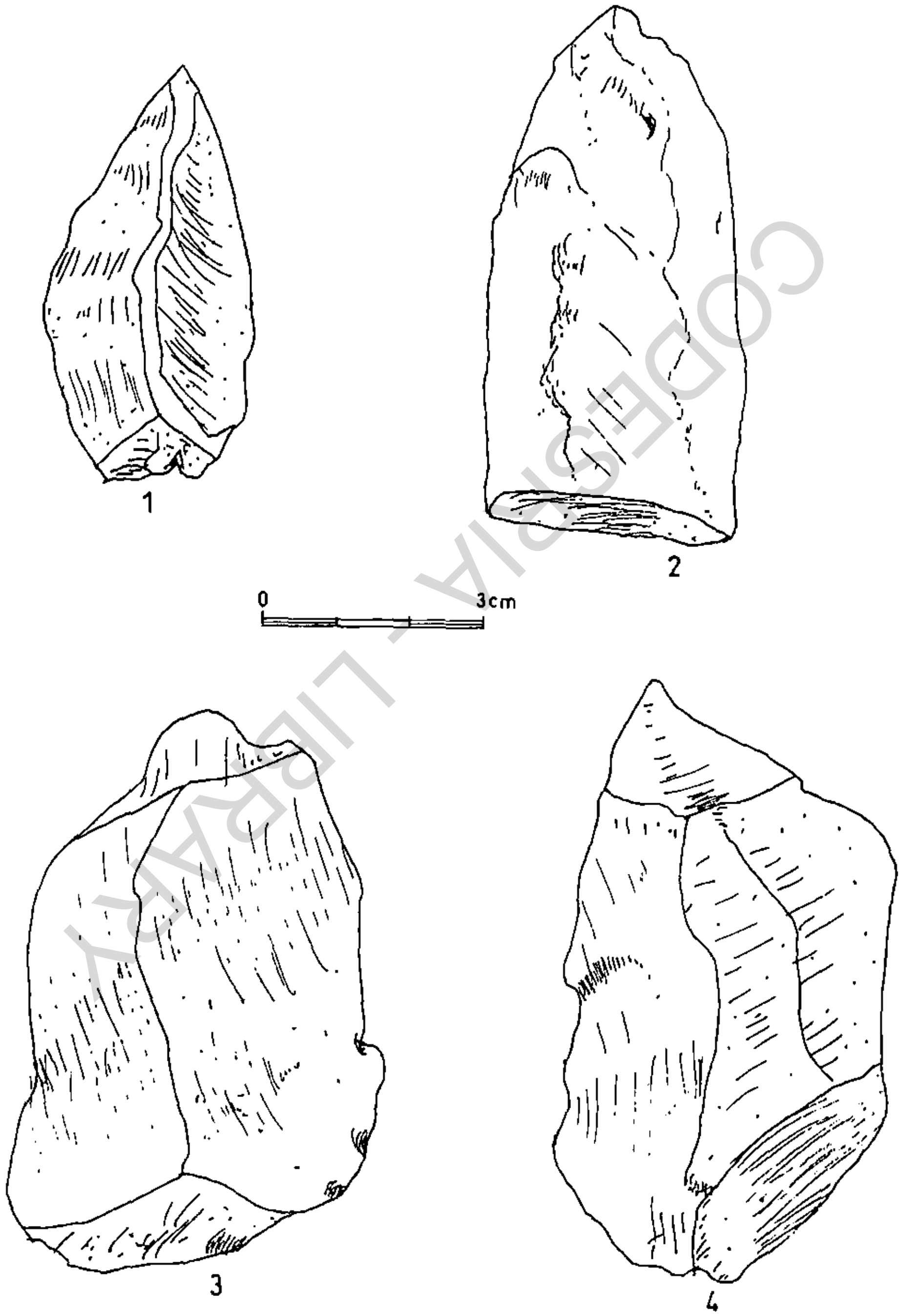


Fig. 28b: AJB UMF'97. Artefacts from Layer C Trench D: (1-2) two medium sized picks; (1) quartz; (2) quartzite.

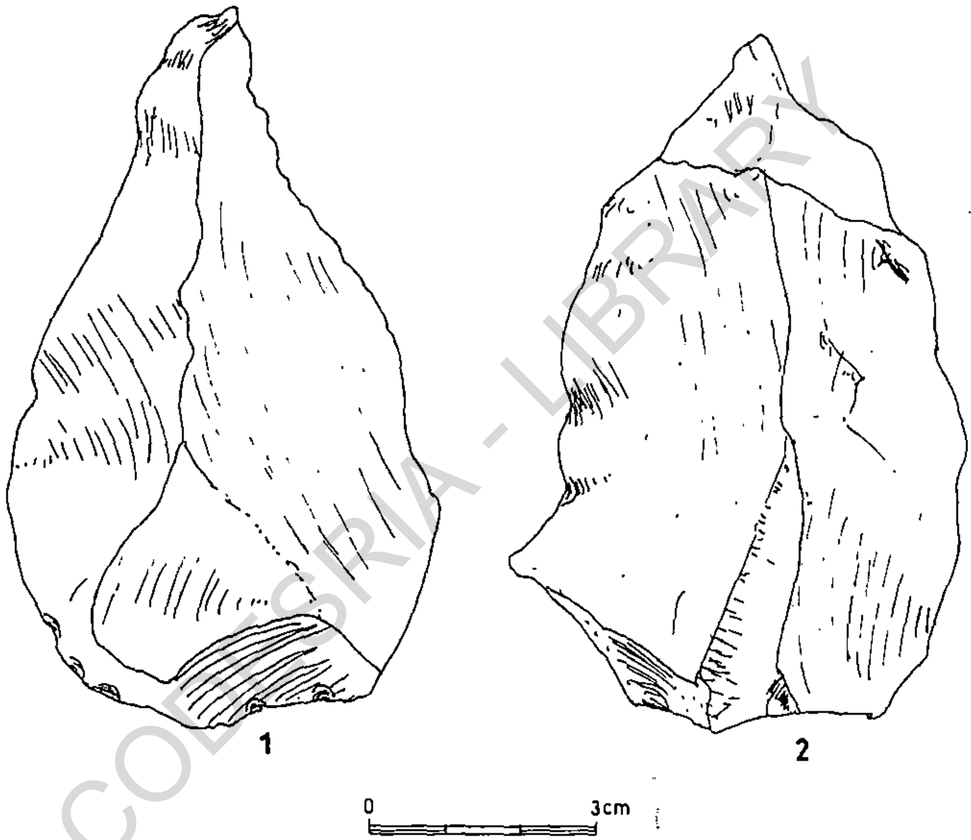


Fig.29 : AJB UMF'97. Artefacts from Layer C, Trench D: (1) mini-chopper; (2) one convergent side-scraper; (4) one Levallois core; (3,5,6) three rectangular cores.

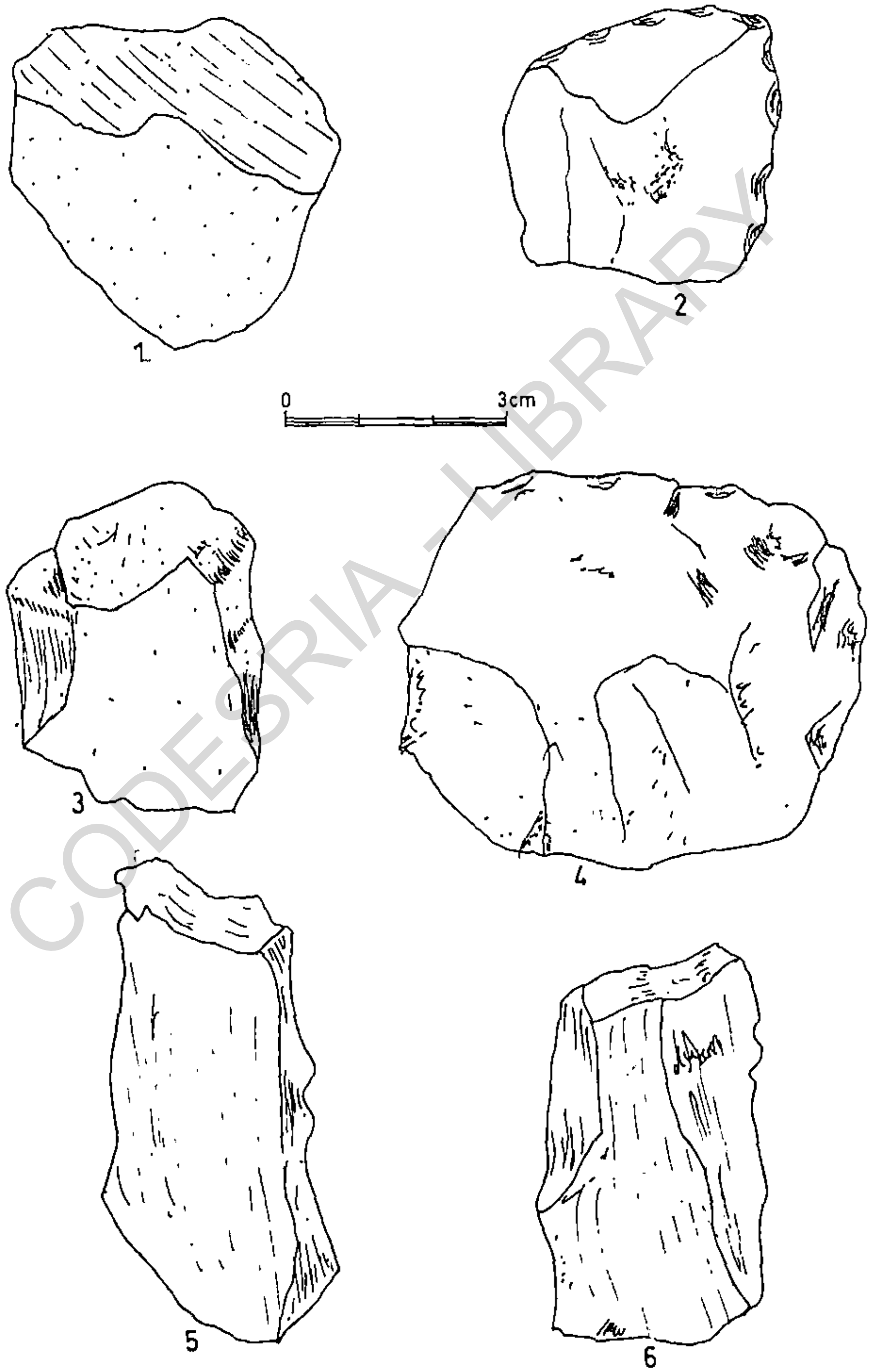


Fig. 30: AJB UMF'97. Artefacts from Layer C, Trench D: (1-7) seven flakes; (4) with sparse patina; (5) with covering patina; (1,3,4,5) quartz; (2,6,7) quartzite.

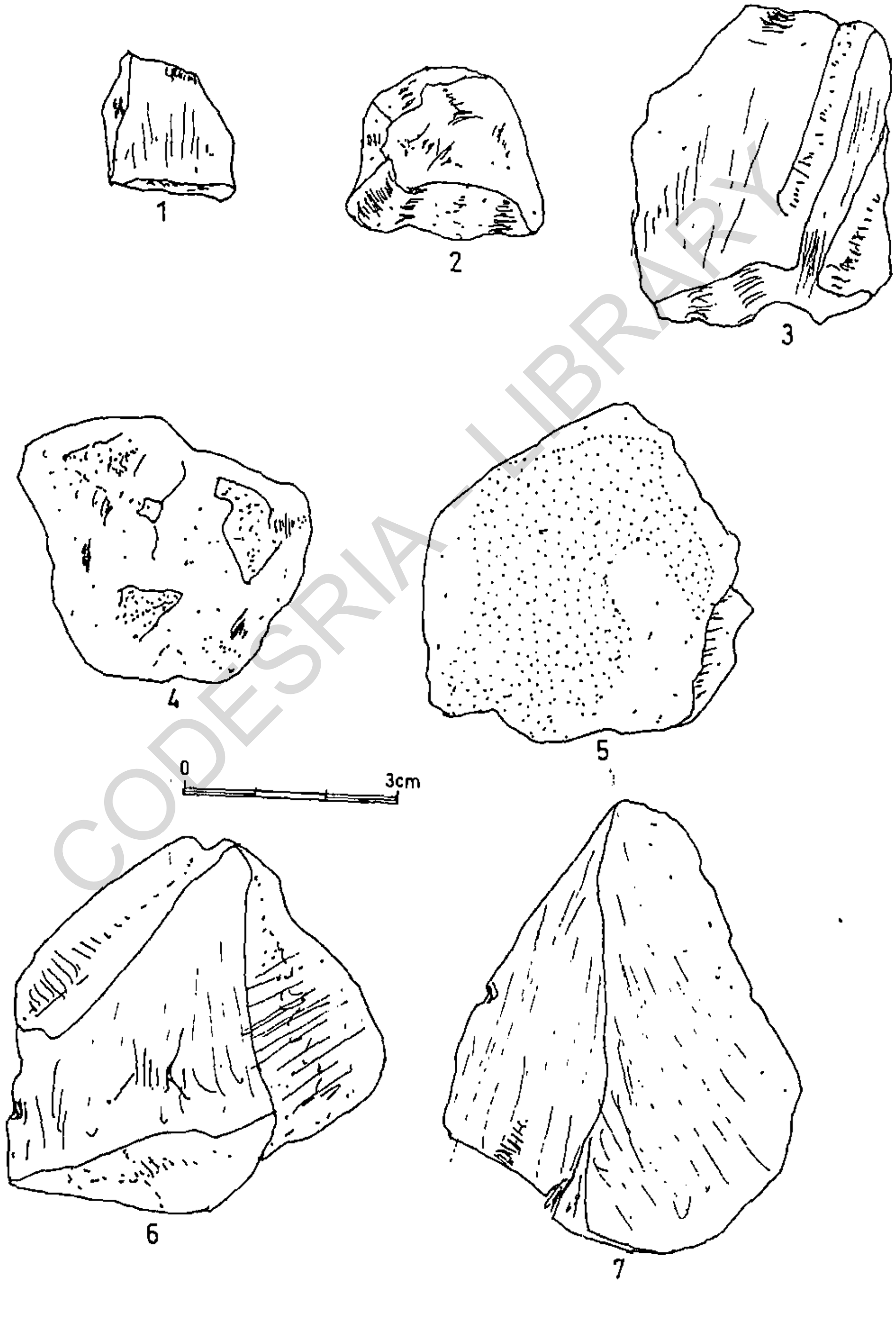


Fig. 31: AJB UMF'97. Artefacts from Layer C, Trench D: (1-2) two broken points; (3) one notched flake; (4-6) three left side-scrapers; (7-9) three flakes; (8) with cortical dorsal face; (1,3-6,8) quartz; (2,7,9) quartzite.

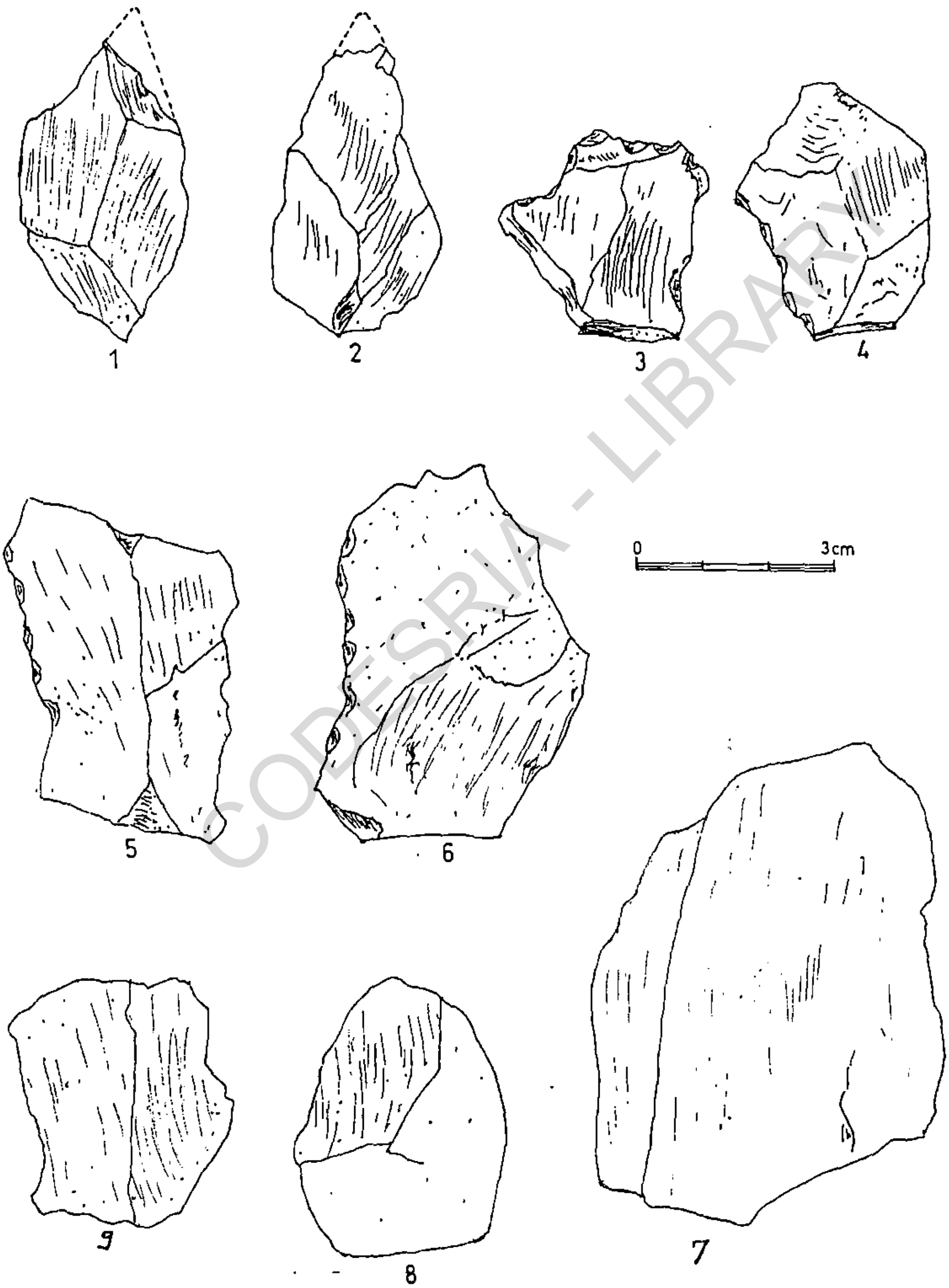
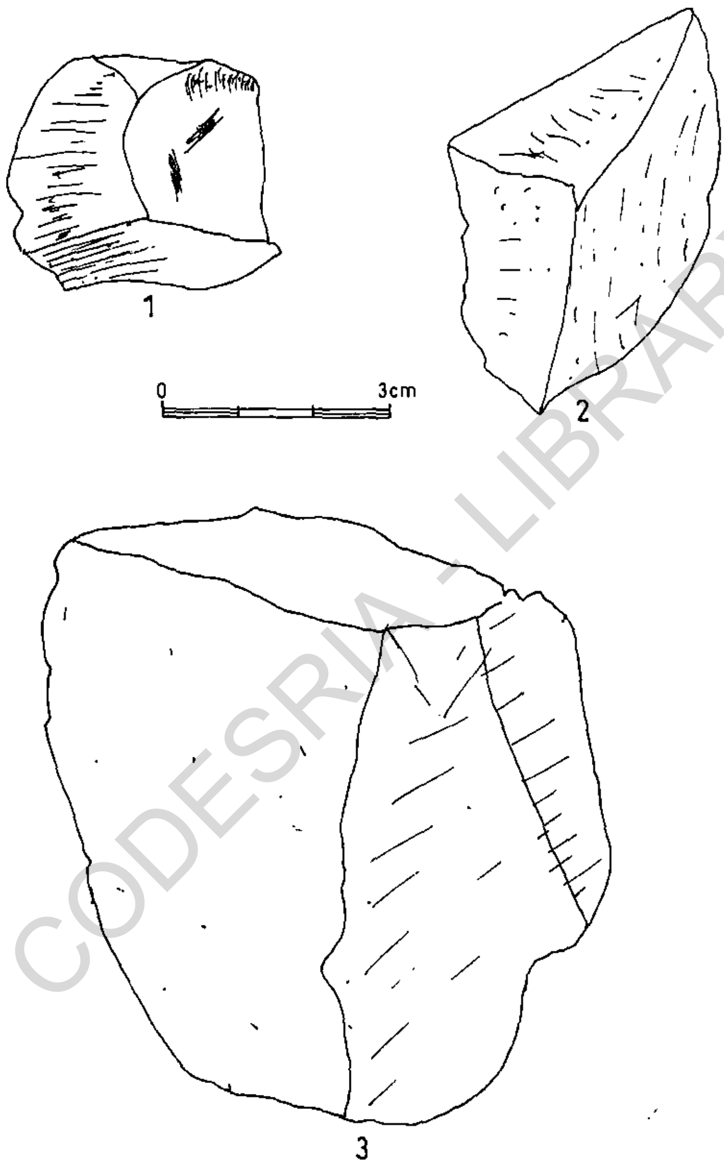


Fig. 32: AJB UMF '97: Artefacts from Layer C, Cutting I: (1) one rectangular core; (2) one triangular core; (3) one Levallois core; all quartz.



Cores

Cores generally are residual lithic pieces that show scars from where flakes, blades and bladelets are removed in a definitely designed pattern. According to Bordes (1988: 95), the three major Levallois cores are those from where flakes, blades and points are removed. Cores that are sampled from AJB UMF Layer C conform with the latter definition. They consist of seven pieces that vary in size and shape (Fig. 29; Table 14). They are sub-rectangular (Fig. 29, n^{os}3,5,6), triangular (Fig. 29, n°3); or in irregular, globular or polygonal Levallois shape (Fig. 29, n°4; Fig. 32, n°3).

The sub-rectangular cores have two opposing striking platforms. The irregular or polygonal cores show more than two striking platforms which are located at any convenient place without regular patterning. One (Fig. 29, n°3) of these latter specimens presents two convex surfaces with a striking platform that does not show obvious evidence of further preparation.

Flakes

Flakes usually are intentionally removed lithic pieces from cores in order to produce tools. On the flakes, the striking platforms and bulbs of percussion are usually obvious. Flakes that are not retouched are usually seen as simple blanks or wastes; sometimes they are used as tools. The form and positioning of the retouch lead to name and cluster the flaked tools.

In spite of being made of quartz or quartzite, flakes from AJB UMF Layer C generally show sections of striking platforms and bulbs of percussion. They also show the proximal, medial and distal parts. There are some nine sampled pieces of Levallois shape which vary in shape and size (Table 14). Some of these flakes are of sub-rectangular shape (Fig. 30, n°3; Fig. 31, n°9), or of sub-triangular shape (Fig. 30, n°7). Those with polygonal or irregular shape vary in size (Fig. 30, n^{os}1,2,4-6; Fig. 31, n°8). The dorsal face of some of the flakes show sparse lateritic patina (Fig. 30, n°4) or covering patina (Fig. 30, n°5). There are flakes with cortical dorsal face (Fig. 28, n°8).

Side-scrapers and notched flakes

Side-scrapers, as well as end-scrapers, are tools generally made with flakes. They show flat ventral faces. They have marginal and unifacial retouched edges. According to the positioning of the retouch, they are differentiated as side-scrapers or end-scrapers. Notched flakes have two or more dents that give a tooth-like working edge.

Sampled pieces from AJB UMF Layer C (Table 14) include one convergent convex side-scraper (Fig. 29, n°2), three left side-scrapers (Fig. 31, n^{os} 4-6), and one notched flake with two dents (Fig. 31, n°3).

Points

Points usually have a single pointed end and two other edges either made blunt by backing or trimming, or not worked at all.

Specimens from AJB UMF Layer C (Table 14) are made of sub-triangular shaped flakes (Fig. 27, n^{os}1-9; Fig. 31, n^{os}1-2). They are generally in Levallois shape (Fig. 27, n^{os}3-9; Fig. 31, n^{os}1-2). Quartz and quartzite are very difficult raw material because of their hardness to work. Thus, points with broken tips are frequent (Fig. 27, n^{os}4,6,7; Fig. 31, n^{os}1-2). Some specimens bear lateritic patina, either sparse (Fig. 27, n°4) or more covering (Fig. 27, n^{os} 5,7).

Picks

Usually picks are lithic tools which have bifacial knapped parts with one or two crude pointed or flattened ends. Generally they present a thick diamond-shaped section. Sometimes they are of trihedral or flat shape (Brézillon, 1980: 191).

The specimens from AJB UMF Layer C (Table 14) do not lay out profile that differs from the usual shape referred to above. They actually consist of six pieces. The smallness of their size seems to be a notable morphological profile (Fig. 28a-b). They are of varying shapes. Most are sub-triangular (Fig. 28a, n^{os}1,2; Fig. 28b, n°2); some polygonal (Fig. 28a, n^{os}3,4). Many present rough pointed end

(Fig. 28a, n^{os}1,4; Fig. 28b, n^{os}1-2), while some are with flattened end (Fig. 28a, n^{os} 2,3). Piece in Fig. 28b, n°1 is a trihedron.

Mini-chopper

Choppers are core tools normally made on large pebbles by sharp cutting edge flaked from one side only.

The single specimen from AJB UMF Layer C (Table 14) is made on a small pebble (Fig. 29, n°1).

5.3 ANALYSIS OF TYPOLOGICAL AND TECHNOLOGICAL ATTRIBUTES OF LITHIC THE ARTEFACT ASSEMBLAGE FROM AJB UMF LAYER E.

Table 15: Artefacts from AJB UMF Layer E , Trench D and Cutting I

Artefacts	Trench D	Cutting I	Number
Cores	9	3	12
Flakes	20	----	20
Denticulates	1	----	1
End-scrapers	----	1	1
Side scrapers	3	----	3
Points	7	2	9
Picks	1	----	1
Total	41	6	47
Percentage	87.23 %	12.76 %	100%

Fig. 33: AJB UMF'97. Artefacts from Layer E, Trench D: (1-7) seven points; (2,4,6) broken points; (5) with partial cortical surface; (7) with patina; (1-4) quartz; (5-7) quartzite.

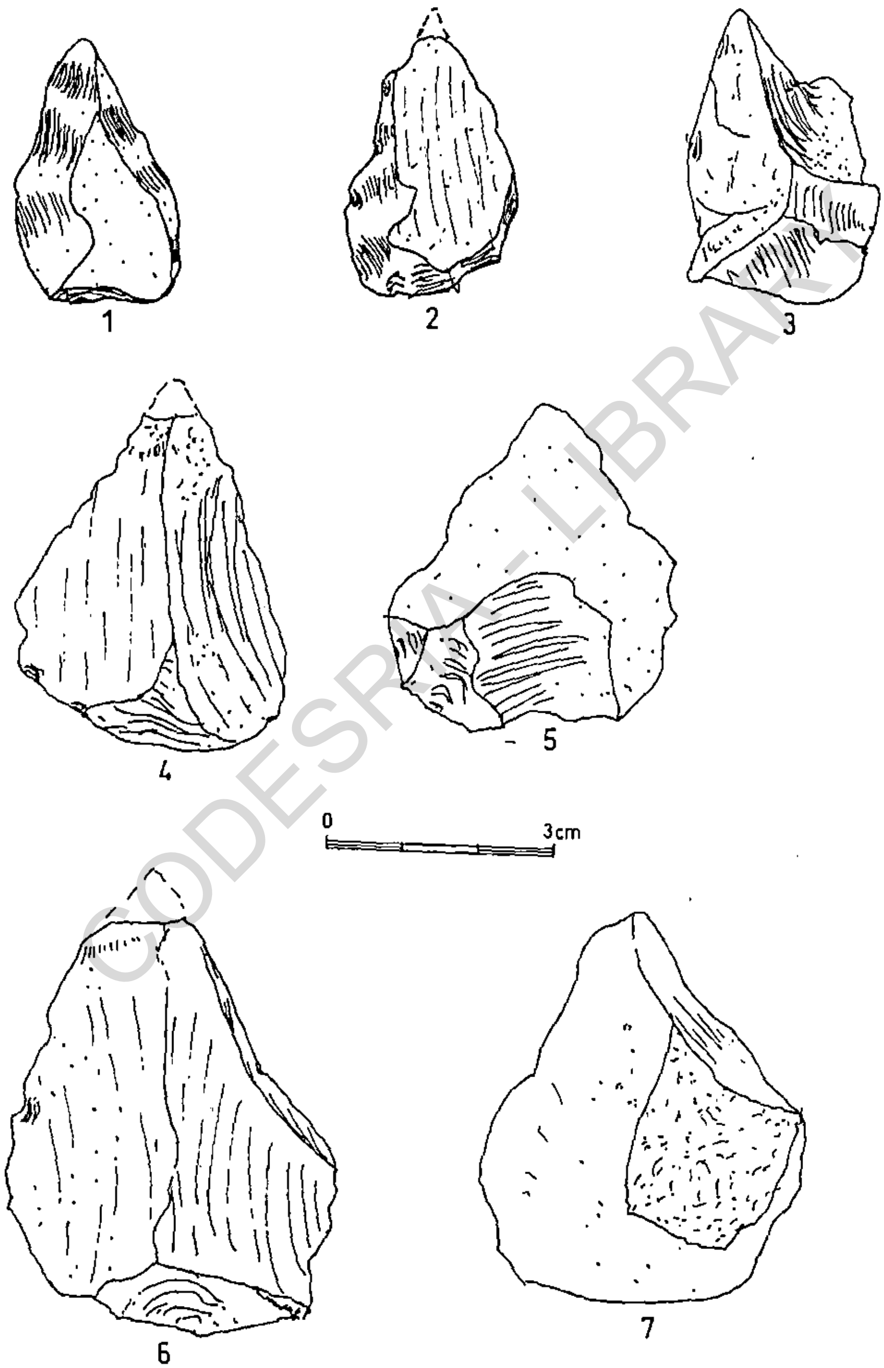


Fig. 34 : AJB UMF'97. Artefacts from Layer E, Trench D: (1) one denticulate; (2) one medium sized pick; (1) quartz, (2) quartzite.

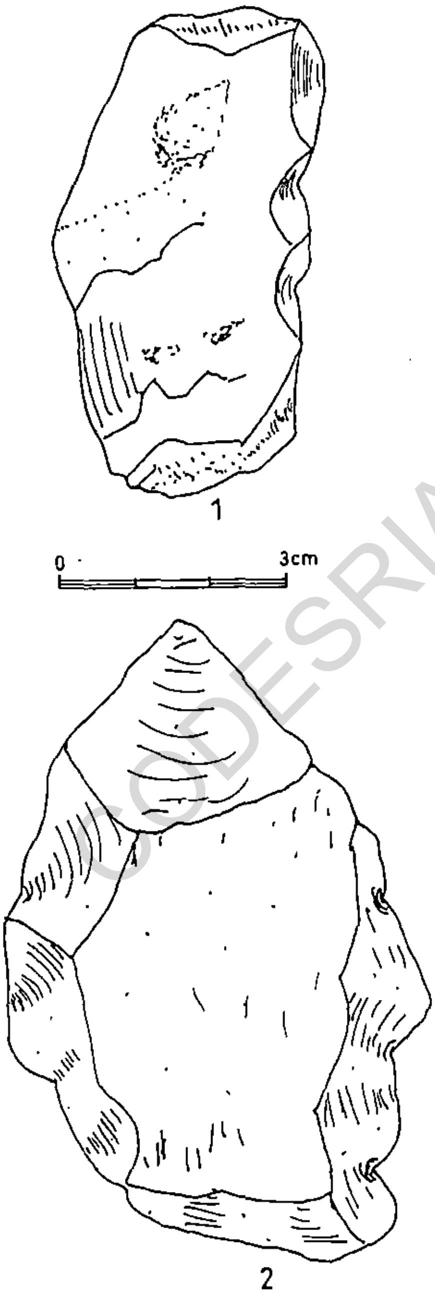


Fig. 35: AJB UMF'97. Artefacts from Layer E, Trench D: (1-3) three left side-scrapers; (4) one rectangular core with double platform; (5-6) two Levallois cores; (2,3,4) quartz, (1,5,6) quartzite.

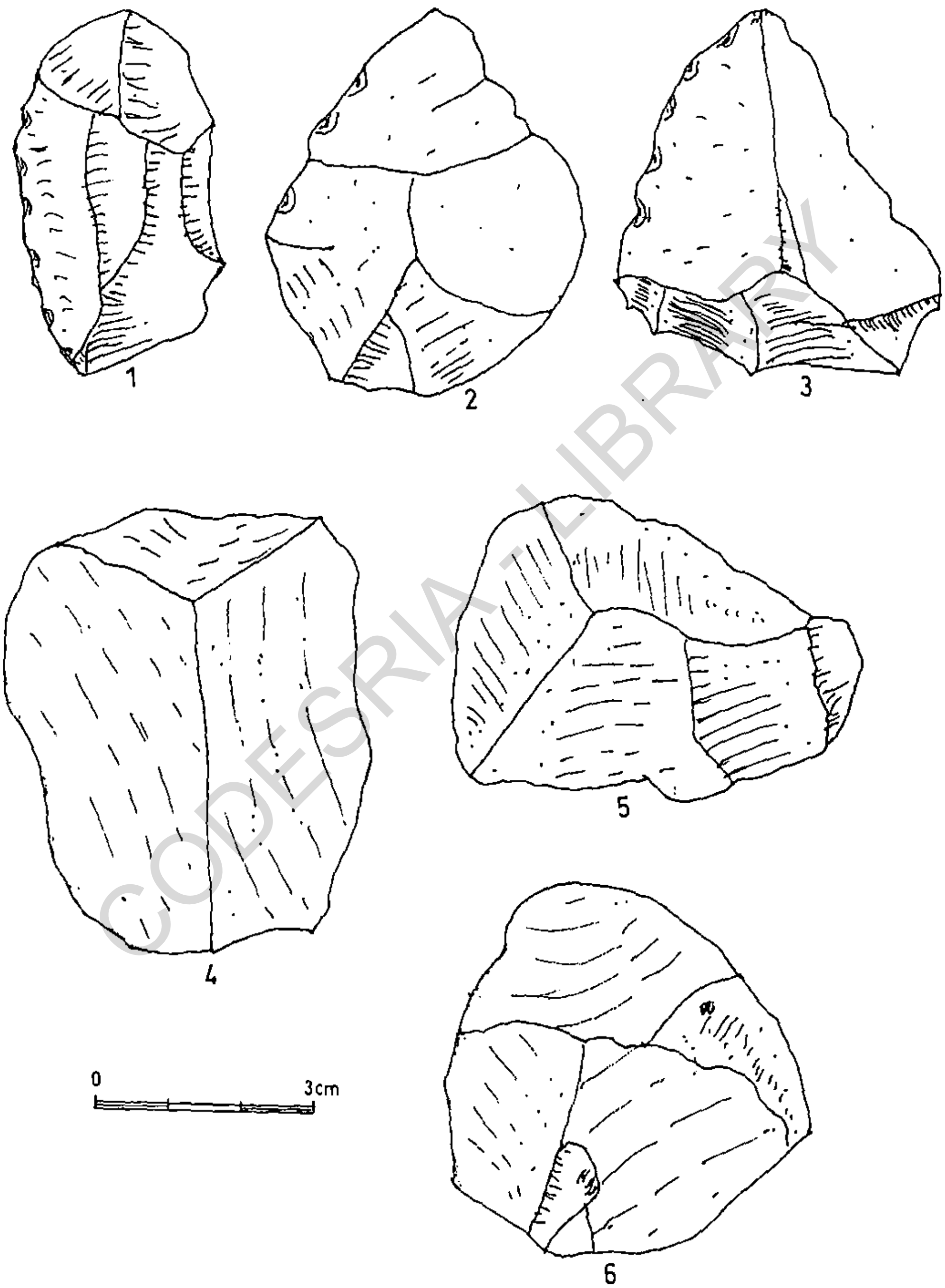


Fig. 36: AJB UMF'97. Artefacts from Layer E, Trench D: (1-6) six Levallois cores; (1,2,5,6) quartz, (3,4) quartzite; (5) with patina.

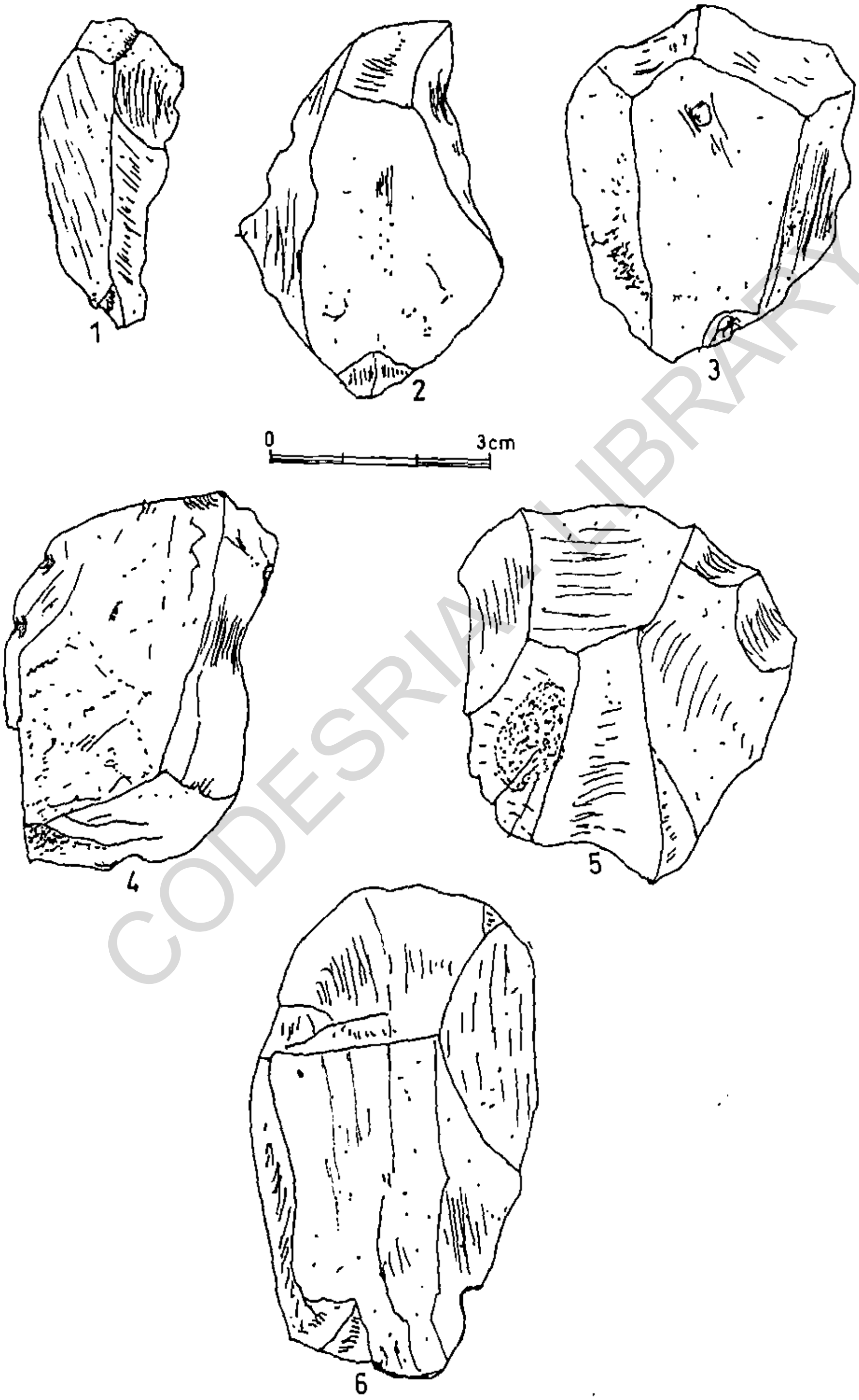


Fig. 37a: AJB UMF'97. Artefacts from Layer E, Trench D: (1-13) thirteen tool-like small flakes; (1-10, 12, 13) quartz, (11) quartzite

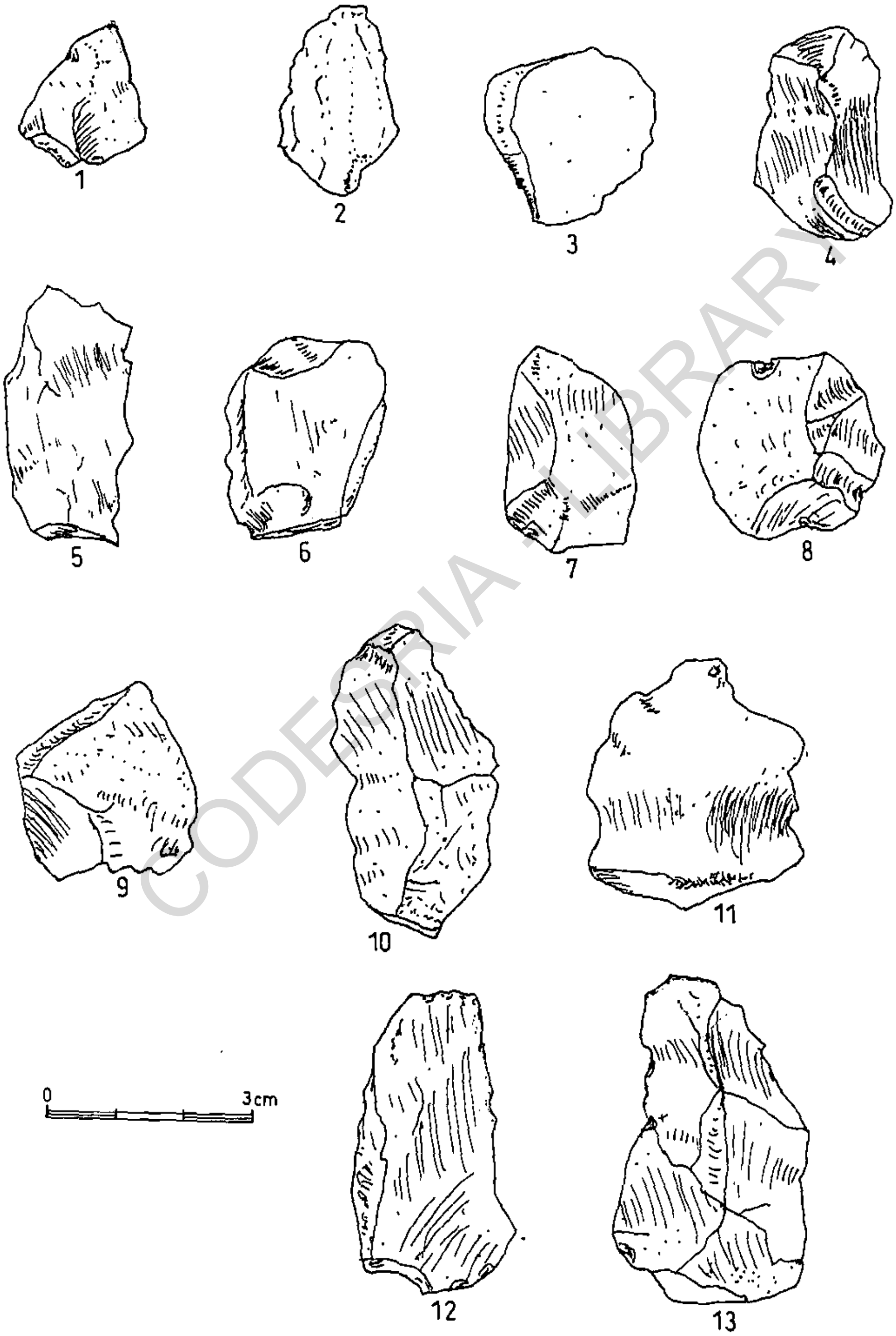


Fig. 37b: AJB UMF'97: artefacts from Layer E, Trench D: (1-7) seven medium sized Levallois tool-like flakes; (3,4,6) quartz, (1,2,5,7) quartzite.

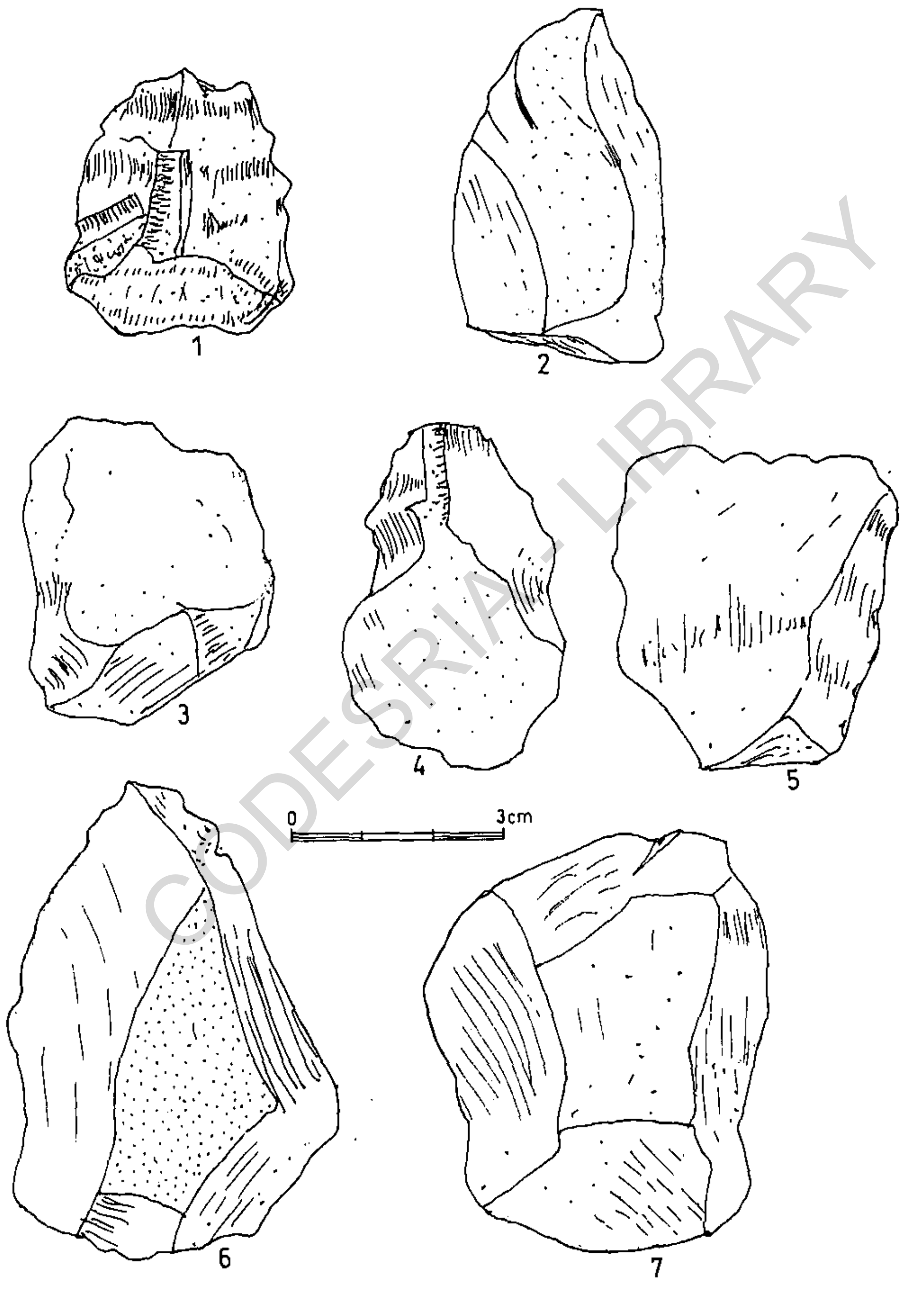
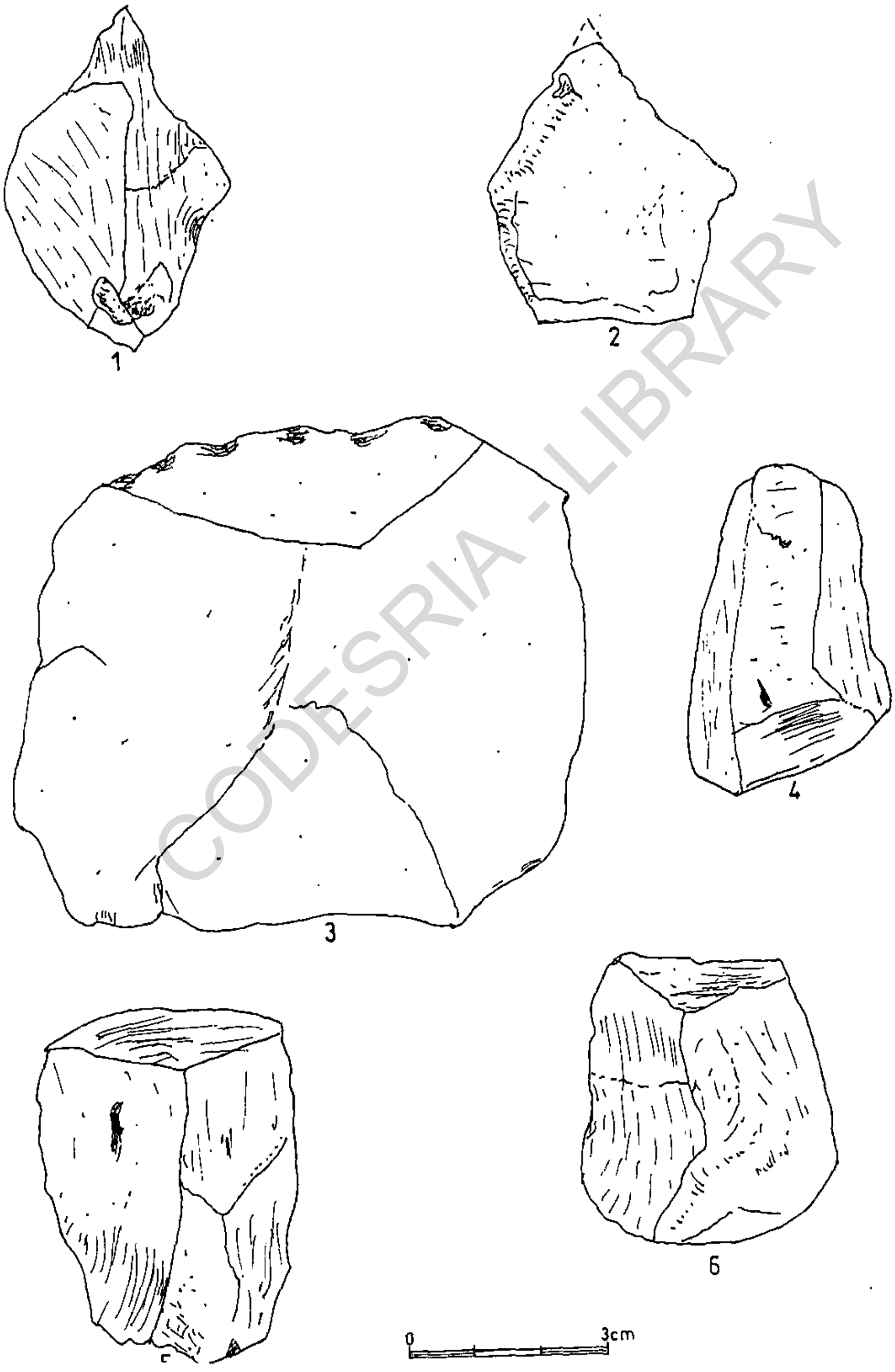


Fig. 38: AJB UMF'97. Artefacts from Layer E, Cutting I: (1-2) two points, (2) broken with patina; (3) one crude end-scraper; (4) one rectangular and single platform core; (5,6) two rectangular and double platform cores; all quartzite



Compared with the tool-types from Layer C, the categories of artefacts from AJB UMF Layer E (Table 15) are similar and complementary. The only minor element of distinctiveness consists of a single mini-chopper from Layer C while none is found from Layer E.

Cores

The twelve specimens of Levallois cores from AJB UMF Layer E (Table 15) vary too in shape and size (Fig. 35, n^{os}4-6; Fig. 36, n^{os}1-6; Fig. 38, n^{os}4-6). Morphologically, they do not differ from those in Layer C. The sub-rectangular cores (Fig. 35, n°4; Fig. 36, n^{os}4,6; Fig. 38, n^{os}5-6) seem to be the same as regular cores with two striking platforms (Fig. 38, n°6). Some cores are sub-triangular (Fig. 35,n°1), some polygonal or irregular (Fig. 35, n^{os}4-6; Fig. 36, n^{os}1-6; Fig. 38, n^{os}4-6).

Flakes

As well as do the cores, the twenty pieces of Levallois flakes from the same Layer E (Table 15) are of shape and size that vary (Fig. 37a-b). Some flakes are sub-triangular (Fig. 37a, n^{os}1,2,7,13; Fig. 37b, n^{os}2,4,6), some rectangular (Fig. 37a, n^{os}4-6,9,12; Fig. 37b, n^{os}1,5), and some polygonal (Fig. 37a, n°11; Fig. 37b, n^{os}3,7). Some present cortical surface (Fig. 37b, n^{os}2,4), or lateritic patina (Fig. 37b, n°6).

Side-scrapers

There are three left side-scrapers from Layer E (Table 15). Their Levallois shape varies from a general polygonal morphology (Fig. 35, n°1-3) to a triangular profile (Fig. 35, n^{os}2-3).

End-scrapers

Only a single end-scraper is obtained from that Layer E (Table 15). It is a relatively large polygonal specimen (Fig. 38, n°3). It is the largest scraping tool from the both Layers E and C. Its blank does not correspond to the usual one as it is referred to by Bordes (1972a: 243) while defining a end-scraper as a narrow flaked tool which has one or two convex working edge(s) at the end(s).

Denticulates

A denticulate is usually accepted as a flake or blade tool with two or more contiguous notches or dents that give a tooth-like working edge. The single sample of denticulate from Layer E (Table 15) is made of blade blank with two notches on the ventral face only (Fig. 34, n°1). Its dorsal face is totally cortical.

Points

There are nine specimens of points from Layer E (Table 15). They vary in shape and size as well as do those from Layer C. They are all sub-triangular

Levallois (Fig. 33, n^{os}1-7; Fig. 38, n^{os}1-2). Four samples present broken pointed ends (Fig. 33, n^{os}2, 4, 6; Fig. 38, n°2). Three show flattened ends (Fig. 33, n^{os}1,5,7). Some have some cortical covering on the dorsal face (Fig. 33, n^{os}1,5; Fig. 38, n°2). Restricted or sparse parts of lateritic patina exist on some of these pointed tools (Fig. 33, n°7; Fig. 38, n°1).

Picks

Only one pick was recovered from Layer E (Table 15). In size, shape and other morphological attributes, this pick is similar to the six samples from Layer C. But it is entirely of thicker shape (Fig. 34, n°2).

5.4. TECHNOLOGICAL ANALYSIS OF DIMENSIONAL ATTRIBUTES OF THE ARTEFACTS FROM AJB UMF LAYERS C AND E

5.4.1. Outline of the Technology and Problems of Tool-Manufacturing

The analysis of the Dimensional Attributes of the Artefacts from both AJB UMF Layers C and E is emphasized in order to complement the Typological and Technological Analysis.

For a better understanding of this Dimensional Analysis, the Artefacts from both layers are counted in order to have the total number of each category of implements from each layer (Table 16). Then, a comparative value percentage is obtained not only from one layer to the other but also from the set of artefacts from both layers (Table 16). A minimum of 50 samples from each type of artefact should be appropriate for a diagnostic analysis of the technological attributes. The artefact-assemblage partially uncovered from AJB UMF Site could not yet provide this minimum quantity. Despite such quantitative insufficiency, the analysis was undertaken and allowed to suggest the provisional statistical results as following.

On the whole (Table 16), only 87 diagnostic pieces were sampled and analysed, out of which 40 came from Layer C and the remaining 47 from Layer E. These are made up of flakes (33.33%), cores (21.83%), points (22.97%), side-scrapers (9.19%), picks (8.04%), end-scrapers (1.14%), notched flakes (1.14%), denticulates (1.14%) and (mini) choppers (1.14%).

The Value Percentage of Artefacts made of quartz or quartzite was also determined in both Layers C and E (Table 17), with the following results of value percentage. On the basis of the total number of artefacts from both Layers C (45.97%) and E (54.02%), artefacts made of quartz represent 60.91%, while those of quartzite are 39.08%. This exclusive use of quartz and quartzite raw materials in manufacturing tools can be related to the dominant presence (95%) of quartzite rock type in Ajibode area (Chapter Four, Section 4.2.1). Because quartz and quartzite have no cleavage but a conchoidal fracture (hardness 7 on Mohs' Scale), the technology of tool-manufacturing was probably the Levallois direct percussion. Such suggestion chiefly based upon the hard property of quartz and quartzite calls for a precaution. It is indeed well known and accepted that rock type's liability to fracture depends too on both specific natural properties and adapted technological procedures (Tixier et al., 1980: 16).

In an earlier study of the MSA industry ambiguously said to be of an "amorphous character" in the Accra Plains in Southeastern Ghana, Davies (1964: 124-132) concluded first that the local sugary textured quartz that this industry was made of flaked very badly and was impossible to trim, then that the typology in this raw material did not show any sense of style. The tool-kit was identified as composed of end-scrapers, side-scrapers, picks and "miniature" picks, points and tanged points, tanged or backed blades, rare choppers etc.. Later Davies (1967: 127-143) specified that this small industry of MSA type was made with fairly small pieces such as side and end-scrapers, discoid/pyramidal pebble-tools, uniface or partly biface picks, and tanged points broken horizontally or blunted at the end etc..

The typological and technological concepts as used by Davies (1964) are sometimes ambiguous. This is the case with such terms as technology without 'sense of style' and of 'amorphous character'. The term of 'miniature' pick was also used instead of that of small or medium sized pick. On the other hand, the concepts of industry and culture were also used instead of those of phase, facies or assemblage as emphasised in Chapter One, Section 1.2.4.

The typological and technological attributes of this MSA industry as emphasized by Davies (1964; 1967) obviously present many ambiguities which have to be cautiously taken into consideration with a view to comparing them with similar attributes of the MSA occurrences in both Layers C and E at AJB UMF Site. So, AJB UMF Site's small and medium sized picks (Fig. 28a, n°1-4; fig. 34, n°2) can show similarities to what Davies (1964; 1967) called "biface" shape and "miniature" size of the picks. Some AJB UMF artefacts appearing to have pyramidal shape can present morphological or/and functional attributes similar to those described as discoid/pyramidal tools by Davies (1967).

Table 16: Comparative Number and Value Percentage of Artefacts from AJB UMF Layers C and E

Artefacts	Layer C	Layer E	Number	Percentage
Cores	7	12	19	21.83 %
Flakes	9	18	27	31.04 %
Notched flakes	1	----	1	1.14 %
Denticulates	----	1	1	1.14 %
Side-scrapers	5	3	8	9.19 %
End-scrapers	----	1	1	1.14 %
Points	11	9	20	22.97 %
Picks	6	1	7	8.04 %
Choppers	1	----	1	1.14 %
Total	40	47	87	100 %

Table 17: Frequency and Value Percentage of quartz, quartzite, patina, cortical and broken attributes of Artefacts from AJB UMF Layers C and E

Artefacts	Layer C	Layer E	Number	Quartz	Quartzite	Broken	Patina	Cortical
Cores	7	12	19	11	8	----	1	----
Flakes	9	18	27	20	7	----	2	2
Notched flakes	1	----	1	----	1	----	----	----
Denticulates	----	1	1	1	----	----	----	----
Side-scrapers	5	3	8	6	2	----	----	----
End-scrapers	----	1	1	1	1	----	----	----
Points	11	9	20	11	9	5	1	1
Picks	6	1	7	2	5	----	1	----
Choppers	1	----	1	1	----	----	----	1
Total	40	47	87	53	34	5	5	4
Percentage	45.97%	54.02%	100%	60.91%	39.08%	5.74%	5.74%	4.59%

On the other hand, the microwear or functional analysis of the edge of some AJB UMF Site Levallois flakes that appear to have been used as tools, can show technological characteristics similar to those of the "ready-to-use-technology" as emphasized by Deacon (1997: 322).

5.4.2 Description and Correlation of Dimensional Attributes

Flakes

From Layer C, among the nine flakes sampled (Table 14) and drawn (Fig. 30), the smallest (n°1) has a length of 1.80 cm, a breadth of 1.80 cm and a thickness of 0.20 cm. The largest (n°7) has a length of 6.30 cm, a breadth of 5.00 cm and a thickness of 2.20 cm. One medium sized specimen (n°3) has a length of 4.40 cm, a breadth of 3.50 cm and a thickness of 1.30 cm.

From Layer E, the twenty flakes sampled (Table 15) and drawn (Fig. 37a-b), gave the following length, breadth and thickness: (i) the smallest specimen (n°1): 1.90 cm, 1.70 cm and 0.40 cm; (ii) one medium sized (n°9): 2.80 cm, 2.5 cm and 1.00 cm; (iii) another medium sized (n°13): 4.7 cm, 2.8 cm, 1.00 cm; (iv) the largest (n°6): 6.60 cm, 4.50 cm, 1.20 cm and (n°7): 6.0 cm, 4.80 cm, 1.30 cm.

Comments on Table 18: Correlation between Dimensional and specific Technological Attributes of the Flakes from Layers C and E:

Layer C:

(i) the flakes (Table 18, n^{os}3-9) are very wide, their breadth is almost the same as their length (6.30 cm and 5.00 cm);

(ii) the ratio thickness to length varies respectively from 1/3 (Table 18, n^{os}5,7-3), 1/5 (n°4), 1/6 (n°6) to 1/9 (n°3).

Layer E:

(i) almost equal dimensions of length and breadth for about 30% of the flakes (Table 18, n^{os}1,3,8,9,11,14); length almost the double of breadth for 35% (Table 18, n^{os}4,5,7,10,12,13,15) as an indication of the Levallois shape; breadth as 2/3 of length for 35% (Table 18, n^{os}2, 6,16,17,18,19,20);

(ii) between the thinner flake (n°1) and the thicker (n^{os}19, 20), 1/3 ratio is shown by the length and breadth and 1/20 ratio by the bulbar section;

(iii) the flakes from both Layers E and C generally consist of a variety of Levallois shape, and show a progressive *miniaturization* in their size.

Table 18: Length, breadth and thickness of Flakes from AJB UMF Layers C and E

Layers	Artefacts	N°	Length (cm)	Breadth (cm)	Thickness (cm)
	Flakes	1	2.50	0.80	0.40
		2	2.40	1.30	0.30
		3	1.80	1.80	0.20
		4	2.90	2.70	0.60
C		5	4.40	3.50	1.30
		6	4.10	3.30	0.70
		7	4.50	5.00	1.00
		8	5.00	5.00	1.70
		9	6.30	5.00	2.20
	Flakes	1	3.70	1.80	1.00
		2	4.60	2.30	1.00
		3	3.70	3.20	1.00
		4	1.90	1.70	0.40
		5	2.70	1.60	0.50
		6	2.50	2.50	0.60
		7	3.10	1.80	0.60
		8	3.00	2.30	0.60
E		9	2.90	1.70	0.60
		10	2.60	2.60	0.60
		11	2.80	2.50	1.00
		12	4.30	2.30	1.00
		13	4.70	2.80	1.00
		14	3.80	3.30	1.00
		15	4.90	2.90	1.00
		16	4.30	3.30	1.00
		17	4.80	3.20	1.00
		18	4.50	3.90	1.00
		19	6.60	4.50	1.20
		20	6.00	4.80	1.30

Fig. 39 Frequency Histogram of Length of Flakes from AJB UMF Layers C and E

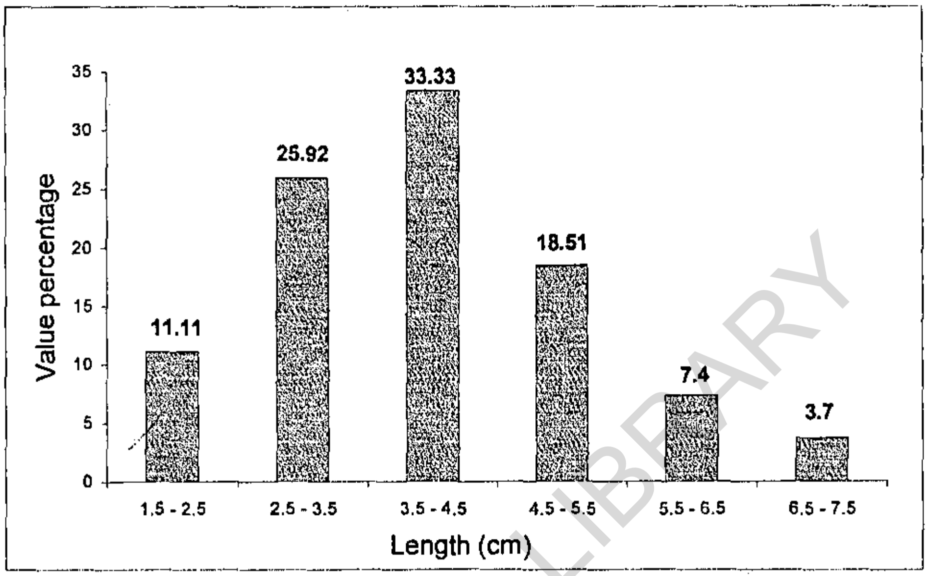


Fig. 40 Frequency Histogram of Breadth of Flakes from AJB UMF Layers C and E

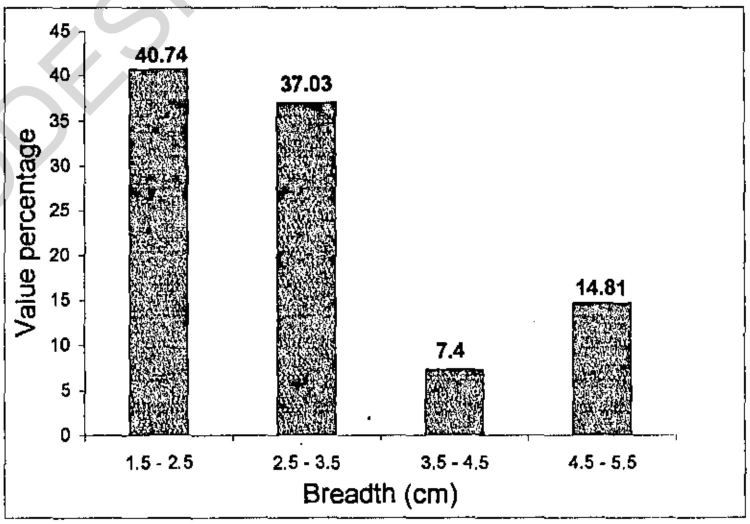
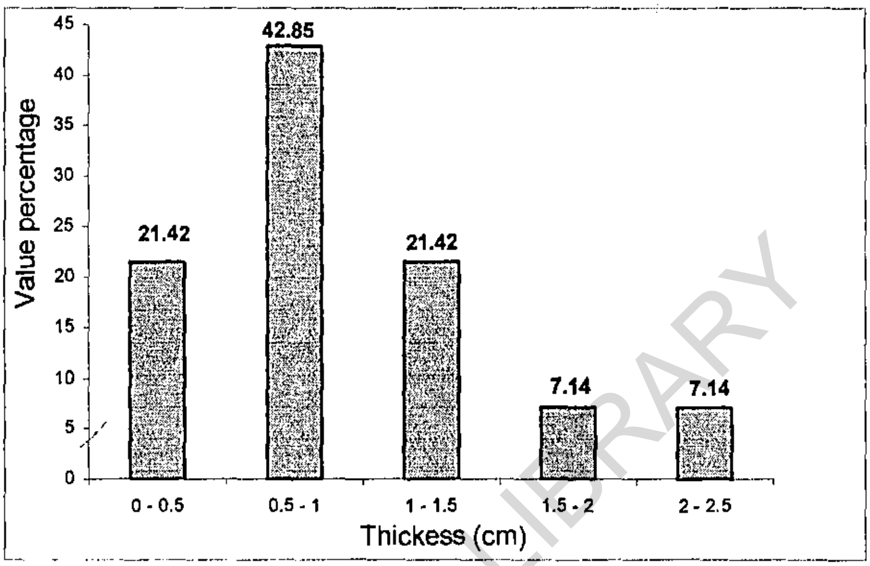


Fig. 41 Frequency Histogram of Thickness of Flakes from AJB UMF Layers C and E



Comments on Histograms of Fig. 39, Fig. 40 and Fig. 41

On the basis of the 29 flakes on Table 18:

i) the Histogram in Fig. 39 shows the respective value percentage of flakes' length: 33.33% (3.50-4.50 cm), 25.92% (2.50-3.50 cm), 18.51% (4.50-5.50 cm), 11.11% (1.50-2.50 cm), 7.40% (5.50-6.50 cm) and 3.70% (6.50-7.50 cm). The medium length of flakes (3.50-5.50 cm) exceeds half of the total value percentage (51.84%), against respectively 37.03% for the shorter length's specimens (1.50-3.50 cm) and 11.11% for the larger length's samples (5.50-7.50 cm);

ii) the Histogram in Fig. 40 indicates the following value percentage of flakes' breadth: 40.74% (1.50-2.50 cm), 37.03% (2.50-3.50 cm), 7.40% (3.50-4.50 cm) and 14.81% (4.50-5.50 cm). The flakes of medium breadth (2.50-4.50 cm) are many (44.43 %) followed by those of thinner breadth (1.50-2.50 cm) equivalent to 40.74%. The wider specimens (4.50-5.50 cm) made up just 14.81 %;

iii) the Histogram in Fig. 41 denotes the corresponding value percentage of flakes' thickness: 42.85% (0.50-1.00 cm), 21.42% (0.00-0.50 cm and 1.00-1.50 cm), 7.14% (1.50-2.00 cm and 2.00-.2.50 cm). The thinner flakes (0.00-1.00 cm) are dominant (64.27%), followed by specimens of medium thickness (1.00-2.00 cm) which made up 28.56%. Thicker samples (>2.00 cm) are few (7.14%).

Comments on Table 19: correlation between Dimensional and specific technological attributes of the cores from Layers C and E:

Layer C:

(i) four sub-rectangular cores with double striking platforms (Table 19: n^{os}1,3,4,5; Fig. 29 n^{os}3,5,6; Fig. 32, n°1). One sub-triangular core with one platform (Table 19, n°6; Fig. 32 n°2). Two polygonal cores with single or multiple platforms (Table 19, n°2; Fig. 29, n°4; Table, n°15; Fig. 32, n°3);

(ii) the length varies from 3.00 cm to 7.00 cm, the breadth from 2.40 cm to 6.50 cm, the thickness from 2.00 cm to 3.30 cm (Table 19).

Table 19: Length, Breadth and Thickness of Cores from AJB UMF Layers C and E

Layers	N°	Length (cm)	Breadth (cm)	Thickness (cm)
C	1	4.50	3.20	2.00
	2	5.20	6.20	2.70
	3	6.50	2.40	2.00
	4	5.20	3.00	2.40
	5	3.00	3.40	2.00
	6	3.00	5.00	2.00
	7	7.00	6.50	3.30
E	1	5.20	3.60	3.00
	2	5.20	3.60	3.20
	3	4.50	4.00	4.00
	4	4.30	1.60	1.70
	5	5.00	3.30	1.80
	6	4.20	4.00	2.40
	7	5.00	3.70	2.80
	8	5.30	4.60	2.50
	9	6.50	3.80	3.20
	10	5.00	3.00	1.80
	11	5.30	3.80	2.30
	12	4.20	3.80	2.10

Layer E:

(i) five sub-rectangular cores with double striking platforms (Table 19: n^{os}1,7,10,11,12; Fig. 35, n°4; Fig.36, n°4; Fig. 38, n^{os}4-6). Seven polygonal cores with single or multiple platforms (Table 19, n^{os}2,3,6,8,9,13,17; Fig. 35, n^{os}5-6; Fig. 36, n^{os}1, 2, 3, 5, 6);

Fig. 42 Frequency Histogram of Length of Cores from AJB UMF Layers C and E

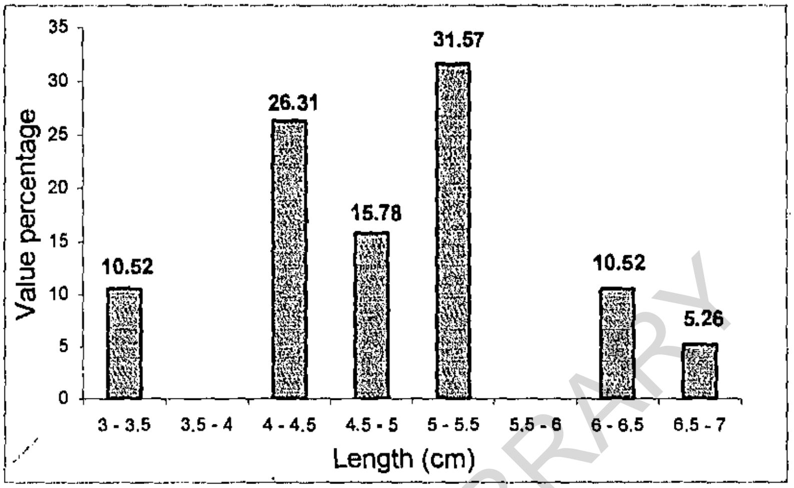


Fig. 43 Frequency Histogram of Breadth of Cores from AJB UMF Layers C And E

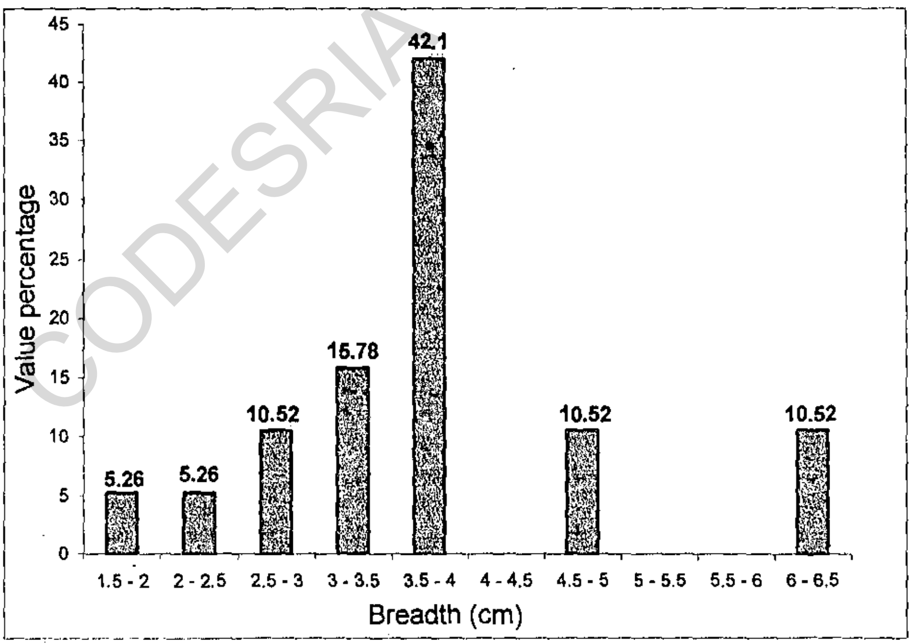
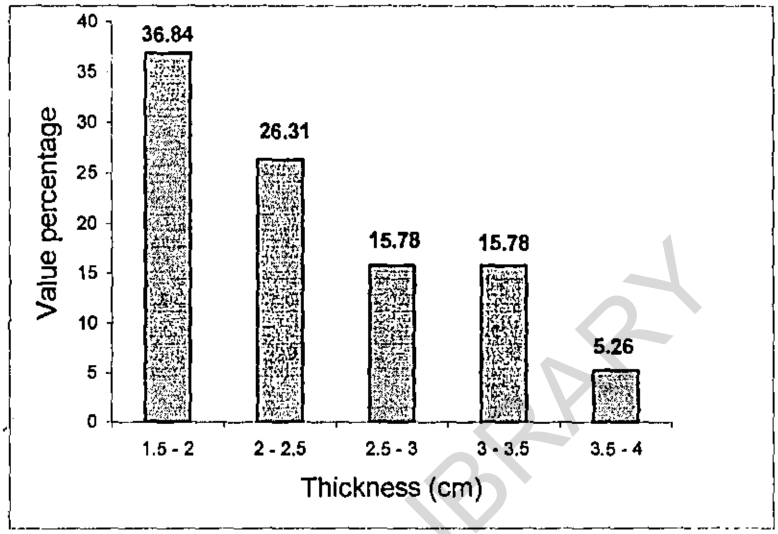


Fig. 44 Frequency Histogram of Thickness of Cores from AJB UMF Layers C and E



(ii) the length of the cores ranges from 4.20 cm to 6.50 cm, the breadth from 1.60 cm to 4.60 cm, the thickness 1.70 cm to 4.00 cm (Table 19).

Comments on Histograms of Fig. 42, Fig. 43 and Fig. 44

On the basis of the 19 cores on Table 19:

i) the Histogram in Fig. 42 displays the respective value percentage of cores' length: 31.57% (5.00-5.50 cm), 26.31% (4.00-4.50 cm), 15.78% (4.50-5.00 cm), 10.52% (6.00-6.50 cm and 3.00-3.50 cm) and 5.26% (6.50-7.00 cm). Cores of medium length (4.00-5.50 cm) are dominant (73.66%), the shorter ones (<4.00 cm) amount to 10.52% and the longer (>5.50 cm) corresponding to 15.78%;

ii) the Histogram in Fig. 43 shows the following value percentage of cores' breadth: 42.10% (3.50-4.00 cm), 15.78% (3.00-3.50 cm), 10.52% (2.50-3.00 cm, 4.50-5.00 cm and 6.00-6.50 cm) and 5.26% (1.50-2.00 cm and 2.00-2.50 cm). The cores of medium breadth (3.00-5.00 cm) are dominant (68.40%), followed by those of smaller breadth (≤ 3.00 cm) with 21.04%. Cores with wider breadth (>5.00 cm) made up 10.52%) of the whole lot;

iii) the Histogram in Fig. 44 denotes the corresponding value percentage of cores' thickness: 36.84% (1.50-2.00 cm), 26.31% (2.00-2.50 cm), 15.78% (2.50-3.00 cm and 3.00-3.50 cm) and 5.26% (3.50-4.00 cm). The thinner cores (1.50-2.50 cm) are dominant (63.15%), followed by those of medium thickness (2.50-3.50 cm) with 31,56%). The thicker cores (>3.50 cm) are few (5.26%).

Table 20: Length, Breadth and Thickness of Side-scrapers, End-scrapers, Denticulates and Choppers from AJB UMF Layers C and E

Layers	Artefacts	N°	Length (cm)	Breadth (cm)	Thickness (cm)
C	Side-scrapers	1	3.00	3.00	1.50
		2	3.30	2.90	1.00
		3	4.70	3.50	1.30
		4	6.00	3.70	2.00
	Notched flake	5	3.00	3.00	1.00
	Chopper	6	4.50	4.60	2.10
E	Side-scrapers	1	4.60	3.00	2.40
		2	5.50	4.50	3.00
		3	5.60	4.60	2.50
	End-scraper	4	7.70	8.30	3.30
	Denticulate	5	6.50	3.00	1.20

Comments on Table 20: Correlation between Dimensional and specific Technological Attributes of Side-scrapers, End-scrapers, Denticulates, Notched Flakes and Choppers from Layers C and E :

Layer C:

(i) a likely dejected convergent convex side-scraper (Table 20, n°1; Fig. 29, n°2) that has a length of 3.00 cm, a breadth of 3.00 cm and a thickness of 1.50 cm. Three concave and convex side-scrapers: one on sub-rectangular flake (Table 20, n°3; Fig. 31; n°5) with a length of 4.70cm, a breadth of 3.50cm and a thickness of 1.30 cm; two on irregular flakes (Table 20, n°2,4; Fig. 31, n°4,6). A notched flake (Table 20, n°5; Fig. 31, n°3).

A flattened mini-chopper with a length of 4.50 cm, a breadth of 4.60 cm and a thickness of 2.10 cm (Table 20, n°6 ; Fig. 29, n°1);

(ii) the dimensions of the thickness show that all the six tools are of a flattened shape which makes them suitable for use as scraping tools. The dimensions of their length and breadth show a picture of smallness that does not obstruct the scraping function.

Layer E:

(i) two convex side-scrapers on irregular flakes (Table 20, n^{os}1,2; Fig. 35 n^{os}1,2). Another convex side-scraper is made on sub-triangular flake (Table 20, n°3; Fig. 35, n^{os}3,5). Their length varies from 4.60 to 5.60 cm, the breadth from 3.00 to 4.80 cm and the thickness from 2.40 to 3.00 cm;

(ii) a double notched denticulate on sub-rectangular flake (Table 20, n°5; Fig. 34, n°1) with a length of 6.50 cm, a breadth of 3.00 cm and a thickness of 1.20 cm. The ratio of the length to the breadth and thickness is respectively 2/1 and 5/1;

(iii) a concavo-convex end-scraper with crude retouched edge. It is one of the largest flaked tools. It has with a length of 7.70 cm, a breadth of 8.30 cm, a thickness of 3.30 cm and a weight of 200 g. (Table 20, n°4; Fig. 38, n°4).

From both Layers C and E, except the crude end-scraper, all the tools are of small or medium size, and the majority of Levallois shape.

Fig. 45 Frequency Histogram of Length of Side-scrapers from AJB UMF Layers C and E

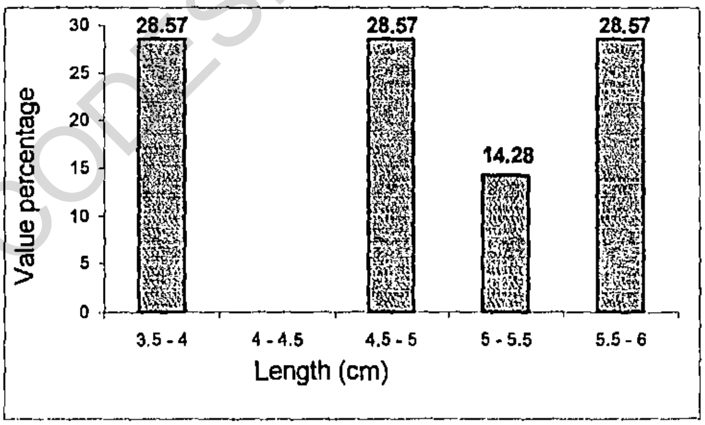


Fig. 46 Frequency Histogram of Breadth of Side-scrapers from AJB UMF Layers C and E

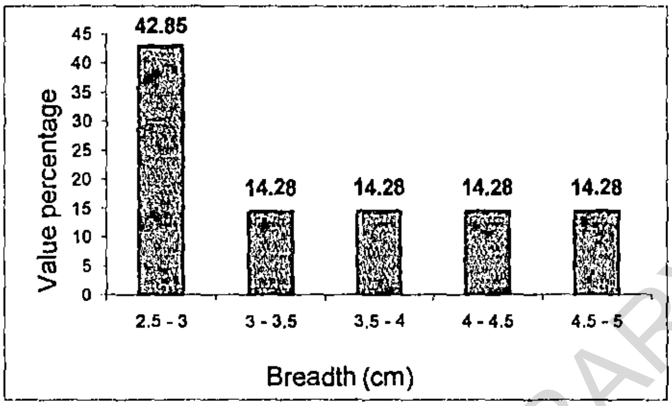
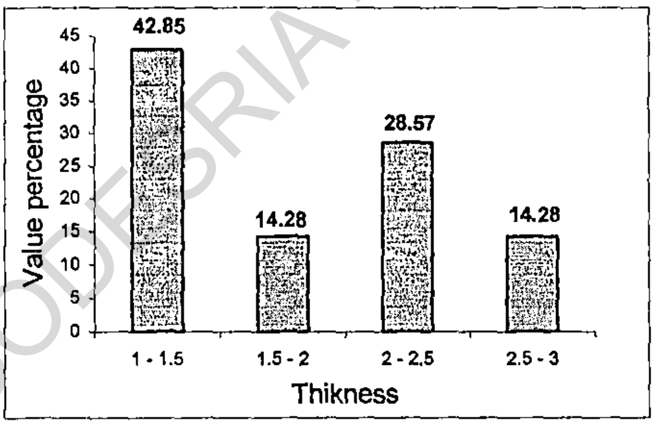


Fig. 47 Frequency Histogram of Thickness of Side-scrapers from AJB UMF Layers C and E



Comments on Histograms of Fig. 45, Fig. 46 and Fig. 47

On the basis of the 07 Side-scrapers on Table 20:

i) the Histogram in Fig. 45 indicates the respective value percentage of side-scrapers' length: 28.57% (3.00-3.50cm, 4.50-5.00 cm and 5.50-6.00 cm) and

14.28% (5.00-5.50 cm). The specimens of medium length (4.50-5.50 cm) are more numerous (42.85%) than those of shorter length (<4.50 cm) and longer length (>5.50 cm) with both categories having the same value percentage of 28.57%;

ii) the Histogram in Fig. 46 yields the respective value percentage of side-scrapers' breadth: 42.85% (2.50-3.00 cm) and 14.28% at once for 3.00-3.50 cm, 3.50-4.00 cm, 4.00-4.50 cm and 4.50-5.00 cm). The value percentage decreases from slenderer specimens (2.50-3.50 cm) corresponding to 57.13% to medium sized pieces (3.50-4.50 cm) equivalent to 28.56% and wider (>4.50 cm) representing 14.28%;

iii) the Histogram in Fig. 47 presents the respective value percentage of side-scrapers' thickness: 42.85% (1.00-1.50 cm), 28.57% (2.00-2.50 cm) and 14.28 % (1.50-2.00 cm and 2.50-3.00 cm). The thinner tools (1.00-2.00 cm) are dominant (57.13%), followed by the medium sized specimens (2.00-3.00 cm) equivalent to 42.85%. None of the tools is actually thick.

Table 21: Length, Breadth and Thickness of Points from AJB UMF Layers C and E

Layers	N°	Length (cm)	Breadth (cm)	Thickness (cm)
C	1	2.40	0.80	0.40
	2	2.50	1.30	0.30
	3	3.00	1.90	0.70
	4	3.00	1.80	0.90
	5	3.60	1.80	0.80
	6	3.20	2.50	1.50
	7	3.80	2.40	0.40
	8	5.00	2.50	1.20
	9	4.80	3.30	0.60
	10	4.40	2.50	1.00
	11	4.30	2.50	0.70
E	1	3.30	2.00	0.50
	2	3.60	2.00	0.30
	3	3.80	2.60	1.70
	4	4.20	3.50	0.80
	5	4.60	3.50	1.00
	6	5.00	4.00	1.00
	7	5.70	3.90	1.40
	8	5.20	3.40	1.20
	9	4.20	3.70	0.80

Comments on Table 21: Correlation between Dimensional and specific Technological Attributes of from Layers C and E :

Layer C:

(i) the two smallest points (Table 18, n^{os}1,2; Fig. 27, n^{os}1,2) have almost equal length (2.50 and 2.40 cm) and thickness (0.40 and 0.30 cm) but different breadth (0.80 and 1.30 cm). Their thickness is similar to that of the thinner flakes from Layer C (0.20 and 0.60 cm, Table 18 n^{os}3,4; Fig. 37a, n^{os}1,8);

(ii) from the set of eleven pointed tools, all are of sub-triangular flaked blank (Table 21, n^{os}1-11; Fig. 27, n^{os}1-9; Fig. 31, n^{os}1-2);

(iii) six of the eleven points have broken ends (Table 21, n^{os}2,4,6,7; Fig. 27, n^{os}2,4,6,7; Fig. 31, n^{os}1-2). The ratio of broken points to the total is 3/5. This is partly because all are slight tools with a thickness that ranges from 0.40 to 1.50 cm against a length that varies from 3.00 to 5.00 cm and a breadth from 1.80 to 3.30 cm. This can be said to be as a result of difficulty in working quartz/quartzite. Two single points have (Fig. 38, n^{os}5,7) covering patina.

Layer E:

(i) the nine points are made of Levallois sub-triangular flakes (Table 21, n^{os}1-9; Fig. 33, n^{os}1-7; Fig. 38, n^{os}1-2);

(ii) four points have broken ends (Table 21, n^{os}2,4,6,9; Fig. 33, n^{os}2,4,6; Fig. 38, n°2); two have flattened ends (Table 21, n^{os}5,7; Fig. 33, n^{os}5,7); one has restricted patina (Table 21, n°7; Fig. 33, n°7). The ratio of broken points to the total of the category is 4/9 (almost 1/2). The maximum length is 5.70 cm, while the minimum is 3.30 cm. The minimum breadth is 2.00 while the maximum is 4.00 cm. The thickness ranges from 0.30 cm to 5.70 cm. These points are thin too.

In shape, size and patterning, these two sets of nine points, respectively from Layers C and E, do not show meaningful differences.

Fig. 48 Frequency Histogram of Length of Points from AJB UMF Layers C and E

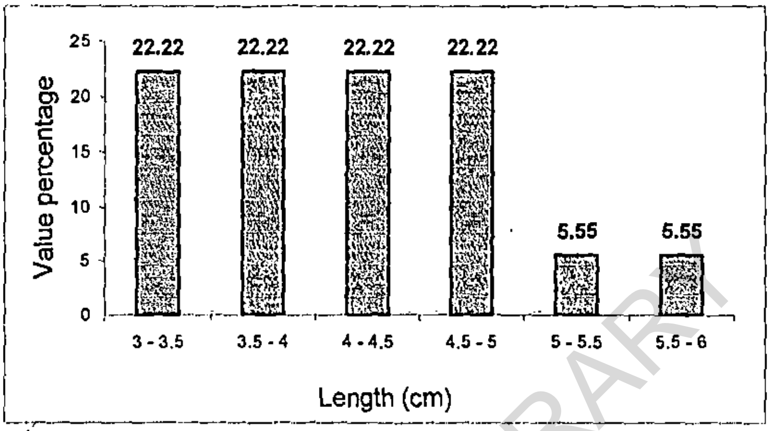


Fig. 49 Frequency Histogram of Breadth of Points from AJB UMF Layers C and E

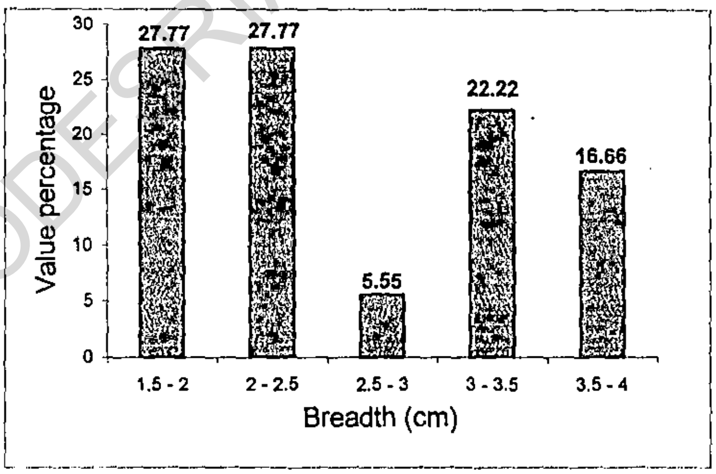
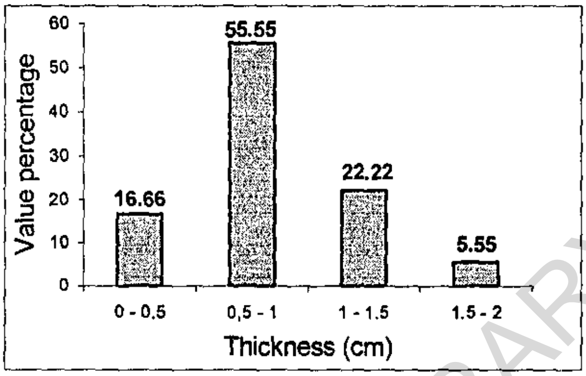


Fig. 50 Frequency Histogram of Thickness of Points from AJB UMF Layers C and E



Comments on Histograms of Fig. 48, Fig. 49 and Fig. 50

In accordance with the 20 points on Table 21:

i) the Histogram in Fig. 48 shows the respective value percentage of the length of the points: 22.22 % at once for 3.00-3.50 cm, 3.50-4.00 cm, 4.00-4.50 cm and 4.50-5.00 cm, and 5.55% both for 5.00-5.50 cm and 5.50-6.00 cm. The value percentage (44.44%) of shorter specimens (3.00-4.00 cm) is equivalent to that of medium sized samples (4.00-5.00 cm). The longer points (>5.00 cm) are few (11.10%);

ii) the Histogram in Fig. 49 denotes respective value percentage of the breadth of points. They are as follows: 27.77% for those with 1.50-2.00 cm and 2.00-2.50 cm, 22.22% for those with 3.00-3.50 cm, 16.66% for those with 3.50-4.00 cm, and 5.55% for those with 2.50-3.00 cm. The thinner points (1.50-2.50

cm) are dominant (55.54%) followed by the sample with medium breadth (2.50-3.50 cm) equivalent to 27.77%. The bigger points (3.50-4.00 cm) represent 16.66%;

iii) the histogram in Fig. 50 displays the respective value percentage of the points' thickness: 55.55% (0.50-1.00 cm), 22.22% (1.00-1.50 cm), 16.66% (0.00-0.50 cm) and 5.55% (1.50-2.00 cm). The thinner points (0.00-1.00 cm) are dominant (72.21%) followed by those with medium thickness (1.00-2.00 cm) which has 27.77%. Actually thick specimens are absent.

Table 22: Length, Breadth, Thickness and Weight of Picks from AJB UMF Layers C and E

Layers	N°	Length (cm)	Breadth (cm)	Thickness (cm)	Weight (g)
C	1	5.60	2.80	2.30	50
	2	7.10	4.40	3.30	100
	3	7.50	4.70	3.50	140
	4	8.00	4.50	3.50	150
	5	9.50	5.70	4.00	220
	6	9.30	5.90	4.00	220
E	1	8.80	4.70	3.70	300

Comments on Table 22: Correlation between Dimensional and specific Technological Attributes of Picks from Layers C and E:

(i) from Layer C, there are six picks with related length that varies from 5.60 to 9.50 cm, breadth from 2.80 to 5.90 cm, thickness from 2.30 to 4.00 cm and weight from 50 to 220g (Table 22, n^{os}1-6; Fig. 28a-b, n^{os}1-6).

(ii) from Layer E, the quantitative attributes of the single pick are a length of 8.80 cm, a breadth of 4.70 cm, a thickness of 3.70 cm and a weight of 300g (Table 22, n°1; Fig. 34, n°2).

The seven picks are relatively small in relation to already known picks, whose measurements range from a maximum length of 37.00 cm, a *minimum* of 7.00 cm; against estimated medium length of 15.00 to 10.00 cm and breadth of 8.00 to 2.00 cm (Brézillon, 1983: 284-287). These AJB UMF Site small to medium sized samples could be cautiously related to "miniature" picks analysed by Davies (1964; 1967), as emphasized in Chapter One (Section 1.2.4) as well as in Chapter Six (Section 6.2).

In view of such characteristics, some concluding remarks can be emphasized as follows:

(i) the size of the seven picks from AJB UMF Layers C and E falls into the usually acceptable minimum relevant size of picks. In the detail, their thickness and weight jointly lead to understand that the two larger specimens from Layer C (Table 22, n^{os}5,6; Fig. 28b, n^{os}5,6) with 220g each are lighter than the single sample from Layer E (Table 22, n°1; Fig. 38, n°2) which is thicker and subsequently heavier with some 300g. All the seven specimens are bifacially chipped and have no cortical surface pattern;

(ii) the smallest (Table 22, n°1; Fig. 28a, n°1) as well as one of the largest (Table 22, n°5; Fig. 28b, n°5) of the seven tools are made of quartz. Both have pointed ends, while the other five are made of quartzite. Three picks (Table 22, n^{os}4,6,7; Fig. 28a-b, n^{os}4-6) have pointed ends and are of larger dimensions. The two smallest (Table 22, n^{os}2-3; Fig. 28a, n^{os}2-3) have flattened ends;

(iii) the variety of size and weight of these seven small to medium sized picks is to be related to the variety of the twenty points from the respective same Layers C and E. The cortical surface pattern of few of the picks is not a significant technological attribute to obstruct the dominant similarity of the respective attributes of each and the both sets of tools from each and the both layers.

Fig. 51 Frequency Histogram of Length of Picks from AJB UMF Layers C and E

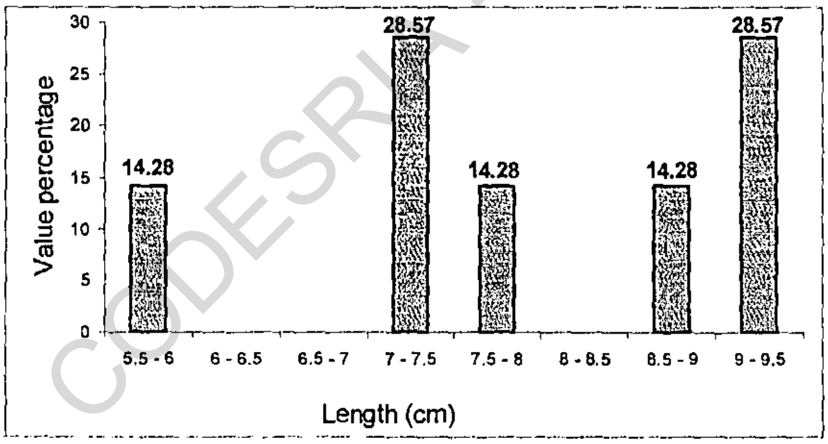


Fig. 52 Frequency Histogram of Breadth of Picks from AJB UMF Layers C and E

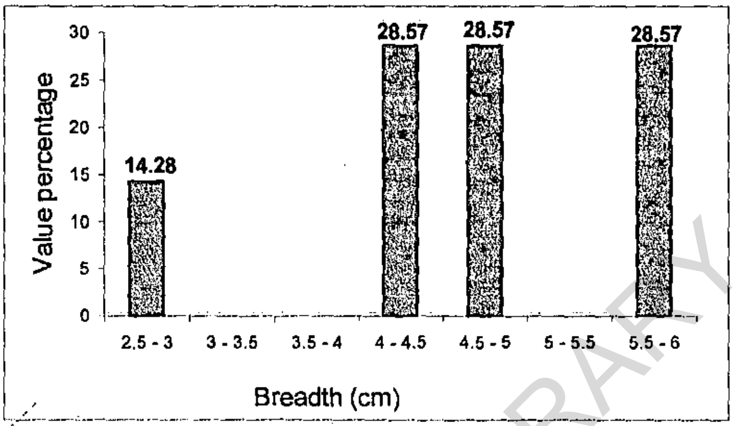
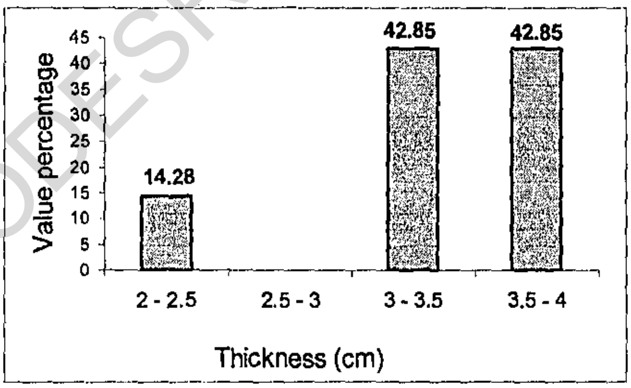


Fig. 53 Frequency Histogram of Thickness of Picks from AJB UMF Layers C and E



Comments on Histograms of Fig. 51, Fig. 52 and Fig. 53

On the basis of the 07 picks on Table 22:

i) the Histogram in Fig. 51 indicates the following value percentage of the length of the picks: 28.57% (7.00-7.50 cm and 9.00-9.50 cm), 14.28% (5.50-6.00 cm, 7.50-8.00 cm and 8.50-9.00 cm). Except the length of the smallest specimen (5.60 cm), all the other six picks present a medium sized length (7.00-9.50 cm) and they represent 85.70% of the total;

ii) the Histogram in Fig. 52 yields the respective value percentage of the breadth of the picks: 28.57% at once for 4.00-4.50 cm, 4.50-5.00 cm and 5.50-6.00 cm and 14.28% (2.50-3.00 cm); except the breadth of the smallest sample (2.80 cm), the other six picks are of medium sized breadth (4.00-6.00 cm) and they represent 85.71% of the total;

iii) the Histogram in Fig. 53 presents the following value percentage of the thickness of the picks: 42.85% (3.00-3.50 cm and 3.50-4.00 cm) and 14.28% (2.30-2.50 cm); except the thickness of the smallest pick (2.30 cm) the other six specimens are of medium sized thickness (3.00-4.00 cm) and they represent 85.70% of the total. The morphological and functional attributes of these pick samples from AJB UMF Site could be cautiously related to those of the "miniature" picks as earlier described by Davies (1964; 1967: cf. Section 6.2 of Chapter Six).

5.5 MIDDLE PALAEOLITHIC/MIDDLE STONE AGE FACIES FROM AJB UMF LOWER TERRACE, LAYERS C AND E

As it is shown on Tables 14 to 17 on the one hand, and in Figs. 27 to 38 on the other hand, the number and percentage of sampled diagnostic artefacts from AJB UMF Layers C and E, are as following on Table 23.

The pieces that are not diagnostic cores and flakes are sorted out as chips or chunks (Table 13). Those that show some technological scars, but that are not obviously diagnostic retouched blanks, are referred to above (Table 23) through their number and corresponding percentage, just for comparison with the relevant tools.

On the basis of the diagnostic tools' number and corresponding percentage, the identified typological and technological attributes are referred to in order to specify the Palaeolithic techno-cultural phase or facies that correspond to the amounted occurrences from the both archaeological Layers C and E.

The hierarchical clustering of both number and percentage indicators show that the points are the dominant tool types, followed respectively by the side-scrapers, picks, end-scrapers, notched flakes, denticulates and choppers. This picture is in accordance with the characteristic tools of the Middle Palaeolithic worldwide, or of its equivalent Middle Stone Age in sub-Saharan Africa.

Table 23: Hierarchical Clustering of Number and Value Percentage of Blanks and Tools from AJB UMF Layers C and E

Artefacts		Number	Percentage
Blanks	Flakes	29 specimens	33.33 %
	Cores	19 specimens	21.83 %
Tools	Points	20 specimens	22.97 %
	Side-scrapers	8 specimens	9.19 %
	Picks	7 specimens	8.04%
	End-scrapers	1 specimen	1.14%
	Notched flakes	1 specimen	1.14%
	Denticulates	1 specimen	1.14 %
	Choppers	1 specimen	1.14 %
Total		69 specimens	100 %

In accordance with conventional procedure of description and identification of the Middle Palaeolithic/Middle Stone Age technological facies, the listed characteristic tool-kits include side-scrapers, end-scrapers, points, denticulates, notched flakes. Occasionally, are also listed notched blades, backed-knives, tanged tools and picks. But some of these tools (e.g. picks) mainly belong to earlier stone ages, while others (e.g. tanged tools, notched blades or backed-knives) are implements of later periods (Bordes, 1972a; 1988; Brézillon, 1983; Tixier et al., 1980).

In the case of sub-Saharan Africa, a correlation between Middle Palaeolithic and Middle Stone Age periods and assemblages is more and more advocated and accepted. The present study is not an occasion for the debate on the relevance of such a peculiar individualization of that part of the continent in connection with the world. It is appropriately done elsewhere (Anozie, 1975: 15-45; Bagodo, 1995). In short, it is the 8th Congress of the Pan-African Association for Prehistory and Related Studies convened in Nairobi (Kenya) in 1977 that took the landmark decision to standardize specifically for and in sub-Saharan Africa the threefold lithic nomenclature of Early Stone Age, Middle Stone Age and Late Stone Age against the worldwide prevailing nomenclature (Bagodo, 1995: 115-116).

Rightly taking into account relevant progress in research methods and results in Southern, Eastern and Northern Africa since the 1980s, prominent specialists started accepting the relevance of establishing a parallel between Middle Palaeolithic and Middle Stone Age. For instance, one of the specialists has unequivocally advocated such a standpoint by emphasizing as follows (Clark, 1995: 254-256):

(i) the Middle Palaeolithic/Middle Stone Age industrial traditions are characterized by the Levallois and disc-core technique of flake production, both designed to minimize wastage of raw materials;

(ii) the raw materials are carefully selected, the cores generally smaller and better prepared, the flakes light and thin to facilitate retouching in order to get a range of scraping, sawing and cutting edges, and pointed ends;

(iii) the characteristic cores are ellipsoid, sub-triangular or rectangular and respectively liable to facilitate the removal of large, oval, sub-triangular and sub-rectangular flakes and blades which will then be retouched and transformed into corresponding tools.

With particular reference to West Africa and the forest/savanna regions of the Equatorial Africa, Clark (1995: 286-293) in accordance with previous views (Davies, 1964; 1967), claims that the late Pleistocene corresponds to a phase of artefact-assemblage that first consists of a facies of crude picks, heavy core-scrapers, polyhedrals and choppers, and later of a facies of finely-made lanceolate, bifacial and tanged points. The phase of crude tools has small flaked tools and is characterized as a "Sangoan" facies at Asokrochona (Southeastern Ghana) and associated sites in the Guinea Region of the Bight of Benin, while the phase of finer and varied tools is identified as a "post-Sangoan" and Middle Palaeolithic or Middle Stone Age facies.

Northwards from the Guinea tropical humid zone, in the Guinea-Sudanic savannas of North Central Nigeria, sites located at Funtua and near Bussa and Yelwa (Fig.1) are described as containing abundant side-scrapers, small disccores, crude side and end-scrapers. These sites are characterized as "Sangoan" facies (Soper, 1965).

Also in the Guinea savanna zone of North Central Nigeria, "Post-Sangoan" facies are described as Middle Stone Age (or Middle Palaeolithic) artefact-assemblage. This is the case with such sites as Mai Lumba, Banke, Tibohi, Zenabi, Pingel and Saminaka (Fig.1) (Allworth-Jones, 1981; 1987; Opadeji, 1998). This North Central Nigerian 'Middle Palaeolithic and Middle Stone Age' (Allsworth-Jones, 1987: 112-121) is said to show the following picture (Table 24) adapted from Allsworth-Jones (1987: 120):

Table 24: Number of MSA Tools from Mai Lumba, Tibehi and Zenabi

Tools	Mai Lumba	Tibehi	Zenabi	Total
Levallois flakes, blades and points	72	7	24	103
Sidescrapers	36	25	97	158
Pseudo-Levallois points	6	----	5	11
Denticulates	2	2	21	25
Endscrapers	1	----	5	6
Notches	3	1	1	5
Limaces	1	4	8	13
Burins	1	----	3	4
Bifaces	2	1	----	3
Various	5	6	12	23
Total	129	46	176	351

This adapted picture (Table 24) indicates amongst the diagnostic tools , the dominant number of side-scrapers (158), respectively followed by Levallois flakes, blades and points (103), denticulates (25), limaces (13), pseudo-Levallois points (11), end-scrappers (6), notches (5).

On the other hand, the Middle Stone Age flakes and tool types from Saminaka show the following sorting picture (Table 25) adapted from Opadeji (1998: 69- 74):

Table 25: Number of MSA tools from Saminaka

Artefacts		Number	Percentage
Flakes and Tools	Flakes	131	80.86 %
	Levallois flakes	4	2.46 %
	Variable side-scrapers	17	12.90 %
	Points	4	2.46 %
	Notched flakes	3	1.85 %
	End-scrapers	2	1.23 %
	Denticulates	1	0.61 %
	Total	162	100 %
Cores	Discoid cores	8	29.60 %
	Rectangular cores	7	25.90 %
	Irregular cores	6	22.20 %
	Pyramidal cores	3	11.10 %
	Globular cores	2	7.40 %
	Levallois cores	1	3.70 %
	Total	27	100 %

This second adapted picture (Table 25) shows that: (i) the flakes are dominant; (ii) amongst the diagnostic tools to follow in number are respectively the side-scrapers, the points, the notches and the end-scrapers; (iii) amongst the variable types of cores, the discoid, rectangular and irregular are respectively dominant in number.

All this many-sided identification of West African Guinean and Sudanic 'Sangoan' or 'post-Sangoan' phases or facies has been critically and repeatedly assessed since the 1970s to 1990s, with strong concerns and debates on the relevance of the conceptual and analytical criteria that are referred to (Wai-Ogosu, 1973; Andah, 1978; 1979a; 1993; 1995a-c).

In complementarily agreeing with both Clark's (1995) and Andah's (1973; 1978; 1979a; 1993; 1995a-c) standpoints, respectively on the relevant equivalence of the Middle Palaeolithic and Middle Stone Age facies and phases in sub-Saharan Africa, and on the relevance of critically referring to these, the diagnostic artefact-assemblage from AJB UMF Lower Terrace, Layers C and E, is characterized and named as a Middle Stone Age facies. From this point of view, this artefact-assemblage is tentatively compared with those from Mai Lumba, Tibehi, Zenabi and Saminaka on the one hand, and with the 'post-Sangoan' ones from Asokrochona. As a result, the following comparative characteristics are emphasized:

(i) the common and dominant tools are respectively side-scrapers, points, end-scrapers, notched or denticulate flakes;

(ii) blades are present at Mai Lumba, Tibehi and Zenabi;

(iii) Ajibode yielded light and thin small to medium sized picks, and a single flattened mini-chopper; while limaces, burins, bifaces and other various tools are partly or wholly recovered at Mai Lumba, Tibehi, Zenabi and Saminaka sites;

(iv) Levallois, rectangular and polygonal cores are common, and discoid, triangular, globular or pyramidal cores are present at some sites. There is a variety of flakes whose sizes and shapes correspond to the different designed cores.

In view of the above lines of comparison, there is obviously the dominance of similar types and attributes of flaked tools and cores. The differences can be used more for a better understanding of each site's peculiar assemblage, as well as for emphasising more complementary (than contrasting) picture between the sites. Such a conclusion is illustrated by the occurrences from Ajibode.

As a case of illustration, both morphological and dimensional attributes of the picks from this site can be referred to. Both in size, shape and surface patterning, these picks do not appear as a "Sangoan" variant facies. They are obviously finely-made light and thin tools. They are suitable more for piercing, drilling or/and scratching than for efficient digging or cutting thick and hard objects. They are designed in order to complement the function of post-Acheulean or "post-Sangoan" tool-assemblages that include such implements as, side-scrapers, end-scrapers, points, denticulates, notched flakes, bladed-knives etc. This tool-assemblage from AJB UMF Layers C and E therefore actually represents a Middle Stone Age or Middle Palaeolithic facies. The next chapter, the last, shows how the lifeways based upon this technological phase adequately match to the late Pleistocene to early Holocene tropical environmental conditions of the Guinea Region of the Bight of Benin.

CHAPTER SIX

A TENTATIVE ANALYSIS OF AJIBODE MIDDLE STONE AGE SETTLEMENT PATTERNS IN THE BIGHT OF BENIN REGIONAL CONTEXT: SCENARIOS, PROBLEMS, AND SUGGESTIONS

Around the world, Palaeolithic settlement histories and patterns of analyses usually vary. Thus, they are not to be indiscriminately framed, packed and labelled (Megarry, 1995: 207-346). This is shown in Hunter-gatherer economy in prehistory. A European perspective (Bailey, 1983). It is also shown in Prehistoric Hunter-Gatherers. The Emergence of Cultural Complexity (Prince and Brown, 1985), but with more emphasis on the American scene during the long-term pre-Columbus times. Africa therefore presents her own peculiarities.

6.1 CURRENT SCENARIOS OF MSA SUBSISTENCE-SETTLEMENT PATTERNS IN AFRICA

The African recorded and reported data during the past two decades actually present an illustrative case of variety and changes of Palaeolithic subsistence-settlement scenarios, through transitions and adaptations between the final Acheulian and the Early Holocene times. There are local and regional studies, as well as continental syntheses. At the micro-scale and medium-scale levels, the picture of transitions and adaptations is illustrated in such studies as

Late Pleistocene and Holocene Hunter-gatherers of the Matopos. An archaeological study of change and continuity in Zimbabwe (Walker, 1995). The micro-scale, macro-scale and continental scenarios are referred to in the present study with a view to obtaining basic and comparative data for modelling purposes.

In this regard, Butzer and Cooke (1995) attempted to assess "The palaeo-ecology of the African continent" in order to first frame the evolutionary scenario of the "Middle Stone Age and Late Stone Age", and then draw the following conclusions (Butzer and Cooke, 1995: 55-69) :

(i) that for sub-Saharan Africa, the Middle Stone Age (MSA) is accepted as equivalent to the Middle Palaeolithic/Upper Palaeolithic in Europe and North Africa on one hand, and the Late Stone Age (LSA) to the Upper Palaeolithic/Neolithic on the other. In some parts of South Africa, LSA began not later than 38,000 BP. In Ethiopia MSA sites are older than 181,000 BP. Compensating the continuing paucity of good polliniferous deposits, faunal assemblages and geomorphic features allow to record the environmental changes over the last 130 000 years. Unlike as Eastern, Southern and Northern Africa, the rarity of local sequences of great time depth in respectively the Congo rainforest of Central Africa and the Guinea rainforest of West Africa cautions against making generalizations at regional scale, and doesn't facilitate correlation with contemporaneous processes established in the other regions of the continent (Butzer and Cooke, 1995: 55-61);

(ii) that because of notable differences in their extent, phases and directions, it is not relevant to get one-to-one correlation of African climatic changes with the higher-latitude glacial chronology. In tropical Africa, the glacial maxima generally corresponded to dry phases, and the interglacial phases to moist periods. African 'pluvial' episodes were of short duration (some less than 2,000 years, few exceeding 5,000 years). The last submaximun of the 'last glacial' (ca. 20,000-12,000 BP) was relatively dry everywhere except in parts of the Nile basin and the South African interior. South of the Sahara, the final Acheulian fauna is richer than present and that of the later Pleistocene predominantly made of living species with a few extinct forms that persisted to the beginning of the Holocene. From Acheulian to Late Pleistocene and Holocene times, the regional faunal setting became more differentiated. Savannas and open woodlands have been the more spread and probably the more adapted to the major part of the late Pleistocene and Holocene fauna (Butzer and Cooke, 1995: 62-69).

FIG. 54: THE DISTRIBUTION OF AFRICAN OLDOWAN SITES KNOWN OR BELIEVED TO BE OLDER THAN 1.5 MILLION YEARS (MODIFIED FROM ISAAC, 1995)

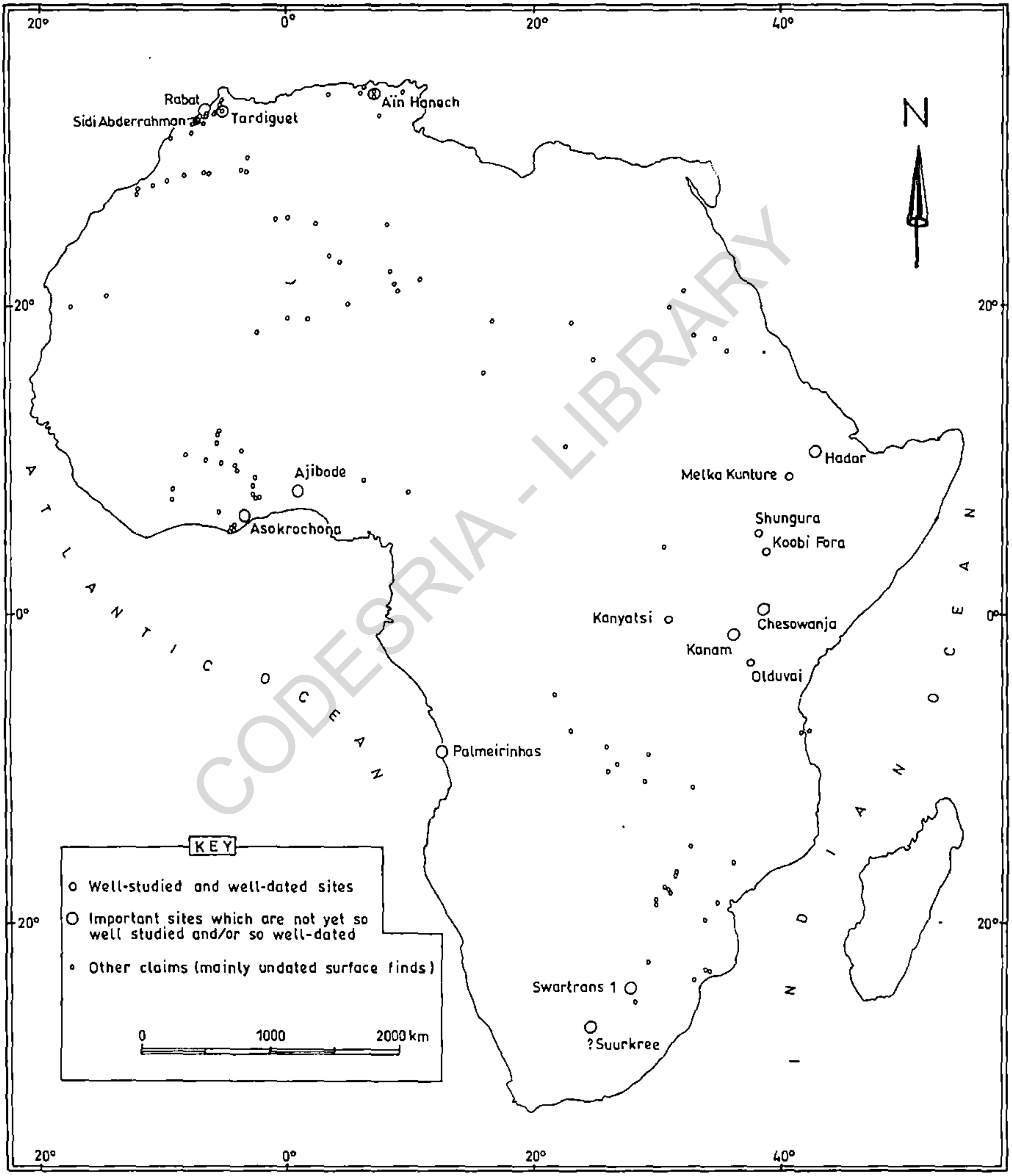


FIG. 55: THE DISTRIBUTION OF EARLY ACHEULIAN AND DEVELOPED OLDOWAN SITES BETWEEN 1.5 AND 0.7 MILLION YEARS (MODIFIED FROM ISAAC, 1995)

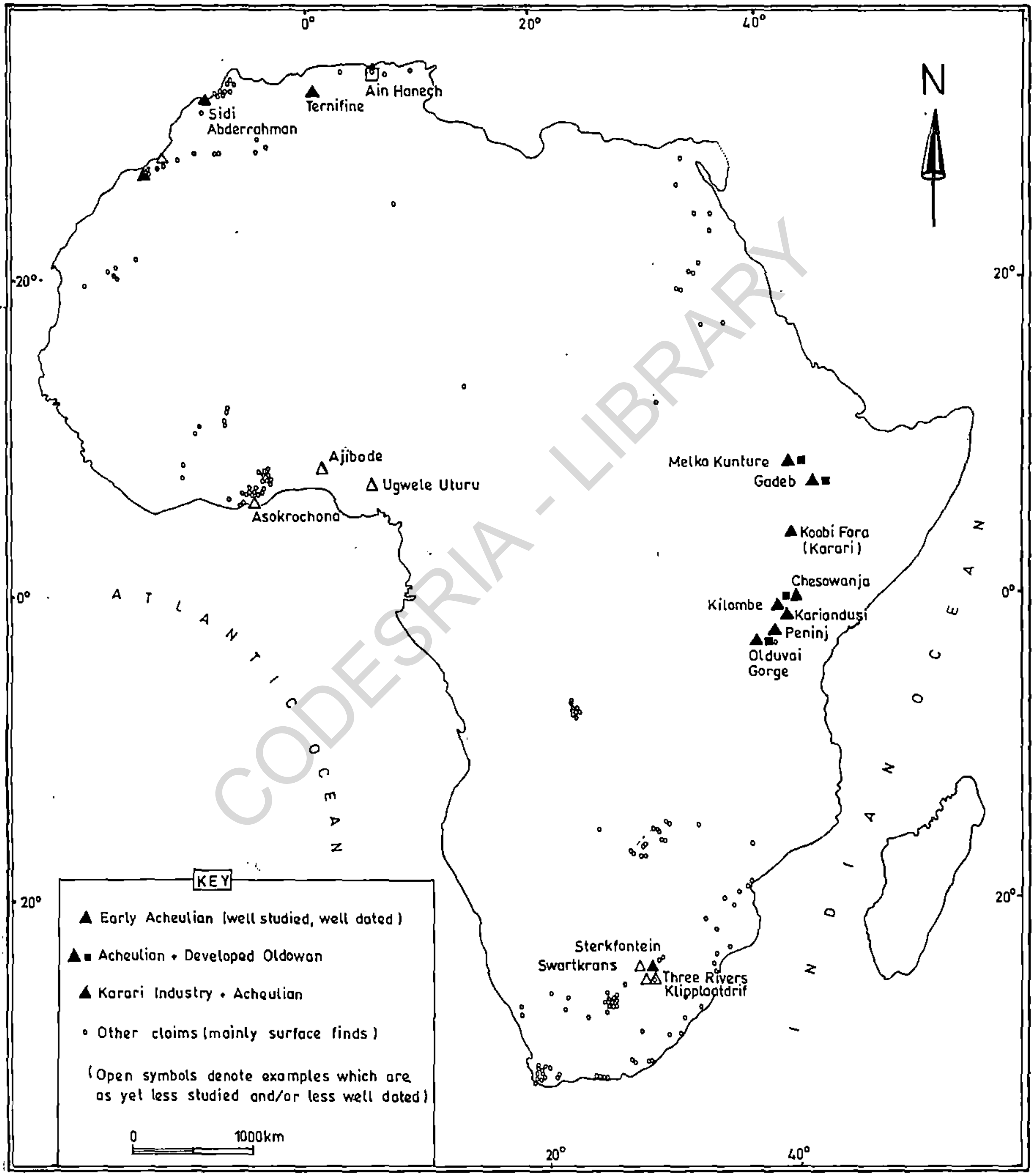
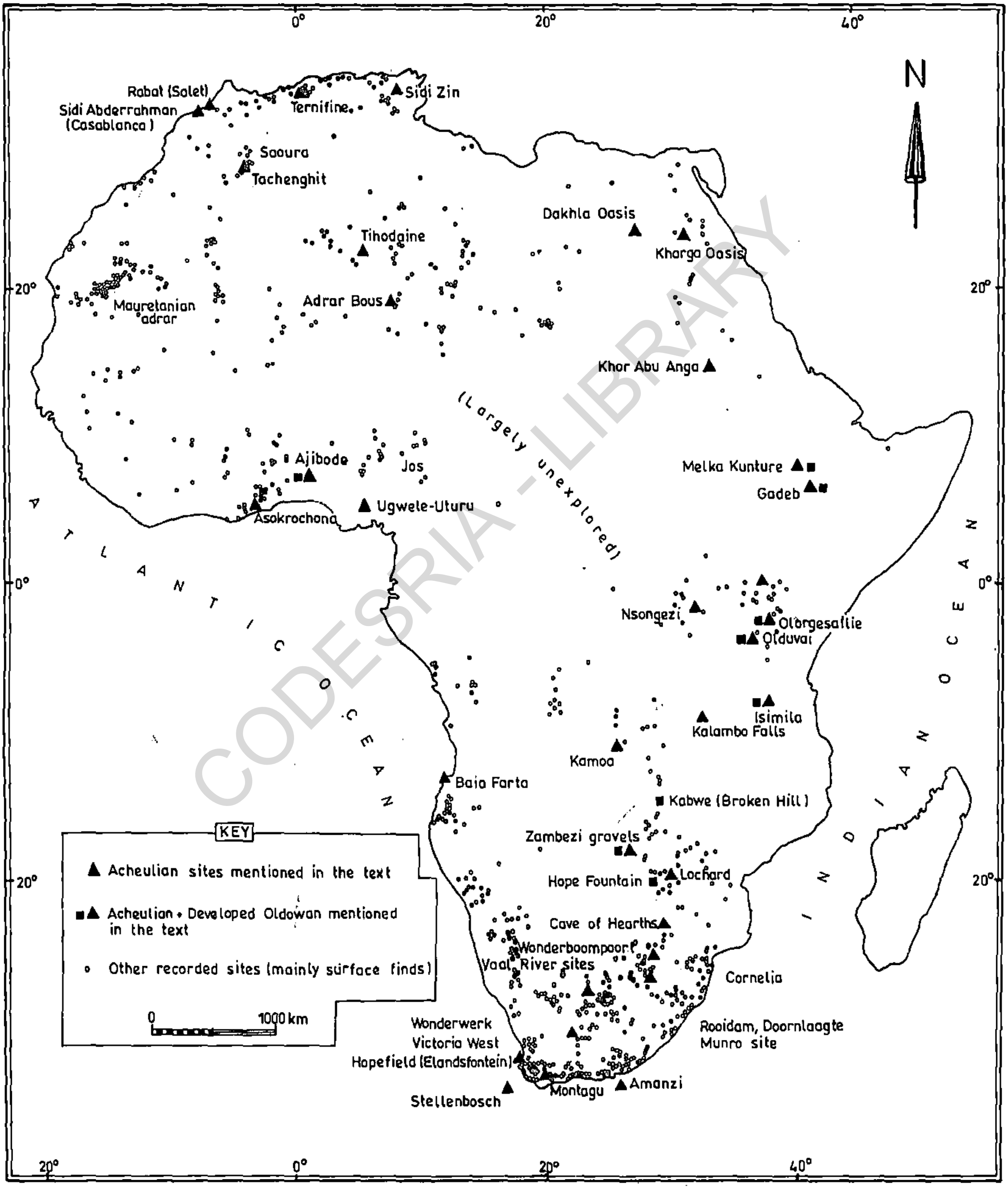


FIG. 56: THE LOCATION OF AFRICAN EARLIER STONE AGE AND LOWER PALAEOLITHIC SITES THOUGHT TO BE BETWEEN 0.7 AND 0.1 MILLION YEARS OLD (MODIFIED FROM ISAAC, 1995)



Again at the African continental scale, but with particular interest in the chronology and the characteristics of the "earliest archaeological traces", Isaac (1995) mapped the illustrative key and secondary sites. He did so with due consideration to sites that are related to the transition from the "end of the Acheulian" to the advent of the MSA, as well as on the basis of a hierarchy of all the sites that range from the well-studied and well-dated to those said to be important but not yet so well-studied or so well-dated. The third and last category is grouped into the label of "other claims" (i.e. mainly undated surface finds). The three illustrating maps are presented on the following lines of arguments (Isaac, 1995: fig. 3.5; fig. 3.6 and fig. 3.7) respectively:

(i) in the amended Fig. 54 is shown a distribution of sites known or believed to be older than 1.5 million years (i.e. Oldowan). In West Africa, only the sites labelled "other claims" are recorded and mainly concentrated in the Bight of Benin Region (Isaac, 1995: 180-181);

(ii) in the amended Fig. 55 is shown a distribution of sites known or believed to be between 1.5 and 0.7 million years (i.e. Early Acheulian and Developed Oldowan). In West Africa, particularly in the Bight of Benin Region, the same "other claims" are also mentioned; but a close-up observation leads to see that the distribution is more concentrated at locales belonging to present-day Southern and Central Republic of Ghana, while North Central Nigeria (i.e. Jos Plateau) is displayed as a blank area (Isaac, 1995: 182-183);

(iii) in the amended Fig. 56 is shown a location of Early Stone Age and Lower Palaeolithic sites thought to be between 0.7 and 0.1 million years old (i.e. Acheulian plus Developed Oldowan/Hope Fountain). The previously said "Other claims" are hereby replaced by "Other recorded sites (mainly surface finds)". These latter are distributed over West Africa, with the following three areas of concentration : (a) two areas in the Bight of Benin, namely in coastal Southeastern Ghana with Asokrochona (wrongly written Asokrachona) as key site and in Central Nigeria with Jos as key site; (b) the third area around the Mauretanian Adrar (Issac, 1995: 184-185).

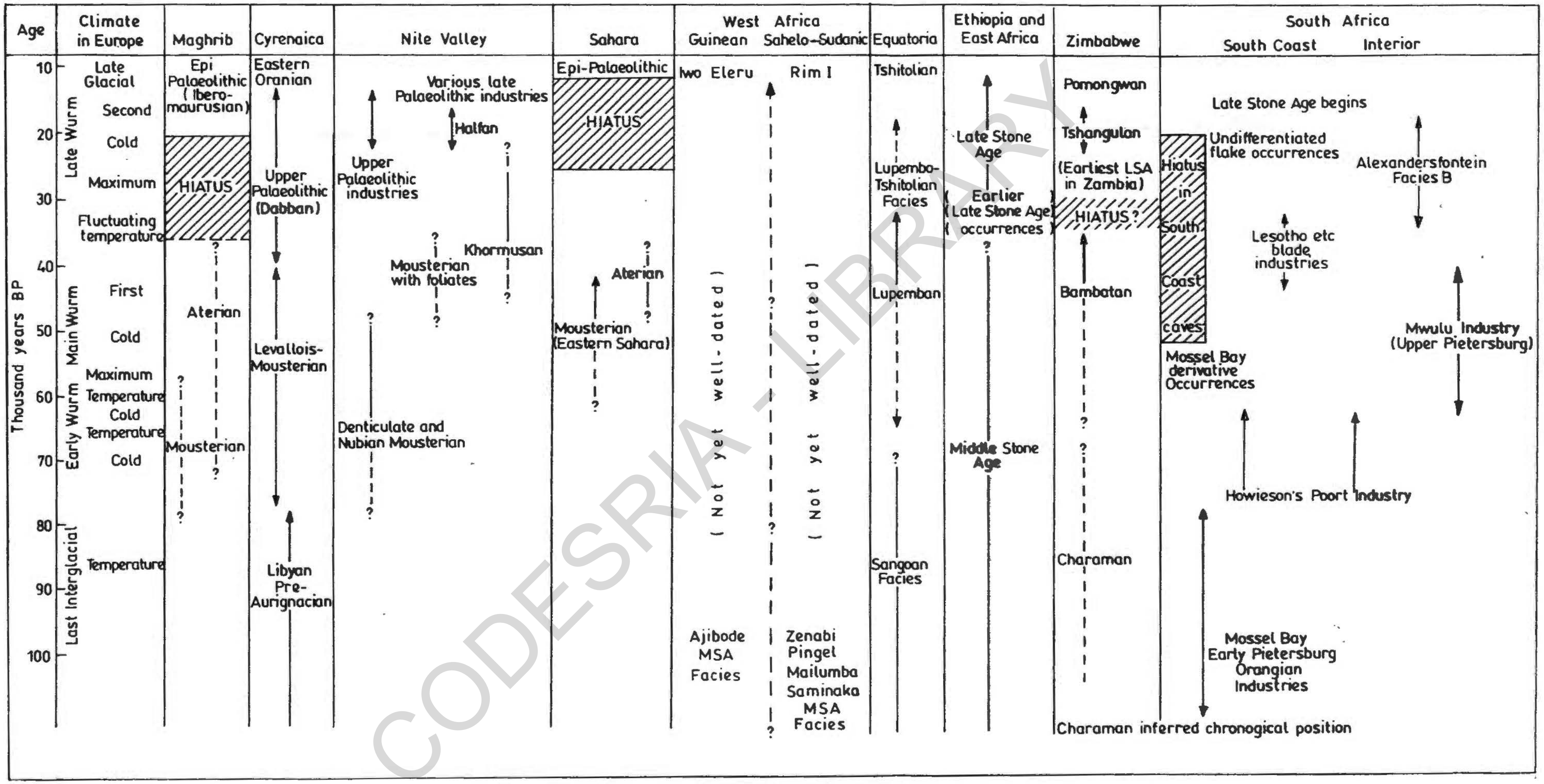
It is worthy to note that Isaac's statement was firstly published in 1982. Railway-cutting at Asokrochona Site was archaeologically examined in 1958 (Davies, 1964: 137-142). The site was intermittently excavated from December 1972 to March 1974, and subsequent reports already published between 1976 (Nygaard and Talbot, 1976: 13-19) and 1979 (Andah, 1979a: 47-85). After 1982, Isaac's synthesis had been reprinted in 1987, 1989 and 1995; while since 1984 a more detailed report on one of the parallel excavations was published (Nygaard and Talbot, 1984: 19-33). How to explain the successive omission of the already available information on excavations at the site? At least, in the 1987, 1989 or/and 1995 reprinted version(s), in Isaac's fig. 3.7 the site might have been removed from the group of "other recorded sites (mainly surface finds)" to that of "Acheulian sites", as well as it had been done in the case of Adrar Bous Site. Otherwise, it might have been recorded according to any other conventionally accepted nomenclature. Such a persistent practice of omission has been unfortunately followed by Phillipson (1988: 43 and 76-77), as well as in a more recently published Encyclopedia of Precolonial Africa. Archaeology, History, Languages, Cultures, and Environments (Vogel, 1997: on the front page's map).

On the tentatively amended Figs. 54, 55 and 56, Asokrochona Site is hence mentioned as "believed" to be of Oldowan, Early Acheulian or "Early Palaeolithic" assemblages, in accordance with (Andah, 1979a; 1993). On the other hand, Ajibode Sites are mentioned on the amended versions of the three maps. This is, because the three successive upper/older (225 m), middle (210 m) and lower/younger (195 m) terrace levels located at Ajibode area are "believed" to stratigraphically bear respectively "Oldowan", "Sangoan" and "Acheulean" assemblages-like (Andah and Momin, 1993; Andah, 1995a; Momin, 1995). In particular, the industrial occurrences of the (195 m) Terrace are recently characterized as of a Middle Stone Age/Middle Palaeolithic facies, as shown in our Chapter Five. As believed to be "Acheulean" too, Ugwele-Uturu Site (Anozie, Chikwendu and Umeji, 1978) is reported on the amended Figs. 55 and 56. Such additions are made on Isaac's three maps in taking account of the relative relevance of the criteria which usually warrant the definition and the selective record of sites as valuable (cf. Chapter One, Section 1.2.2). All these amendments are tentatively made with the good hope that advances in on-going or/and future investigations in Ajibode, Ugwele-Uturu areas or/and elsewhere in the entire West Africa will lead to get more conclusive results.

Concerning the end of the Acheulian patterns and the advent of the MSA lifeways in Africa on the whole, Isaac (1995: 245-247) concluded, after balancing the pro and con of the implications of the published radiometric dates, that the Acheulian industries went out of use before or during the time span between 100,000 and 70,000 BP, and that fully characteristic MSA industries extended back at least to 50,000 BP. Some MSA local craft patterns are said to extend at least to the time of the high sea level associated with the Last Interglacial some 70,000 years BP, while in Ethiopia MSA industries are accepted to be earlier than 150,000 BP.

In addition to the editorship of the entire book containing the assessments respectively made above by Isaac (1995), Butzer and Cooke (1995), Clark authored a contribution focussed mainly on "The cultures of the Middle Palaeolithic/Middle Stone Age" (Clark, 1995: 248-314). The statement is illustrated by two complementary maps covering respectively the northern and southern half land mass of the continent (Clark, 1995: 257, fig. 4.2; p.285, fig.

TABLE 26: CHRONOLOGY OF THE MIDDLE PALAEOLITHIC/MIDDLE STONE AGE INDUSTRIES (AFTER CLARK, 1995) WITH MODIFICATION (BASED ON ANDAH, 1978; 1979d; SHAW AND DANIELS, 1984)



4.7). On the mapped northern part, Asokrochona and Adrar Bous are the only recorded as West African sites to have been referred to in the text. For the purpose of clarification such as that emphasized in both our Chapter One (Section 1.2.4) and Chapter Five (Section 5.5), Clark (1995: 248) synonymously defined the 'Middle Palaeolithic'(MP) and 'Middle Stone Age' (MSA) as: "(...) that part of the prehistoric cultural record that follows the Lower Palaeolithic or Earlier Stone Age, and precedes the Upper Palaeolithic or Later Stone Age (...)".

Acknowledging that the term MP is the current one used for North Africa and that of MSA for south of the Sahara desert, Clark (1995: 316-317, fig. 4.15) has chronologically framed the MP/MSA as shown on Table 26, and has subsequently explained that (Clark, 1995: 252-253):

> (...) its first appearance more than 100.000 years ago during the Last Interglacial (Eemian), in Africa a time of somewhat increased rainfall, warmer climate, and transgressive sea level, and the possibility exists that the beginnings of Middle Stone Age technology may be nearby 200 000 years old (...). The evidence comes both from northern Africa and from southern Africa. The latest assemblages that are essentially Acheulian in character, having, that is to say, a significant proportion of hand-axes and/or cleavers of Acheulian type, appear to date from between 200 000 and 100 000 years ago and, (...) by 100 000 years ago the Acheulian Industrial Complex had everywhere been replaced by specialized flake industries of Middle Palaeolithic/Middle Stone Age type that sometimes used also various new forms of 'heavy-duty' equipment (...).

As clearly emphasized by Butzer (1994) and Gamble (1986) (cf. our Chapter One, Section 1.2.3), and shown on Table 26, the temporal change, succession and variation of technological knowledge and know how, as well as the spatial traditions of lifestyles, had to do with environmental, demographic and cultural determinants which led to adjust or innovate sheltering and subsistence strategies. Amongst these determinants are the sufficient and permanent availability of water, faunal and floral resources, the ratio between size of habitats and density of human groups, the adjacent, close or far location of tool and ustensil processing raw materials, the security and defence potentials etc.. The interaction of such determinants led to long-term processes of regional diversification during the Stone Age times. As a consequence, seven major and specific MSA/MP regions are considered to have emerged (Clark, 1995: 256-315) as these are: (1) North Africa (e.g. The Maghrib and the Sahara, Northern Libya, the Nile Valley); (2) Ethiopia and the Horn; (3) East Africa, (4) West Africa and the forest/savanna regions of Equatoria, (5) The woodlands and grasslands of South Central Africa, (6) Southern Africa, and (7) Zimbabwe).

What Clark (1995: 286-293) specified as the fourth region (i.e. West Africa and forest/savanna regions of Equatoria) is not fully illustrated (cf. Table 26). Indeed, well-known and valuable West African "Late Stone Age/Upper Palaeolithic" Sites such as Iwo Eleru in the Guinean zone (Shaw and Daniels, 1984) and Rim I (Andah, 1978) in the Sahelo-Sudanic zone are omitted, with disregard to the appropriate mention of contemporaneous sites in the Maghrib, Cyrenaica, the Sahara, the Nile Valley and the Equatoria. Accordingly, this Table

26 has been amended in order to incorporate Iwo Eleru and Rim I Sites into Clark's scheme of correlation.

The Bight of Benin land portion, as our macro-scale case study area within the broader African context of the Guinea Region, is part of the above MSA/MP specified "West Africa and the forest/savanna regions of Equatoria". These latter forest/savanna regions are accepted as including (Clark, 1995: 286) Lake Victoria basin, west of the Rift, the whole Congo basin, the Zambezi drainage and the savanna and forest lands of West Africa. Such vast regions are today characterized by a flat topography (150-610m), a vegetational patterning of woodland savannas, mosaic forest or evergreen forest (Figs. 1 and 3, in Section 2.2 of Chapter Two). During much of the Upper Pleistocene, a large part of the region had to be subjected to considerable drying and cooling alternating climates due to the cross-influence of the south Atlantic wind systems, the northward extension of the cold Benguela Current into the Gulf of Guinea in relation with the expansion of the Antarctic ice sheet coincident with the high-latitude/European Würm Glaciation.

The processes and effects of such long-term changes in the environmental setting have been discussed earlier in both Chapter Two (Sections 2.3.1 and 2.3.2) and Chapter Three (Sections 3.1.1 and 3.2.1). Amongst other effects, the alternating expansion and contraction of the latitudinal vegetation belts have been pointed out, from the coastal areas to the present Sahara desert, and vice versa. From such Upper Pleistocene environmental changes were derived the Holocene and present environments. The presence of hand grindstones (i.e. pounder and grinder) and nut-cracking stones at some MSA Transvaal, Zimbabwean and Zambian sites in macro-scale savanna habitats might be considered as a good indicator of increasing collection of grains and hard seeds in the subsistence strategies (Clark, 1995: 326).

Where natural long-term preservation is possible in sub-Saharan Africa, MSA occurrences of macro-scale, medium-scale, or/and micro-scale habitats are associated with faunal remains predominantly of medium-sized species. There also are remains of some giant forms such as horse (Equus capensis), alcelaphine (Magabotragus sp. or Alcelaphus helmei), wild-beest (Connochaetes grandis, or Connochaetes sub-sp), buffalo (Pelorovis antiquus), an exctint springbock (Antidorcas bondi), giant wart-hog (Stylochoerus sp.) and others including large antelope or giant eland (Taurotragus derbianus). It is to be noted that species such as buffalo and alcelaphine persisted until about 12,000 years ago. The small game animals that are yielded include amongst others, tortoise (Tustudo sp.), mole-rat (Heterocephalus glaber), hare (Lepus sp.), tree hyrax (Dendrohyrax dorsalis), bush duiker (Sylvicapra sp.), extinct zebra or quagga (Hippotigris quagga quagga) (Clark, 1995: 327).

Genera and species now existing only in the Ethiopian fauna of tropical Africa have their fossil representative at North African Mousterian and/or Aterian occupation sites. These genera and species include medium/large game animals like elephant (Luxodonta africanus) , rhinoceros (Diceros bicornis), hippopotamus (Hippopotamus amphibiusi), giant buffalo (Syncerus caffer) and wild cattle (Caratotherium simum), large zebra (Dolichohippus sp.), Nubian wild ass (Asinus africanus), pig or warthog (Phacochoerus aethiopicus), Barbary sheep or goat (Ammotragus lervia), antelope or bush-buck (Tragelaphus scriptus), dorcas gazelle (Gazella dorcas) (Clark, 1995: 327).

Well-documented and worldwide oldest evidence for the exploitation of sea-foods (e.g. shell-middens) dating to early in the Last Interglacial have been recovered from Southern African coastal sites of 'Sea Harvest' and Saldanha Bay, as well as from the northern coastal site of Haua Fteah (Cyrenaica). Considering that bones of flightless birds such as seals and penguins are common in the food waste, and those of fish and flying sea-birds are either absent or very rare until the beginning of the Later Stone Age, it might be questioned if the MSA groups had not developed subsistence strategy based upon fowling and securing fish (Clark, 1995: 326).

These different lines of arguments emphasized above by Clark (1995) obviously appear as updated consolidation and adjustment of previous views (Clark, 1970; 1980a-b). For instance, while assessing "The Coming and Spread of Modern Man" in Africa since 70,000 BP, Clark (1970: 105-147) referred to a twofold maps of "Possible scheme of population change in Africa" (Clark, 1970, fig. 27). On the first map dated to ca. 50,000 B.C., West and Central Africa are presented as a blank region. On the second of ca. 9,000 B.C., this region of West and Central Africa is presented as occupied by a "Negro Stock". The appearance of "the various subspecies of Homo sapiens" is related to the advent of "New Habitats and New Industries" between 60,000 and 35,000 BP (Clark, 1970: 107-107). The map of distribution of such new tool-kits (Clark, 1970, fig. 21) shows Asokrochona as the solely known amongst the exclusively Sangoan sites in the entire West Africa, as well as in the northern half of Central Africa. Between 40,000 and 30,000 BP another map of distribution of Upper Palaeolithic and 'Middle Stone Age' Industries (Clark, 1970, fig. 30) shows the presence of anonymous sparse "Lupemban and Related Occurrences" in the Guinea Region of West Africa and in the western part of Central Africa. According to Clark (1970: 105-106), from ca. 70,000 to 12,000 BP the settlement patterns of West and Central Africa negatively experienced the long term lowered temperatures related to the drying effects of the subtropical anti-cyclons and the cold Benguela Current. Thus, it is since about 12,000 to 10,000 BP that the rise of temperatures and subsequent more humid climate had favoured the continuous occupation of these western and central regions that correspond respectively to the present Guinea and Congo rainforest lands. As a conclusion of what is emphasized above, Clark (1970: 108) stated that the climatic and vegetational chifts in the early Upper Pleistocene in connection with the intellectual and technological abilities, had an important influence on "Modern Man's" choice of inhabiting in and exploiting his "New Habitats". Another conclusion is the ethnographic inference to the daily diet of African tropical peoples who are nowadays at a hunting and gathering stage of culture, in a view of a better understanding of the respective bulk of the vegetable and meat (Clark, 1970: 76). Thus, in the case study of the Central Kalahari Bushmen (rightly named the Khoisan) and the Hadza (in Central Tanzania), the vegetable foods estimated at 60-80 % of the total food supply exceed the meat (Clark, 1970: 76).

On the basis of another ethnographic inference also focussed on the Khoisan of Southern Africa, Deacon (2001 and 1997) emphasizes "an African archaeological Perspective" on the emergence of Modern Human and the associated cultural transitions and adaptations. Deacon (1977: 320-322) tackles the issues in transitions and adaptations in African cultures in stating that the study of modern peoples' emergence has increased interest in the MSA of the Later Middle to Late Pleistocene in sub-Saharan Africa. According to Deacon (1997: 320), some 200,000 years ago the large bifacial Acheulian artefacts were replaced by MSA half as large regularly formed stone flakes. These very standard flakes and flake blades of $\geq$ 5 cm in length, often made from prepared cores are said to be characteristic of all MSA assemblages (as shown in our chapter Five, Sections 5.2 and 5.3) and a "ready-to-use-technology" (Deacon, 1997: 322), because the preparation of the cores made flakes struck off in predetermined proportions. Thus, hard rock types (e. g. quartz and quartzite in our chapter Five) were used for cores, and the robust edges of derived flakes did not need strengthening by secondary trimming. Secondary trimming was rare and modification of the edges was frequently damage caused by use (Deacon, 1997: 322). In terms of lifeways in Southern and Eastern Africa, LSA technology associated with "bow-and-arrow hunting" is estimated to have started since 23,000 years ago, and the retouched points were an indication of both importance of hunting and relative richness of large-mammal faunas. Notched sides of flakes were used for working hard materials such a woods for shafts, and for possibly digging sticks and spears, whilst scrapers were aimed at preparing skins for garments (Deacon, 1997: 322).

Such lines of arguments are later and broadly emphasized as an African based and oriented archaeological perspective on the emergence of "Modern Human" (Deacon, 2001). As a summary of this latter analysis, Deacon (2001: 213) claims that the dependency of the African population expansion between 130,000 and 60,000 years ago was due to the then prevailing environmental changes in the middle and low latitudes due to orbital forcing. So, it is only after 60, 000 years ago that the population in the higher latitude of Eurasia is said to have expanded, partly in association with the spread of modern humans of Upper Palaeolithic. Therefore, the Upper Palaeolithic is regarded as not to be the earliest evidence for "modern symbolic behaviour" because such behaviour was evident at the beginning of the Late Pleistocene in the MSA of Africa (Deacon, 2001: 213-214).

Concerning the palaeo-environmental impact on the population history of the continent, Deacon (2001: 214) points out that aridity has been the major limiting factor for the distribution and the densities of the settlement patterns, and that generally aridity corresponded to global glacial periods and pluvials to interglacial periods. Subsequently, Deacon (2001: 215) specifies that Last Interglacial (140,000 to 118,000 years ago) was a period of maximum humidity only paralleled in the Holocene; while the warmer stadia at 103,000 and 84,000 years ago were less pronounced humid peaks. In Northern Africa, the test that such pluvials were periods of population expansion is archaeologically evidenced by the *main* MSA occupation at Bir Tarfawi Site in Southwestern Egypt. There, the distribution of early modern humans occurred between 140,000 and 65,000 years ago. Until the end of the Pleistocene, there was no human occupation. This is one of the driest places on the earth and it is habitable only at times of population expansion (Deacon, 2001: 215). South of the Sahara, in Southern Africa, most of the well-studied and dated MSA sequences represent occupation in the Last Interglacial or the first half of the Late Pleistocene (e.g. Howiesons Poort as a horizon marker dated at 70,000 years ago from Zimbabwe to the Cape). These sequences also show that end-Pleistocene and Holocene presented occupations on a more substantial scale (Deacon, 2001: 215). In East Africa

(Deacon, 2001: 215), the beginning of the MSA is evidenced from Kapthurin Formation in northern Kenya (dated to 250,000 years ago). Other MSA occurrences are evidenced in Ethiopia at Gadamote (181,000 years ago), in Tanzania (129,000 years for the Ngaloba Beds), in Democratic Congo at Katanda (90,000 years) and in Kenya at Enkapune Ya Muto (≥ 46, 000 years). For the rainforest zone and its margins in Central and West Africa, archaeological visibility is said to be yet low, recorded Acheulian, Sangoan and MSA sites not adequately dated, and transition from the Acheulian to the MSA equated with poorly defined Sangoan (Deacon, 2001: 215).

On the "Emergence of Modern Bahaviour", Deacon (2001: 217-219) affirms that the archaeological markers of the European Upper Palaeolithic such as specialised stone tools, bone artefacts, personal ornaments and art cannot be taken as universal markers for the recognition of the emergence of symbolic bahaviour everywhere. For this reason, he warns against the current African based/oriented search for the roots of the Upper Palaeolithic that predated the European evidence. Amongst these African antecedents of the "eurocentric symbolic revolution", Deacon (2001: 217) mentions the threefold evidence of: (a) blade production at 250,000 years ago (Kapthurin Formation); (b) association of ochre, bone harpons, equipment for catching spawning fish and marker of nuclear family pattern at 90,000 years at Katanda Site; and (c) microlithic formal stone tools, ochre and beads of before 50,000 years at Enkapune Ya Muto, considered as horizon marker of transition from MSA to LSA in Tropical Africa.

On the contrary to such 'eurocentric' research perspective, Deacon (2001: 218) suggests to search for distinctive attributes of "modern behaviour" through African centred inference from the Ethnographic Present to the Holocene and the Pleistocene Behavioural Archaeology. For instance, in the Southern African context such ethnographically-oriented approach is viewed as aimed to include: (a) family basis, to foraging groups with mechanisms for aggregation and dispersal; (b) individual hearths possibly for reproductive woman and for formal living space; (c) active hunting of all size of bovids and management of plant food resources; and (d) colour symbolism and reciprocal exchange of artefacts. The relevance of this methodological suggestion is referred to MSA peoples' behaviour at Kkasies River main Site that is dated between 120,000 and 60,000 years and shows evidence of multiple short-term occupations marked by hearths, stone artefacts, shell middens and faunal remains. In the site's area, there is evidence of similar formation processes and contexts of LSA sites, with the presence of red ochre. The current use of red ochre in rites of passage is seen as meaningful for this approach (Deacon, 2001: 218).

With regard to his entire African Archaeological Perspective on the Emergence of Modern Human Behaviour, Deacon (2001) emphasizes the following conclusions:

(i) that Southern Africa is "(...) a remote cul-de-sac(...), a unique situation where continuities traced over an extending time (...)" so, there is a high level of genetical and cultural continuity between early modern peoples in the Late Pleistocene and recent population (Deacon, 2001: 219);

(ii) that MSA foragers like those in the LSA were eurytopic and able to occupy all positions in the landscape, while Acheulian archaic groups were stenotopic and occupied a narrow ecological niche (Deacon, 2001: 219);

(iii) that in the different contexts of Africa, behaviour in the Middle and Later Stone Ages shows continuity and similarities in site formation processes, and in the distribution of sites in all landscape positions denoting eurytopia (Deacon, 2001: 220);

(iv) that the African MSA to LSA transition, unlike the European Middle to Upper Palaeolithic transition, did not signal population replacement or a quantum change in behaviour. Early Modern Humans of the MSA, like the peoples of the LSA, were modern in their bahaviour (Deacon, 2001: 220).

6.2. THE BIGHT OF BENIN REGIONAL PERSPECTIVE ON THE SETTLEMENT PATTERNS AT AJIBODE MSA SITES

As shown in the precedent Section, statements made by Butzer and Cooke (1995), Isaac (1995), Clark (1970; 1995) and Deacon (1997; 2001) at the African continental scale, have specifically and complementarily emphasised less the evidence or potentials than the problems of the Late Acheulian, MSA and LSA settlement patterns in the Guinea Region of West Africa. Before their statements, earlier studies centred on West Africa were devoted to the same research topic (Davies, 1964; 1967; Shaw, 1976; 1992). Following or critically assessing these earlier studies, further investigations are conducted with a view to more emphasizing aspects of the last-waiting problems (Wai-Ogosu, 1970; 1973; Andah, 1978; 1979a; 1987; 1993; 1995a-b-c; Allsworth-Jones, 1981; 1987; Anozie, Chikwendu and Umeji, 1978; Opadeji, 1998).

The present Section, as well as Sections of the precedent Chapters, is not intended to focus on the history of Stone Age Settlement patterns in the Guinea Regional context of the Bight of Benin as geographically demarcated in Chapter One (Section 1.3.1) and Chapter Two (Section 2.1; Fig.1). As specified in the research aims and objectives in Chapter One (Section 1.1), the study is intended to characterize the MSA settlement patterns at Ajibode Lower Terrace Sites in the context of the Bight of Benin. As shown above in the precedent Section (Deacon, 2001; Clark, 1995), the characterization of such settlement patterns requires the presence of faunal and floral fossil evidence in order to understand the lifeways of the site's inhabitants. Up to date, these organic data that serve as direct evidence have been usually absent from the stratigraphic context of the Stone Age Sites in the Bight of Benin Region. Thus, the relevant identification of the occupants' subsistence-settlement lifeways has not been possible. In addition, the radiometric dating of the natural and cultural sequences of the uncovered Acheulian, MSA and early LSA open air sites has not been possible too. The only exception has been the early-Holocene-old Rockshelter Site at Iwo Eleru in Southwestern Nigeria (Shaw and Daniels, 1984). Consequently, the sites are generally given a relative age by indirect and always questionable methodological procedures. Often the morphological characterization of the artefact assemblages is referred to as a hypothetical chronological indicator by some, or simply accepted as a more reliable 'fossile directeur' by others. It is well-known that many field Stone Age archaeologists strongly disagree with such a procedure of reference to a somewhat 'artefact marker' in dating sites' sequences, even in terms of relative chronology. Some of the criticisms are emphasized in Chapter Two (Section 2.3.1). Amongst others, Shaw (1970: 16-17) warned against such dating procedure as a dangerous circular argument. Andah (1979b: 19-20; 1995a) not only warned against this dating method but also against another method that consists of referring to lateritic formations as reliable chronostratigraphic markers of ancient land surfaces. The absence of primary sedimentary contexts at these sites, except in the lacustrine and rockshelter sequences, is generally accepted as a core problem for the stratigrahic contextual analysis, interpretation and dating (Andah, 1995a; Tubosun, 1995: 7-30). As emphasized in Chapter Four (Sections 4.1; 4.4 and 4.5), these problems that obscure or/and obstruct the adequate interpretation and dating of open but not lacustrine deposits in the Guinea Region of the Bight of Benin, are all present at Ajibode Lower Terrace Sites too.

In view of such methodological handicaps, the most expressive of the previous known studies from the Late Acheulian to early LSA settlement patterns are taken into consideration for an appropriate interpretation of the specific MSA patterns at Ajibode Sites. Davies (1964: 94-137) attempted this kind of study in the seventh Chapter of his book devoted to the Quaternary of the Guinea Region Coastlands. In Chapter One (Section 1.2.4) and Chapter Five (Section 5.4.1), the terminology and lines of arguments that he (Davies, 1964; 1967) used are emphasized as presenting ambiguities that have to be cautiously referred to. On the "Palaeolithic Industries", Davies (1964: 83-97) firstly emphasised the Earlier Stone Age technologies till the "Late Acheulian" that he located along the "Atacora-Akwapim Range". This "Late Acheulian" is said to consist of well-made long hand-axes, long and small cordiform ovates flaked at the butt, and cleavers (Davies, 1964: 94). Davies (1964: 98-107) then presented the "Early Sangoan Culture" as to follow the precedent stage, and as a culture which most characteristic tools are heavy picks, biface or sometimes uniface, made preferably on a large pebbles of which the butt was unflaked. The archaic technique of stone on stone was used, giving a sinuous edge. These picks are said to be intended for digging both game-traps and tubers. This early Sangoan culture is said to be used to respond to the aridity in pressing into wooded areas (e.g. gallery-forests) where the Acheulian had flourished. Sangoan culture is said not to be associated with equatorial forest equally said to never be penetrated by primitive man. Sangoan culture must have dispersed widely in regions such as the Natal Coast and West Africa where there had been very little Acheulian occupations. Sangoan is said to imply culture-contact and migration, and to be well represented in Ghana. Like previous immigrants, Sangoan people are said to come down to Atacora-Akwapin Ridge from the Niger and to more widely spread (Davies, 1964: 98-100). Thus, Davies (1964: 94) stated that in Ghana, the Acheulian prior appearance is evidenced by sites located in Northern and Central Dahomey (i.e. Bénin Republic).

Davies (1964: 124-132) then emphasized the "Middle Stone Age of Southern Ghana". This MSA technological stage is said to be "an industry of a most amorphous character" located in the Accra Plains. Such MSA tools are said to be made of sugary textured quartz that flakes very badly and impossible to trim, and to be stratigraphically pre-Mesolithic (Davies, 1964: 124). The preference for sugary quartz is said to give this MSA industry "an air of extreme degenerancy; the typology in quartzite also loses all sense of style" (Davies, 1964: 125).

Drawing illustrations (Davies, 1964: 124, fig. 54; pp. 126-127, figs. 55 and 56) from respectively Legon Botanical Gardens Excavation levels, Tema Terrace and Tema Bend of Main Accra Road, all show quartz and quartzite MSA tools composed of end-scrapers, side-scrapers, picks and miniature picks, points and tanged points, tanged or backed blades, chisels, push-planes, discores, rare choppers etc.. A tentative interpretation of these MSA occurrences was made by Davies (1964: 130; 132). So, slicers are said to be perhaps intended for cutting fish or meat. Picks from stratigraphic position could indicate a continuation of Sangoan traditions. Late Sangoan reminiscences are seen in pebble-picks, miniature-picks and pebble-choppers, all viewed as wood-working tools. Small uniface points which are many could have been rotated as drills, while rare biface points could have been missiles. Finally, the conclusion is that "It is difficult to fix the origins of so atypical a culture as the MSA of Ghana Coastlands'' (Davies, 1964: 130).

In the third Chapter of another book further published on the Archaeology and the Prehistory of Africa before the Europeans' arrival, Davies (1967: 89-146) again emphasized the "Palaeolithic in West Africa" as a period that preceded "The Neolithic" (Davies, 1967: 147-234). The lines of arguments did not change. They consisted of giving more clarification or more emphasis to the precedent arguments. For instance, amongst other clarifications, Davies (1967: 99) specified that it is not possible to subdivide the West African Acheulian on the basis of typological assemblages, because collections have been unmethodical, scaled living sites have not been found, stratigraphic subdivisions only possible in a very few cases, hand-axes and cleavers as the only tools to be identified as presenting forms that were believed by analogy with other regions to be Late Acheulian (e.g. small cordiforms and long lanceolate hand-axes). Davies (1967: 101-104) also specified that between 8° and 12° N, sites on the Jos Plateau that presented fairly clear stratification seemed to be typologically Middle Acheulian, while a more developed Acheulian has been located in the Atacora Mountains in Northern Dahomey (i.e. Bénin Rupublic), and in Southeastern Ghana and Central Togo. Along the Togo-Akwapim Range to the Accra Plains many small cleavers and finely worked hand-axes have been picked up on scattered sites. This latter area is said to show a pattern of distribution of sites which hardly can be classified as Acheulian rather than Sangoan; the two cultures seeming to have arrived in the same climatic cycles and by the same route along the Atacora Mounts from R. Niger. Then, Davies (1967: 104-106) emphasized that the Sangoan Culture belongs to sub-Saharan Africa only, that its heavy picks seem to mark a degeneration from the Acheulian technique, but at the same time the Sangoans are said to possess a well developed Lavallois technique and to be skilled at making smaller and finer tools from cores of Levallois type. Since man cannot degenerate simultaneously over the greater part of Africa, the apparent clumsiness of some Sangoan tools must have been dictated by their function. The Sangoan industry is said to appear unrolled usually in West Africa on the Lower Terraces of rivers. It appears regularly on the lower stone-lines, below the soils, now often lateritized, which accumulated during the Gamblian Pluvial. The Sangoan flourished not later than the end of the pre-Gamblian Interpluvial. In terms of Sangoan lifeways in the Bight of Benin Region, Davies (1967: 116-118) emphasized that they were matched to woodland and waterside habitats, many tools were for woodworking, tool-kit does not suggest open hunting because grassland animals probably became scarce and new sources of food had to be found, traps dug by picks would catch woodland animals going to water not in large herds, presumed practice of some form of river navigation on bundles of reeds or in rudimentary canoes, available fish and molluscs might have been preyed, knowledge of fire must have provided access to an important source of food based on tubers like yams that might be rather indigestible without cooking, cooked or burnt meat would be more digestible too.

Coming to the "Middle Stone Age Cultures", Davies (1967: 127-136) stated that undifferentiated MSA existed from Ghana, Dahomey (i.e. Bénin Republic) and the forest and bush-savanna to the south. It is a small industry of MSA type. Most of the pieces are fairly small, often of fine-grained stone, pebbles were sometimes used, some discoidal and pyramidal cores occurred. The main characteristic tools were tanged points and scrapers, several were broken horizontally, which would suggest that the points were used not as weapons. In addition, they were blunted at the end and showed wear along the edges; therefore they are presumed to have been rudimentary drills. Uniface or partly biface picks and the others listed above (Davies, 1964) occurred also. Davies (1967: 136-143) finally referred to an "Ultimate MSA" that he said to be a culture of mainly MSA affinities with 'Mesoneolithic' influences such as numerous chisels, small burins and perhaps microtranchet arrow-heads. At Legon Botanical Gardens Site, the depth of MSA soil was considerable to lead to define a slight hiatus by which an upper level could be separated from the principal MSA horizon. This upper level might correspond to the Ultimate MSA occupational layer. Many other Ultimate MSA sites were located in Western coastal and inland Ghana with assemblages including small cores, blades and blunt-backed blades, denticulated backed blades, tanged blades, side and end-scrapers, burins, chisels, and slicers which might be precursors of the early Neolithic edge-ground celts (Davies, 1967: 136-140).

The two complementary statements on MSA cultures and associated subsistence-settlement strategies in the Bight of Benin Region of West Africa were made by Davies (1964; 1967) when theories and models of Stone Age Settlement Archaeology were starting to come into their own. The 'Africanist' Archaeology was then dominated by 'Eurocentric' views and concepts, within the general ambit of both the beginning of radiometric dating methods and the ascent of the 'New Archaeology'. As shown in our Chapter One (Section 1.2.3), advances during the 1970s and 1980s, both in the theory and practice of 'New Archaeology', and in the radiometric dating methods, have decisively contributed to meaningful achievements in the Stone Age subsistence-settlement pattern analysis. Consequently, there was progressively a better understanding of the MSA lifestyles as cultural manifestations of the general "Modern Human Behaviour" before 150,000 years ago in the African continent, as shown above (Deacon, 1997; 2001), as well as below (Rightmire, 1987; Deacon and Shuurman, 1992; Masao, 1992; Braüer, 1987; Braüer, 2001a-b; 1994; Braüer and Stringer, 1996; Stringer and Braüer, 1994; Wu and Braüer, 1993).

In view of such methodological developments, Wai-Ogosu (1970, 1973), Andah (1979a; 1993; 1995a-b-c), systematically opposed alternative interpretations and conclusions to those previously emphasized by Davies (1964 and 1967). Between these two demarcated attempts, Allsworth-Jones (1981; 1987) tried to propose some intermediate views which are inconveniently limited to the typological analysis. Subsequently to the overview of these three distinctive standpoints, a multilinear analysis is adopted with a view to tentatively 'modelling' the settlement patterns of the MSA occurrences at Ajibode UMF Site, on the basis of the stratigraphic context analysed in Chapter Four, and the technological and typological attributes described in Chapter Five.

A brief look at the statements made by Allsworth-Jones (1981 and 1987) can allow one to note that they are basically typologically oriented and framed.

This is firstly noted through the title and then the substance of the 1981 "Preliminary Report" on MSA investigations into northern Jos Plateau in Central Nigeria (Allsworth-Jones, 1981: 1-24). After an introductory review of previous works conducted in the middle 1950s and 1960s, the first objective of the study is said to provide full and quantified descriptions of the assemblages so that they can be compared with others elsewhere and assessed in relation to them. With regard to the deficiency of systematic stratigraphic descriptions and illustrations, a second longer term objective is devoted to making good this deficiency (Allsworth-Jones, 1981: 2). The new finds of the reconnaissance carried out in 1976-77 are analysed in "using an essentially Bordean system", and are characterized as "Middle Stone Age industries" similar to the "Middle Palaeolithic character" described by earlier authors (Allsworth-Jones, 1981: 2). Allsworth-Jones (1981: 21-23) concluded that numerous MSA type artefacts have been recorded particularly from Zenabi and Mai Lumba Sites. Artefacts from Mai Lumba are presented as constituting a more standard form of Levallois-oriented Middle Palaeolithic, whereas those from Zenabi are viewed as possessing certain idiosyncratic characteristics. The need for more materials is expressed in a view of comparison with industries known from Bilma Site in Eastern Niger and from Mayo Louti in Northern Cameroun. There is no reference to Davies' (1964; 1967) studies in Ghana for the same purpose of comparison at the West African regional scale.

Compared with this first statement, the second made six years later (Allsworth-Jones: 1987: 87-128) shows peculiarities and deficiencies. The two key peculiarities are on the formulation of the title. First, the topic is focussed on "Earliest Human Settlement". Second, the spatial scope is not West Africa only, but the Sahara desert too. The direct and contradictory reference to Davies (1964; 1967), Wai-Ogosu (1970; 1973) and Andah (1979a) constitutes the third major peculiarity. Through the lines of arguments, there is no emphasis on the usually accepted Stone Age settlement patterns, as shown in the precedent section as well as in Chapter One (Section 1.2.3). So, the title should have been correctly phrased in terms of "Earliest Archaeological" "traces", "evidence", "occurrences", or "phases" (cf. Isaac, 1972). This should be more appropriate as title because of the advanced state of the Stone Age Settlement Archaeology in the 1980s, as emphasized above and in Chapter One (Section 1.2.3). Then, in coupling West Africa with the Sahara, instead of making the couple with Central Africa, the author has adhered to the "Eurocentric" perspective, as rightly emphasized by Deacon (2001) above, and earlier by others (Andah and Bagodo, 1993). The 'Chadian' Australopithecines evidenced successively in 1995 (Brunet, 1998) and 2001 (Brunet, 2001) seem to warrant the anteriority and continuity of the East/West human expansion since before three million years. Such methodological remarks correspond to the key deficiencies of this second study. The absence of at least one illustrative map is an additional deficiency. On the contrary to these deficiencies, the useful reference to sites in Ghana makes more understandable the regional scope. In the specific case of the MSA which our study is mainly concerned with, Allsworth-Jones (1987: 112-122) is of the viewpoint that the dating and contextual evidence are less than perfect and this makes useful and relevant the comparison with the Sahara and North Africa (Allsworth-Jones, 1987: 113-118). More further south, accordingly with Davies (1964) and Nygaard and Talbot (1984), "stratified MSA material above the Sangoan" is located at Asokrochona, Tema West and the Ghanaian Nautical College, all nearby Accra. The MSA sites of Zenabi, Mai Lumba in North Central Nigeria are referred to, as well as the MSA evidence at Mayo Louti in Northern Cameroun (Allsworth-Jones, 1987: 118-121). This survey of the MSA in West Africa and the Sahara is said to show that "the evidence is still comparatively scattered and fragmentary". With regard to the hominids that were associated with the MSA, Allsworth-Jones (1987: 121) once again suggested that evidence for such should be sought for in North Africa but without any prejudice to "recent discoveries in South Africa".

In most of his lines of arguments, Allsworth-Jones (1981; 1987) explicitly disagrees with Wai-Ogosu (1970; 1973) and Andah (1979a). Particularly, the disagreements are emphasized on the Asokrochona Site's occurrences viewed as Sangoan Industry (Allsworth-Jones: 1987: 112) versus Oldowan (Andah, 1979a). Disagreements exist also on the analysis of the stratigraphic context of the site. In any case, the radical difference in this regard is the generally purely typological approach of Allsworth-Jones against the usually multidirectional approach of Andah. Indeed, as early as the 1970s, Andah (Wai-Ogosu, 1970: 642-652) used the ethnographic inference based on the analysis of the "Subsistence ecology of living hunter-gatherer" for the purpose of the "prehistoric studies". Referring to the usually sampled present-day African hunter-gatherers (Parkington, 1996) such as the "Bushmen", Pygmies, Hadza and other "surviving hunting bands", Andah (Wai-Ogosu, 1970: 644) warned against the fact that these foraging peoples have no more choice or chance to independently adopt and adapt their lifeways to variable habitats, since they are forcibly relegated to live in the "worst environments". On the other hand, Andah (1987: 53-85) was of the opinion that in West Africa, the time depth of linguistic inference in archaeological and historical perspectives could go as far as the late Pleistocene and perhaps much earlier (Andah, 1987: 81).

Following and improving such an 'anthropologically-oriented' lines of arguments, Andah (1995b) edited a book titled The Epistemology of West African Settlements. In his editorial emphasis particularly focussed on West Africa, Andah (1995c: 2-6) emphasized that the archaeological and historical records in different ways show very incomplete pictures of peoples' past behaviour. He went further to say that there are several biases and distortions in the settlement histories, and that definitions of basic concepts are usually European rather than

African culture centred. In his opinion, the most appropriate approach is to study settlements in a cultural context approach that is placed in a vantage position to solve amongst the many problems that of "Eurocentric evolutionism". Consequently, settlements are viewed primarily as outcomes of macro-structural or micro-behavioural social processes. The book is conceived to frame respectively the settlement history from earlier populations up to those of the LSA times, the development of complex settlements, the ethnographic insights, and other aspects that can meaningfully match with our research on the MSA settlement patterns at Ajibode in the context of the Bight of Benin Region. In view of this, the book's first chapter focussed on "The Earliest Human Occupation and Settlement in West Africa" (Andah, 1995a: 8-33). First and foremost, Andah (1995a: 9) in disagreement with Allsworth-Jones (1981; 1987) and Clark (1970; 1980a-b), suggested that the over-emphasis on typology and technology, as well as the correlation of few representative artefact types present in an area should be abandoned in preference to well defined industrial entities present elsewhere. On the basis of the available archaeological evidence in West Africa, Andah (1995a: 10-16) emphasized many problems and subsequently offered some tentative explanations. In view of the rarity of Stone Age sites of primary context as a result of secondary deposition it is usually difficult to draw any significant and meaningful inferences on artefact and associated finds. The sites of secondary context that are common in the Guinea Region are found on the superficial deposits, mainly in the coastal and river valley cuttings. The valley cuttings are prominent and are found in sections of the major rivers (e.g. the Volta in Ghana, the Niger-Benue in Nigeria) and minor watercourses (e.g. the Mono in Bénin and Togo, the Ona in Ibadan Region, the Yamoje in Ajibode area). These sites occur in the southern coastland and neighbourhood, or in the northwards hinterland. For instance, in the Bight of Benin Region, the southern sites are situated at the present-day ecotone zone between the forest and the derived savanna vegetation (e.g. Ajibode in SW of Nigeria and Ugwule Uturu in SE of Nigeria). On the basis of this current location, one would like to know if these sites were located at the earliest or MSA times in the moist lowland tropical forest and of what importance were the river streams or the lagoons? On the contrary to the current locational patterns of these common sites of secondary context, the exceptional sites of primary context are often rockshelter and cave sites (e.g. Iwo Eleru in SW of Nigeria). Outside the Bight of Benin Region, sites of primary context are found in lacustrine deposits (e.g. Air, Adrar Bous in Southern Sahara).

Concerning "The Habitats of the Earliest African Hominid" (Andah, 1995a: 16-20) and the "Social Arrangements and Economic Habits of Early Man" (Andah, 1995a: 20-30), the lines of arguments are mainly focussed on the Early and Middle Pleistocene contexts, and subsequently on the subsistence-settlement patterns of Australopithecus and Homo habilis to erectus. Such concerns and subsequent explanatory emphases are prior to and different from those of the Late

Pleistocene to early Holocene situations to which correspond successively the MSA and early LSA subsistence-settlement patterns and their analysis. For instance, Andah's (1995a: 23) appraisal of "the habitations and settlements of earliest manlike creatures in West Africa" and of "the major early man artefact scatters in West Africa" is related to Asokrochona and "Ajibode high and mid terraces" on one hand, and to "Chadanthropus uxoris (Archaic homo erectus or Australopithecus) ?" on the other. Early Stone Age tool assemblages that include Oldowan and Acheulian are linked with these sites. In view of such occurrences, Andah is right to claim to be dealing with actual "Earliest" human occupations and settlements and associated lifestyles. This evident correlation between a scheme and its subsequent implementation is another line of demarcation from Allsworth-Jones (1987) who deals with the MSA occurrences as part of the "Earliest" Human Settlement. The statements in the 1960s as emphasized in the West African scene by Davies (1964; 1967), and the consecutive debate in the 1970s at the African continental scale level (Isaac, 1972; Binford, 1972a) as lately emphasized by Deacon (1997, 2001), Clark (1995), Issac (1995) and Butzer and Cooke (1995), all obviously are in accordance with Andah's standpoint versus Allsworth-Jones' view. So, are the MSA occurrences at Ajibode Lower Terrace Sites, as technologically and typologically characterized in our Chapter Five, in accordance with Andah and the others referred to against Allsworth Jones, or vice versa ?

The adequate characterization of the MSA settlement Patterns at Ajibode Lower Terrace Sites implies a multilinear analysis based upon: (a) the current statement on the emergence, expansion and characteristic behaviour of "Modern Human" since at least the beginning of the Late Pleistocene up to the early Holocene in sub-Saharan Africa; (b) the Late Pleistocene to early Holocene environmental determinants in Ibadan Region matched to the context of Southwestern Nigeria; (c) the stratigraphic context of the MSA cultural sequence at Ajibode Lower Terrace AJB UMF Site; and (d) the possible subsistence-settlement behavioural implications of the MSA artefact-assemblage from this AJB UMF Site.

The debates or controversies (Stringer, 1992; 1994; Bräuer, 1996; Aiello, 1993; 1996; Oxnard, 1997; Maienschen, 1997; Fagan, 1996) on the period of the emergence, expansion and diversification of "Modern Humans", as well as on their anatomical characteristics and behavioural attributes, became a worldwide concern since Unesco/Inqua Symposium held in 1969 in Paris on The Origin of Homo sapiens (Bordes, 1972b). Since then, two major views emerged viz. the monogenetic and monocentric theory versus the polygenetic and polycentric or multiregional theory. Such debates and controversies are then reflected by publications such as The Origins of Modern Humans. A World Survey of Fossil Evidence Continuity or Replacement (Smith and Spencer, 1987), Controversies in Homo sapiens evolution (Bräuer and Smith, 1992), Origins of Anatomically

Modern Humans (Nitecki and Nitecki, 1994), Aux origines d'Homo sapiens (Hublin and Tillier, 1991), Humanity from African Naissance to Coming Millennia (Tobias, Raath, Moggi-Cecchi and Doyle, 2001) and Conceptual Issues in Modern Human Origins Resarch (Clark and Willermet, 1997).

In short, the two theories or models can be portrayed accordingly with Stringer (1994: 149) as follows:

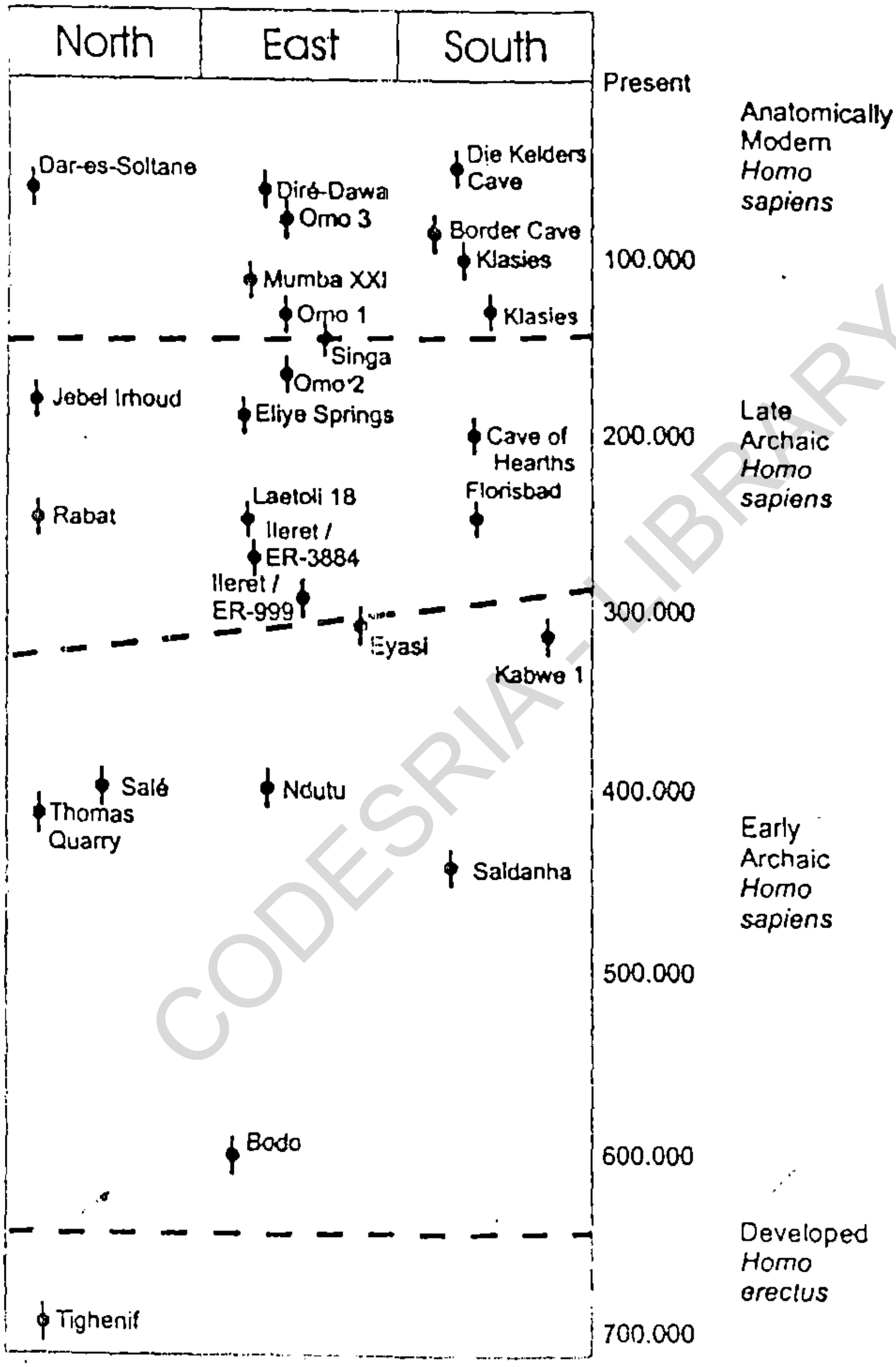
> (...) two evolutionary models dominate current debate about the origins of modern humans. These are the model of multiregional evolution, which traces the origins of modern human anatomy and racial diversity to variation developed over the period 1,000,000 to 100,000 years ago during the evolution of Homo erectus and so-called "archaic Homo sapiens", and the recent African origin ("Out of Africa") model, which argues for an African origin probably within the last 200,000 years, and a subsequent radiation and diversification of early modern humans around the world during only the last 100,000 years (...).

So, according to the specialists who support the model of 'Multiregional evolution' (Wolpoff, 1991; 1992; Bar-Yosef and Vandermeersch, 1991; Smith and Trinkaus, 1991; Wu, 1991; 1997; Bar-Yosef, 1994; 1995; Wolpoff, Thorne, Smith, Frayer and Pope, 1994; Smith, 1992; 1994), local populations of archaic humans in Eurasia (e.g. the Neanderthals in Europe and the Near East) played significant, if not the major, roles in the origins of modern people in their respective regions. In the detail, some of these specialists believe that the basic fundamental modern human anatomy may well have developed in one region (e.g. Africa, Europe or Southwest Asia) and strongly influenced the emergence of this modern anatomical pattern elsewhere. Others, however, claim that such a gene flow did not play particular 'catalytic' role in modern human emergence.

On the contrary, the specialists who favour the monocentric emergence of modern humans (Rightmire, 1987; 2001; Stringer 1991; 1992; 1994; 1995; Bräuer, 1987; 1991; 1992; 1994; 2001a-b; Stringer and Bräuer, 1994; Bräuer and Stinger, 1997; Bräuer, Leakey and Mbua, 1992; Deacon, 1997; 2001; Deacon and Shuurman, 1992; Masao, 1992) have generally pointed to Africa as the most likely source for modern humanity. Amongst them, supporters of 'Out of Africa' model suggest that the transition to modern humans occurred in Africa only. Some views emphasize that the dispersal of the African modern humans throughout the 'Old World' resulted in the replacement of the previous inhabitants (e.g. Eurasian Neanderthals). Other views insist on hybridization during replacement processes, but consider the African influence as the catalyst and major factor in the emergence of modern Eurasians. The 'Out of Africa' model is endorsed by Mitochondrial DNA polymorphism in living human geographic populations (Cann, 1992; Cann, Rickards and Lum, 1994; Lucotte, 1992). But further assessments of the mtDNA phylogenies pointed out some problems and deficiencies as well as prospects (Templeton, 1997; Harpending and Relethford, 1997; Oxnard, 1997).

As an anticipated reply to some of such criticisms to their 'replacement scenario', Bräuer and Stringer (1997) warned against research perspectives that

Table 27 : Updated Scheme of Middle and Late Pleistocene Hominid Evolution in Africa (After Bräuer, 2001b, fig.2)



look "(...) somewhat like a "thicket" of misreadings, polarization, and biases, which instead of clarifying the problems have caused more confusion (...)" (Bräuer end Stringer, 1997: 191).

So, if the mtAND could be seen now as a more or less problematic support to the 'Out of Africa' model, a compensating support is provided by new dating and analyses of previously-known palaeontological and archaeological data, and by new fossil discoveries. This standpoint is recently emphasized by Bräuer (2001a-b), and updated data from Eastern, Southern and Northern Africa are taken into account for illustration as shown on Table 27 (i.e. fig. 2 in Bräuer, 2001b). On the basis of these updated data, the following conclusions are pointed out by Bräuer (2001b: 193-196):

(i) that after "recent dating evidence", the Ileret KNM-ER 3884 cranium and the KNM-ER 999 Guomde femur from Kenya are respectively dated to 272,000/279,000 years and 300,000 years. In South Africa, the Florisbad hominid is dated 259,000 ± 35,000 years. In Tanzania, the Laetoli Hominid 18 cranium from Ngaloba Beds is dated to more than 200,000 years. Thus, these different hominids dated by different methods and different laboratories, point to the presence of a near-modern or late archaic anatomy in Africa between 250,000 and 300,000 years ago. They are followed by early anatomically humans such as the Singa cranium from Sudan dated to ca. 150,000 years, the cranium and post-cranium remains of the Omo Kibish I hominid dated to ca. 130,000 years, the n°41815 mandibule specimen from the SAS member from Klasies River dated to ca. 100,000 years, and the "famous frontal fragment" from this latter site dated ca. 80,000 years (Bräuer, 2001b: 193-194);

(ii) that after backdating "modernization process", in summary, the fossil hominids and the most recent dating evidence clearly indicate that the evolution of modern anatomy occurred relatively early in Africa. Late archaic or near-modern already existed in Eastern and Southern Africa at least 250,000 years ago. This modernization process of sapiens evolution can be traced back to the Bodo cranium from Ethiopia, a specimen of early archaic Homo sapiens dated to ca. 600,000 years that deviated significantly from Homo erectus morphology. Thus, a speciation processus probably occurred ca. 700,000 years ago (Bräuer, 2001b: 194-196);

(iii) that on the "phylogenetic perspectives", finally, with regard to the African sequence into a larger phylogenetic scheme, the speciation process in the continent took place ca. 700,000 or

> 800,000 years ago between Homo erectus and archaic Homo sapiens, followed by more or less gradual evolution to anatomically modern humans; whereas in Europe the evolution led from Ante-Neanderthals to Neanderthals. However, the situation for Africa seems to be more difficult because the late archaic Homo sapiens group is already quite close to anatomically modern humans. In such a scenario, Homo sapiens should be regarded as including not only the anatomically modern humans, but also the late archaic Homo sapiens. On the other hand, it appears rather difficult to clearly distinguish early from late archaic Homo sapiens in Africa on a species or paleospecies level. Thus, it is more plausible to consider the African sequence over the last 600,000 years as a rather gradual evolution of our own species, Homo sapiens (Bräuer, 2001b:196).

In the precedent Section as well as above in this current Section, West Africa generally and the Guinea Region particularly, have appeared as more or less archaeologically blank during the Lower and Middle Pleistocene. The palaeontological picture in the Middle and Late Pleistocene has just shown a no-controversial gap. In the Guinea Region of the Bight of Benin, until date, only a skull fossil of the end of the Late Pleistocene is revealed at Iwo Eleru LSA

Rockshelter Site in Southwestern Nigeria (Shaw and Daniels, 1984). Northwards in the Chadian Basin, since the mid-1990s, Late Miocene to Middle Pliocene stratigraphic contexts have yielded Australopithecus respectively dated to 6 and 3 million years (Brunet, Beauvilain, Coppens, Heintz, Moutaye and Pilbeam, 1995; 1996; Brunet, Guy, Pilbeam, Mackaye, Likius, Ahounta et al., 2002; Wood, 2002). So, there is a provisional palaeontological gap over the Pleistocene times. With the possible good will of filling such a gap on the molecular biological basis, Langaney (1988: 162-163) earlier claimed that only some time before 25,000 years ago, has started the occupation of "Black Africa" (i.e. sub-Saharan) by Modern Humans, and such a modern peopling should have specifically started in Central and West Africa around 8,000 years ago. Such a viewpoint is to be confronted with Bräuer's and Stringer's (1997: 191) warning already referred to above in this section. In any case, years before Langaney's (1988) claim, Iwo Eleru Modern Man was already known and accepted as dated to 11,200 ± 200 BP (Shaw and Daniels, 1984: 7). There is the good hope that future improvement and intensification of research methods will help to adequately fill the last-waiting gap. In view of such positive developments, the past and present Quaternary environmental determinants have to be appropriately taken into consideration. In our case study of the MSA settlement patterns particularly the Late Pleistocene to Early Holocene environmental determinants have to be taken into account, with due reference to Ajibode Lower Terrace Sites in the Ibadan regional context of Southwestern Nigeria. The constituents of these specific environmental determinants are at once topographic, geologic, climatic, vegetational and faunal, as well as each and all are referred to above in appropriate chapters and sections.

In our Chapter Two (Section 2.3.1), Petters (1991: 647) emphasized that in West Africa the present geomorphic and climatic setting is the base line against which to assess the Quaternary palaeogeographic and palaeoclimatic features. In other words, the present physical geographical setting generally is not radically different from the past Quaternary physical and climatic features. So, in our Chapter Three (Section 3.2.1) AJB UMF Site lithostratigraphic sequence is related to the Orita Member of the Bodija Formation, and the sequence consequently characterized in Chapter Four (Sections 4 and 5) as a secondary contextual redeposition that is not (yet) datable. In addition, it is emphasized above in the present section accordingly with Andah (1995a), that these lithostratigraphic characteristics are not peculiar to the AJB UMF Sequence of the Bodija Formation. Everywhere at Olude Araromi Sequence (Andah and Ajayi, 1981), Bodija Railway Cutting Sequence (Burke, 1970; Burke and Durotoye, 1970; 1971; Andah, 1979a-b) and Asejire Sequence (Oyenuga and Ozanne, 1968), the Bodija Formation shows the same picture that is basically similar to that at Ajibode. In view of this dating problem, the present stage of knowledge does not provide any definitive information on the age of the Quaternary superficial deposits that constitute the Ajibode and other sequences of the Bodija Formation. The broadly palaeoclimatically inferred relative chronologies have shown their actual limits of validity, as previously emphasized by others (Davies, 1964; 1967; Shaw, 1970; Andah, 1979b; 1995a; Andah and Ajayi, 1981; Tubosun, 1995), as well as in our Chapter Two (Section 2.3), Chapter Three (Section 3.2) and Chapter Four (Sections 4.1; 4.4 and 4.5). With regard to such a problematic situation, how to emphasize the Late Pleistocene to Early Holocene environmental determinants in view of relevant analysis of the MSA Settlement Patterns at Ajibode? Is it possible to do so in successfully avoiding any kind of palaeoclimatic inference? Or is it possible to selectively involve in a due consideration of local evident reflectors or indicators of the worldwide established "Astronomical Theory" as shown in our Chapter Two (Sections 2.3.1 and 2.3.2)? This latter option seems to be the best amongst the alternatives that are possible and relevant. In involving in such a methodological alternative, two categories of determinants can be taken into account, viz. the Ajibode "on-site" reflectors and the Bight of Benin regional indicators.

The first of the "on-site" reflectors obviously is the terracing levels at Ajibode. This is a tangible remnant feature of past fluviatile processes. The AJB UMF Site is located on the third, recent and lower terrace at more or less 195 m a.s.l., as emphasized in Chapter One (Section 1.3.4) and Chapter Four (Sections 4.1 and 4.2). Sedimentological analyses from Ajibode's samples emphasized in

Chapter Four (Section 4.4) indicate similarities with Orita and Agodi Members of the Bodija Formation. The entire Bodija Formation is presented by Burke (1970) and Burke and Durotoye (1970; 1971) as a Quaternary superficial deposit; whilst its Orita Member is said to be of Holocene age, the Agodi Member of Late Pleistocene age and the Kongi Member of later Middle Pleistocene to earlier Late Pleistocene age (cf. Table 3 and Fig. 14 in Chapter Three). This AJB UMF Lower Terrace as well as the Middle Terrace at ca. 210 m a.s.l and the Upper (older) Terrace at ca. 215 m a.s.l fit with the current topographic setting matched to River Ona drainage system to which belongs Yamoje stream (cf. Fig. 13 in Chapter Three). This topography made of hills, plains and valleys, also appears as an "on-site" reflector with which the Bodija Formation lithostratigraphy shares the same Quaternary morphogenetic changes.

The peculiar problem of total absence of organic fossils that could provide the necessary chronometric dates for the local palaeoenvironmental reconstruction at AJB UMF Site could possibly be compensated for by making tentative chronometric inferences using palaeoclimatic indicators from the Bight of Benin from the Late Pleistocene to Early Holocene. The first of such indicators is the Holocene vegetational history established by recent palynological investigations in the Dahomey Gap Scrub (Tossou, 2002). As shown in Figs. 4 and 5 in Chapter Two, this recent palynological research has reconstructed the local vegetational history from the Middle Holocene to Present (Tossou, 2002: 106-115). The time span implied ranges successively from 7,500 BP to 2,500 BP (Middle Holocene) and 2,500 BP to Present (Late Holocene). This vegetational history is evidenced on the basis of pollen analysis on sediments from four cores in Southern Bénin Republic which corresponds to the eastern central part of the Dahomey Gap Scrub. The results are as follows (Tossou, 2002: 108-110): (a) during the Middle Holocene (7,500 to 2,500 BP), the study area was covered by mangrove forest, swamp forest and semi-deciduous forest. The rainforest was continuous from the western to the eastern hinterland of the Gulf of Guinea as shown in Fig. 4 (i.e. fig. 28 in Tossou, 2002: 109). The West African Vegetation is said to be then affected by marine transgression and extended forest cover; (b) during the Late Holocene (2,500 BP to Present) the mangrove had disappeared, all the other types of forest had regressed, and an open vegetation such as savanna and meadow had been established. This sudden change of the vegetation is related to climatic fluctuations including rainfall shortage, while the Human impact is said to be waiting for further appropriate emphasis. Such vegetational changes are said to have happened in the entire Dahomey Gap as shown in Fig. 5 (i.e. fig. 29 in Tossou, 2002: 110). In short, the scenery at the beginning of the Middle Holocene can meaningfully help to retrospectively throw light on the Early Holocene, period with which the end of the MSA Settlement Patterns is concerned. In this view, the environmental interpretation of a previous LSA research conducted northwards, but not far from Ajibode area, has to be complementarily referred to (Shaw and Daniels, 1984).

The research site is Iwo Eleru Rockshelter located at 7° 26' 30"N and 5° 7' 40"E in Southwestern Nigeria, some 24 km from Akure (Shaw and Daniels, 1984: ix-x). The excavation carried out from 4 February to 19 May 1965 provided six radiocarbon dates that timely range between 11,200 ± 200 and 3,465 ± 65 BP (Shaw and Daniels, 1984: 1-7). The finds which consist of LSA assemblages, pottery, bones, shell and botanical data also include one human skeleton's skull, mandibule and bones dated to 11,200 ± 200 BP after a charcoal collected from around (Shaw and Daniels, 1984: 8-31). The analysis of the data showed that the present forest zone of Southwestern Nigeria was continuously inhabited by 'Negroid' "Modern Humans" at least since 12,000 BP. A tentative palaeoenvironmental interpretation (Shaw and Daniels, 1984: 45-51) indicates that the beginning of subsistence-settlement patterns at Iwo Eleru coincided approximately with the end of the 'Ogolian Aridity' and the beginning of subsequent wet period. At the height of this aridity the site would have been in savanna context. Were the then involved subsistence-settlement strategies aimed to exploit the newly re-established forest or the wetter savanna (more likely)? Palynological evidence is viewed as to unequivocally lead to accurately and precisely date this local changes from savanna to forest conditions. Nonetheless, it is hypothetically emphasized that even nowadays there is no real frontier between forest regions and savanna regions, but a gradual change from forest with patches of savanna and vice versa, and more a spread of forest trees from scattered local refuges than the commonly accepted long-distance expansion from wettest parts. For future research, Shaw and Daniels (1984: 76) were of the opinion that the "Site catchment analysis" approach will be able to reveal the likely patterns of food resources. Finally, all "speculations" (Shaw and Daniels, 1984: xiv) depend on the assumption that the boundaries between the different vegetation zones did not change for the last 12,000 years. Thus, as it is the case nowadays, the environmental context of the end of the MSA subsistence-settlement strategies and lifestyles at Ajibode could be similar to those of the post-Ogolian wetness at Iwo Eleru. In view of such a probable similarity, what could have been the background situation at Ajibode since the beginning of the Last Interglacial around 130, 000 BP?

Amongst the relatively recent studies that could meaningfully help to answer such a question is the one that is specifically focussed on the vegetation history of the Dahomey Gap in relation to the Guinean and Congolian lowland rainforest and its environs during the last 150,000 years (Dupont and Weinelt, 1996). The study is based on pollen and spore samples from a 2860 m deep-sea core at site GIK 16856 (40° 48'N and 3° 24'E), west of the Niger Delta and south of Lagos, in the Bight of Benin. The emphasis is that this tropical lowland rainforest was uninterrupted in West Africa from Guinea Republic to Cameroon Republic during the Last Interglacial and the Early Holocene, and the Dahomey Gap "savanna" existed and separated the Guinean and Congolian parts of this rainforest during the other periods of the same time span. In summary, this standpoint correlates the six distinctive Isotope Stages with inferred palaeoenvironmental changes as follows (Dupont and Weinelt, 1996: 280-287):

(i) Isotope Stage 1: Since 12,000 BP to Present. During the Early and Middle Holocene, high precipitation and high sea level occurred, as well as mangrove swamps' extension. The lowland rainforest had its largest extension and the Dahomey Gap most probably did not exist;

(ii) Isotope Stages 2 to 4: From 12,000 to 74,000 BP. Except Podocarpus forest expansion in the mountains and strong expansion of mangrove swamps parallel to sea-level rise at the end of Stage 2, generally little fluctuation is shown. Sea levels, precipitation and Niger discharge were low. Mangrove swamps and rainforest areas were very reduced. The Dahomey Gap was wide, and the savanna and woodland were extensive;

(iii) Stages 5a to 5d: Between 74,000 and 115,000 BP. There was a few change of sea-level parallel to a reduction of mangrove swamp. Lowland rainforest was still widespread. A narrow Dahomey Gap separated the Congolian from the Guinean rainforest. Woodland taxa expanded during Stages 5b and 5d, as well as mountainous Podocarpus forest in Cameroon and, possibly, in the highlands of Nigeria;

(iv) Stage 5e: From 115,000 to 130,000 BP. Strong change of the environments, parallel to the latter Stage 1. There were high sea-level and expansion of mangrove swamps, high precipitation, and increased fresh water discharge and extension of the rainforest along the northern border of the Gulf of Guinea; and

(v) Late Stage 6: At the end of the Middle Pleistocene before 130,000 BP. There were low sea-level and few or small mangrove swamps along the Niger Delta. Both lower sea surface temperatures and precipitation restricted the rainforest and expanded the savanna and open woodland. The Dahomey Gap must be large.

6.3 SCENARIO OF AJIBODE MSA SETTLEMENT PATTERNS, SUGGESTIONS AND CONCLUSIONS

6.3.1 Scenario of Ajibode MSA Settlement Patterns

The wet or humid palaeoenvironments in the Bight of Benin as emphasized by Dupont and Weinelt (1996: 286) at Isotope Age 1 (i.e. Early to Middle Holocene) and Isotope Age 5e (i.e. Late Interglacial), are similar to those presented by Tossou (2002) from the Early to Middle Holocene, as well as to what Shaw and Daniels (1984) referred to as a post-Ogolian wetness. These different standpoints are in accordance with what Sowunmi (1993: 14-15; 1998: 68-71) emphasized (cf. our Chapter Two, Section 2.3.1) as "wetter conditions" (12,000 to 10,000 BP) and an expansion of "Rhizophora swamp forest" (8,000 to 5,000 BP) that followed an "Ogolian regression" (24,000 to 12,000 BP). According to Dupont and Weinelt (1996: 280-287), during the last 150,000 years the other successive Isotope Stages 2 to 4 and 5a to 5d (between 12,000 BP and 115,000 BP) were matched to drier or less humid palaeoenvironments. Specifically, from Isotope Stage 2 to 4 (12,000 to 74,000 BP) the savanna and woodland were extensive and the Dahomey Gap Scrub was wide; while from Isotope Stage 5a to 5d (74,000 to 115,000 BP) the lowland rainforest was still widespread, the woodland expanded and the Dahomey Gap was narrow. At the late Isotope Stage 6 that corresponded to the transition from the end of the Middle Pleistocene to the beginning of the Late Pleistocene i.e. before 130,000 BP to 150,000 BP, the lowland rainforest was restricted while the savanna and open woodland expanded, and the Dahomey Gap was consequently large.

Thus, the alternating presence versus disappearance and expansion versus restriction of the Dahomey Gap Scrub during the last 150,000 years (Dupont and Weinelt, 1996; Tossou, 2002; Sowunmi, 1993; 1998) appear to be a reflection of alternating drier to wetter palaeoenvironmental conditions. According to Deacon (2001: 214), amongst the palaeoenvironmental determinants in the tropical Africa, aridity has the major limiting impact on the general population history, and subsequently on the distribution and densities of subsistence-settlement patterns. Some Physical Geographers (Whittow, 1984: 37; George, 1974: 23) are of the opinion that a climate that has no sufficient precipitation (less than 250 mm of annual rainfall) to support vegetation could be defined as arid and it is emphasized a difference between climates that are hyperarid (with occasional rainfalls after more than one year of dryness), arid (with yearly occasional rainfalls), semi-arid (with seasonal rainfalls) and subhumid (with seasonal dryness, but permanent watercourses and groundwater). Since the last 150,000 years, hyperarid to arid palaeoenvironments are not evidenced in the Bight of Benin Region (Dupont and Weinelt, 1996). Even during the drier Isotope Stages 2 to 4 and Late Isotope Stage 6, the subhumid to humid vegetation such as savanna and woodland were extensive. During these drier Isotope Stages, the Dahomey Gap became wider. Presently, the Dahomey Gap Scrub as characterized by subhumid environmental conditions with extensive savanna and woodland is suitable for subsistence-settlement patterns. The past vegetational picture since 2, 500 BP does not seem to radically differ from the Dahomey Gap current environments. As highlighted in Chapter Two (Section 2.2.1), such a comparison is tentatively attempted in the Accra Coastal Plain by Nygaard and Talbot (1976: 13; 1984: 19-20) both of whom emphasized a current 732 mm mean annual precipitation matched to a vegetation of dry savanna on the contrary to a suggested mixture of open grassland and thicket woodland for the past centuries or millennia. Andah (1979a:

49; 55; 1993: 90-91) on his own emphasized that the Accra Coastal Plain is drier than the Ghanaian northern savannas, and than the western coast of Takoradi and Cape Three Points. Eastwards, in Southern Togo and Bénin Republics, Mondjannagni (1969), Bokonon-Ganta (1987) and others emphasised an annual rainfall that ranges from 900 mm to 1,300 mm and three successive vegetation belts that are made of heterogenous taxa on the coastal plain, of isolated moist or semi-decidous forests on the northern "Lama Depression", and of derived forest on the valleys (cf. Chapter Two, Section 2.2.1).

Ajibode area of Ibadan Metropolitan Region in the context of present-day Southwestern Nigeria (cf. Chapter Two, Section 2.2.2), is presented by Oguntoyinbo (1994: 58-71) as characterized by yearly alternating rainy and dry seasons with a mean annual rainfall of 1, 258.36 mm. According to Areola (1994: 103-105), Ibadan current vegetation consists of a patch work of broken forest, savanna woodland, dense thickets large forb of vegetaion and regenerated mixed forests, while Udo (1994: 8) and Ikporukpo, 1994: 1) insisted on Ibadan location on the fringe of the forest near the savanna. Most of these scholars accept that Ibadan's present vegetation has been markedly affected by long-term clearing for farming purposes and by recent urbanization.

In terms of current climatic and vegetation attributes, Ajibode open and terrace Sites in Ibadan Region and the Iwo Eleru Rockshelter Site in Akure area have some ecological similarities. At Iwo Eleru, Shaw and Daniels (1984: xiii-xv) emphasized a mean annual rainfall of 1,400 *mm* and a vegetation of closed forest with high proportion of deciduous trees. The site is located at some 25 km from the northern limit of the continuous closed forest beyond which occurs the forest/savanna mosaic. Shaw and Daniels (1984: xiv) hypothetically suggested that this current northern boundary of the closed forest could be in the same position at the end of the Pleistocene, and that the earlier hunter-gatherers of Iwo Eleru would have exploited both forest and savanna resources. The advantage of such an ecotone milieu was to provide a rich natural reservoir of food.

Ajibode Sites have the same advantage of such an ecotone situation nowadays. During the last 130, 000 years, the forest and woodland milieus could have been the most prevailing environmental conditions. Such forest and woodland milieus could have offered a variety of seasonal and yearly abundant floral and faunal resources to the MSA hunter-gatherer subsistence-settlements at the Lower Terrace Sites. Probably, it is only during the driest phases that occasional forest/savana ecotone conditions could have occurred. This scenario is possible in the context of Butzer's and Cooke's (1995: 66) standpoint that in sub-Saharan Africa, the later Pleistocene fauna consisted predominantly of living species, with a few extinct forms that persisted to the beginning of the Holocene.

For a better understanding and interpretation of the apparently less favourable ecotone situations' impact on the MSA subsistence-settlement patterns at the Ajibode Lower Terrace Sites, there is the need to take into account the fact that these transition zones between two or more different faunal or/and floral communities at land-water interfaces are usually typically species-rich (Allaby, 1996: 164). Sometimes, in the ecotone situation, although the two or more floral or/and faunal communities may appear to bend, they may actively compete for the same territory, so that such a situation may be that of tension (Whittow, 1984: 164). At Ajibode, situations of tension did probably occur occasionally at the advent of the MSA lifeways, or repeatedly during their long-term processes. In this regard, the firstly Homo sapiens and lately Homo sapiens sapiens hunter-gatherers could have aptly adopted and adapted to eurytopic behaviour. As emphasized by Deacon (2001: 219) the eurytopic behaviour consists of having intellectual and psychological capabilities, as well as social, economic and technological know-how that could lead to indefinitely and successfully occupy all positions on the landscape.

After AJB UMF'97 Excavation and cuttings, the local MSA artefact assemblage as shown by the typological and technological analysis in our Chapter Five appears to be suitable for the eurytopic behaviour from the Late Pleistocene to the Early Holocene. The technological and typological analysis revealed some tool manufacture processes and subsequent tool-using purposes and lifeways that could reflect eurytopic behaviour. Amongst these suggestive manufacture processes and subsequent using purposes, two may be referred to as emphasized in Chapter Five (Sections 5.2; 5.3 and 5.4) and in the present Chapter (Sections

6.1 and 6.2). The first concerns what Deacon (1997: 322) referred to as a "ready-to-use-technology". It consisted of preparing the hardly workable quartz and quartzite core in order to make flakes of predetermined proportions and robust edges that did not need strengthening by secondary trimming. So, secondary trimming was rare and modification of the edges was frequently the resultant effect of damage caused by use. This know-how technology in sub-Saharan Africa some 200,000 years ago led to replace the large bifacial Acheulian artefacts by MSA half as large regularly formed flakes (Deacon, 1997: 220).

The second consideration is that Davies (1964: 124-134) within the ambit of the "eurocentric" state of the discipline in the 1960s could not understand the local facies of this "ready-to-use-technology" while analysing the MSA of Southern Ghana. Davies (1964) therefore saw it as "an industry of most amorphous character" that is based on a preference for sugary quartz that markedly gave to this industry "an air of degenerance". With regard to such a standpoint, from Late Sangoan to MSA stages, pebble-picks, miniature-picks and pebble-choppers are viewed as woodworking tools while many uniface points are said to have been rotated as drills and rare biface points were considered as missiles (Davies, 1964: 130). Some three years later, Davies (1967: 104-106) came up with the idea of a Sangoan technological degeneration from the Acheulian technique by emphasizing that Sangoans possessed the skill to making smaller and finer tools from Levallois cores. As a result man could not have degenerated simultaneously over the greater part of Africa and the apparent clumsiness of some Sangoan tools must have been dictated by their function. In this context, Davies (1967) intuitively grasped Deacon's (1997: 322) later concept of "ready-to-use-technology". On the basis of such a reappraised viewpoint, Davies (1967: 126-136) "functionally" reviewed the post-Sangoan MSA broken points as drills rather than as weapons, and the numerous horizontally broken points as an indication that they were not used as weapons.

In view of these, the present and past land-water resources at Ajibode can be referred to for the analysis of the MSA settlements and lifeways from the early phase of the Late Pleistocene to the Early Holocene. In considering the present-day environmental similarities between Ajibode and Iwo Eleru areas, the Early Holocene situation can be referred to for the purpose of understanding the end of the MSA lifeways at Ajibode. The faunal resources available to the LSA hunters and trappers as emphasized by Shaw and Daniels (1984: xiv-xv) included large mammals such as elephant (Loxodonta africana), buffalo (Syncerus caffer namus) and bush-pig (Potomochoerus porus). They also included smaller mammals such as aardvark (Orycteropus afer), bushbuck (Tragelephus scriptus), duiker (Cephalophus silvicultor), chevrotain (Hyemoschus aquaticus), cane rat (Thryonomys swinderianus), porcupine (Atherurus africanus), chimpanzee (Pan troglodytes) and other monkeys (Cercopithecus erythrotis sclateri, Cercopithecus petaurista, Cercopithecus mona), tree hyrax (Dendrohyrax arborelina). There were also reptiles such as monitor lizard (Varamus niloticus) and python (Python regius, Python sebae), whilst the invertebrates included land crab (Sudanautes africanus), giant snail (Achitina sp.) and bees (for the honey). There were in addition several species of termites, some 200 species of forest birds and freshwater fish. The vegetable resources were provided both by the forest's thousands of species and the humid savanna species amongst which the commonest are Adansonia digitata, Butyrospermum paradoxum, Burkea africana, Lophira lanceolata, Daniella oliveri, Afzelia africana, Terminalia glaucescen.

According to Dupont and Weinelt (1996), during the Isotope Age 1 (12,000 BP to Present) and the Isotope Age 5e (115,000 to 130,000 BP) the floral and faunal resources of rainforest expanded, whilst during Isotope Stages 2-4 (12,000 to 74,000 BP) savanna and woodland resources were dominant. During Isotope Ages 5a to 5d woodland resources expanded. Thus, the floral and faunal resources were probably so varied and abundant at Ajibode that MSA subsistence-settlement patterns and lifeways could have continuously occurred between 130,000 BP and 12,000 BP. But at AJB UMF Site, the occupational level could not be dated. The only data available for the analysis of the MSA patterns are the artefacts. Unfortunately the few number of the analysed samples of this artefact-assemblage can hardly lead to a firm conclusion, even on its permanent campsite or occasional workshop functions. Usually, the MSA characteristic tools are said to be used for cutting, piercing, boring, drilling, scraping and scratching purposes

(Hours, 1987: 81). In the African humid tropics such as the Ajibode area, Clark (1995: 325) emphasized that the MSA tool-kits are interpreted as used for the food resources of the woodlands and forest ecotone such as inner and outer bark, resins, latex, soft and hard woods and honey extraction. Clark (1995: 327) on the other hand emphasized that the main MSA occurrences in sub-Saharan Africa are associated predominantly with medium game but with certain giant forms such as horse (Equus capensis), alcelaphine (Magalotragus sp. or Alcelaphus helmei), wild-beest (Connochaetes grandis, or Connochaetas gnousub sp.), buffalo (Pelorovis antiquus). Favoured by their eurytopic behaviour the Ajibode MSA hunter-gatherers could have occasionally or permanently occupied every available position on the landscape for the purpose of active hunting of game and management of plant food resources.

6.3.2 Suggestions for further studies

In view of both the research aims and objectives presented in Chapter One (Section 1.1), the chronological problems of Quaternary and Palaeolithic studies in West Africa as reviewed in Chapter Two (Section 2.3), the problems of dating the AJB UMF MSA Site's natural and cultural sequences as emphasized in Chapter Three and Chapter Four (Section 4.5), the dearth of the artefact assemblage analysed in Chapter Five, and the suggested scenario of the MSA

Settlement patterns at the Site, the following suggestions are therefore made for further studies:

(i) there is the need to conduct complementary excavations at the Site complex, particularly on the remaining part of the mound and at Cutting I spot. The results obtained from such an exercise will presumably supplement and complement the insufficiency of the artefact-assemblage and subsequently strengthen the evolving inferences;

(ii) there is also the need to carry out additional detailed surveys and excavations at other related sites in Ajibode area for a better appraisal and understanding of the provisionally suggested MSA settlement patterns on the Lower Terraces;

(iii) there is equally the need for continued contacts and discussions with natural scientists in general, and chronostratigraphers in particular, with the view to resolving some of the contending issues relating to dating problems of West African Quaternary and Palaeolithic studies;

(iv) and finally there is the need for greater properly focussed and well coordinated multidisciplinary collaborative work amongst palaeoanthropological researchers on a regional scale in West

Africa with a view to promoting Ajibode Palaeolithic Sites in relation to other sites such as Asochrochona and Iwo Eleru.

6.3.3 Conclusions

The present project was conceived with a hope of providing a comprehensive picture of the MSA settlements and lifeways at AJB UMF Lower Terrace Site. In the light of the problems encountered and the results obtained, as highlighted in the Section that is devoted to suggestions for further studies, there is the urgent need to search and improve the laboratory procedures of dating the West African Quaternary and related ESA, MSA and LSA subsistence-settlement patterns.

Such a long-term interdisciplinary research might appear ambitious. However, as rightly pointed by Maienschein (1997: 422) in his attempt to emphasize what he phrased "The One and the Many: Epistemological Reflections on Modern Human Origins Debates":

> For those who do insist on persisting with the debates, let them recognise that different epistemic styles exist, and that just as others are making contested epistemic assumptions, so they are themselves, and that all conclusions are conditional on those various assumptions. And let them recognise (…) that science will nonetheless persist in finding some approaches more useful in the

long run - not necessarily because they are true but because they work better.

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APPENDIX I

GRAIN SIZE ANALYSIS

Sample A – 23cm

B.S Sieves	ϕ	Weight retained (g)	Cumulative weight (g)	Percentage retained	Percentage passing	Cumulative percentage passing
2.8mm	-1.49	10.2	10.2	10.22	89.78	10.22
1.6mm	-0.68	12.1	22.3	12.12	76.66	22.34
1.18mm	-0.24	10.8	33.1	10.82	66.84	33.16
1.00mm	0.00	7.3	40.4	7.31	59.53	40.47
850ym	0.23	3.1	43.5	3.10	56.43	43.57
600ym	0.74	10.2	53.7	10.20	46.23	53.77
500ym	1.00	5.4	59.1	5.41	40.82	59.18
250ym	2.00	17.6	76.7	17.64	23.18	76.82
212ym	2.24	1.2	77.9	1.20	21.98	78.02
150ym	2.74	2.3	80.2	2.30	19.68	80.32
75ym	3.74	14.4	94.6	14.41	5.27	94.73
Pan	—	5.2	99.8	5.27	—	100.00
		99.8				

Sample B – 40cm

B.S Sieves	ϕ	Weight retained (g)	Cumulative weight (g)	Percentage retained	Percentage passing	Cumulative percentage passing
2.8mm	-1.49	14.0	14.0	14.1	85.9	14.1
1.6mm	-0.68	17.3	31.3	17.4	68.5	31.5
1.18mm	-0.24	8.8	40.1	8.8	59.7	40.3
1.00mm	0.00	7.2	47.3	7.2	52.5	47.5
850ym	0.23	3.6	50.9	3.6	48.9	51.1
600ym	0.74	8.3	59.2	8.3	40.6	59.4
500ym	1.00	5.2	64.4	5.2	35.4	64.6
250ym	2.00	10.4	74.8	10.4	25.0	75.0
212ym	2.24	2.1	76.9	2.1	22.9	77.1
150ym	2.74	2.3	79.2	2.3	20.6	79.4
75ym	3.74	15.2	94.4	15.2	5.4	94.6
Pan	—	5.2	99.6	5.2	0.2	99.8
		99.6				

Sample C – 73cm

B.S Sieves	ϕ	Weight retained (g)	Cumulative weight (g)	Percentage retained	Percentage passing	Cumulative percentage passing
2.8mm	-1.49	35.5	35.1	35.17	64.83	35.17
1.6mm	-0.68	20.4	55.5	20.44	44.39	55.61
1.18mm	-0.24	6.4	61.9	6.41	37.98	62.02
1.00mm	0.00	6.2	68.1	6.21	31.77	68.23
850ym	0.23	5.1	73.2	5.11	26.66	73.34
600ym	0.74	5.8	79.0	5.81	20.85	79.15
500ym	1.00	5.4	84.4	5.41	15.44	84.56
250ym	2.00	6.0	90.4	6.01	9.43	90.57
212ym	2.24	1.2	91.6	1.20	8.23	91.77
150ym	2.74	2.2	93.8	2.20	6.03	93.97
75ym	3.74	4.2	98.0	4.20	1.83	98.17
Pan	—	1.8	99.8	1.80	0.03	99.97
		99.8				

Sample D – 85cm

B.S Sieves	ϕ	Weight retained (g)	Cumulative weight (g)	Percentage retained	Percentage passing	Cumulative percentage passing
2.8mm	-1.49	30.2	30.2	30.23	69.77	30.23
1.6mm	-0.68	17.1	47.3	17.12	52.65	47.35
1.18mm	-0.24	8.2	55.5	8.21	44.44	55.56
1.00mm	0.00	6.2	61.7	6.21	38.23	61.77
850ym	0.23	5.4	67.1	5.41	32.82	67.18
600ym	0.74	6.9	74.0	6.91	25.91	74.09
500ym	1.00	5.8	79.8	5.81	20.1	79.90
250ym	2.00	7.9	87.7	7.91	12.19	87.81
212ym	2.24	1.0	88.7	1.00	11.19	88.81
150ym	2.74	2.4	91.1	2.40	8.79	91.21
75ym	3.74	3.5	94.6	3.50	5.29	94.71
Pan	—	5.3 99.9	99.9	5.31	-0.02	100.02

APPENDIX II

STATISTICAL INTERPRETATION OF TEXTURAL PARAMETERS OF A-D SEDIMENT SAMPLES

Sample A – 23cm

$$\text{Mean} = \frac{\Phi16 + \Phi50 + \Phi84}{3}$$

$$= \frac{-1.00 + 0.50 + 12.80}{3}$$

$$= 0.77$$

$$\text{S. D.} = \frac{\Phi84 - \Phi16}{4} + \frac{\Phi95 - \Phi5}{6.6}$$

$$= \frac{2.80 - 1.00}{4} + \frac{3.70 - 2.10}{6.6}$$

$$= 0.95 + 0.88$$

$$= 1.83 \text{ (poorly sorted)}$$

$$\text{S. K.} = \frac{\Phi16 + \Phi84 - 2\Phi50}{2(\Phi84 - \Phi16)} + \frac{\Phi5 + \Phi95 - 2\Phi50}{2(\Phi95 - \Phi5)}$$

$$= \frac{-1.00 + 2.80 - 1}{2(2.80 + 1)} + \frac{-2.10 + 3.70 - 1}{2(3.70 + 2.10)}$$

$$= \frac{0.8}{7.6} + \frac{0.6}{11.6}$$

$$= 0.11 + 0.05$$

$$= 0.16 \text{ (fine skewed)}$$

$$\text{kg} = \frac{\Phi95 - \Phi5}{2.44\,(\Phi75 - \Phi25)}$$

$$= \frac{3.70 + 2.10}{2.44\,(1.90 + 0.50)}$$

$$= \frac{5.80}{5.85}$$

$$= 0.99 \text{ (Mesokurtic)}$$

Sample B – 40cm

$$\text{Mean} = \frac{\Phi16 + \Phi50 + \Phi84}{3}$$

$$= \frac{-1.40 + 0.20 + 2.90}{3}$$

$$= 0.57$$

$$\text{S. D.} = \frac{\Phi84 - \Phi16}{4} + \frac{\Phi95 - \Phi5}{6.6}$$

$$= \frac{2.90 - 1.40}{4} + \frac{3.70 - 2.35}{6.6}$$

$$= 1.075 + 0.917$$

$$= 1.99 \text{ (poorly sorted)}$$

$$\text{S. K.} = \frac{\Phi16 + \Phi84 - 2\Phi50}{2(\Phi84 - \Phi16)} + \frac{\Phi5 + \Phi95 - 2\Phi50}{2(\Phi95 - \Phi5)}$$

$$= \frac{-1.40 + 3.70 - 0.4}{8.6} + \frac{-2.35 + 3.70 - 0.4}{12.1}$$

$$= 0.22 + 0.08$$

$$= 0.30 \text{ (strongly fine – skewed)}$$

$$\text{kg} = \frac{\Phi95 - \Phi5}{2.44\,(\Phi75 - \Phi25)}$$

$$= \frac{3.70 + 2.35}{2.44\,(2.00 + 0.90)}$$

$$= \frac{6.05}{7.1}$$

$$= 0.85 \text{ (Platykurtic)}$$

Sample C – 73cm

$$\text{Mean} = \frac{\Phi16 + \Phi50 + \Phi84}{3}$$

$$= \frac{-2.80 + 0.80 + 1.00}{3}$$

$$= 0.87$$

$$\text{S. D.} = \frac{\Phi84 - \Phi16}{4} + \frac{\Phi95 - \Phi5}{6.6}$$

$$= \frac{1.00 + 2.80}{4} + \frac{2.70 + 4.00}{6.6}$$

$$= 1.95 + 1.02$$

$$= 1.97 \text{ (poorly sorted)}$$

$$\text{S. K.} = \frac{\Phi16 + \Phi84 - 2\Phi50}{2(\Phi84 - \Phi16)} + \frac{\Phi5 + \Phi95 - 2\Phi50}{2(\Phi95 - \Phi5)}$$

$$= \frac{-2.80 + 1.00 - 1.6}{2(1.00 + 2.80)} + \frac{-4.00 + 2.70 + 1.6}{2(2.70 + 4.00)}$$

$$= \frac{-0.2}{7.6} + \frac{0.3}{13.4}$$

$$= -0.03 + 0.02$$

$$= -0.01 \text{ (Nearly Symmetrical)}$$

$$\text{kg} = \frac{\Phi95 - \Phi5}{2.44\,(\Phi75 - \Phi25)}$$

$$= \frac{2.70 + 4.00}{2.44\,(0.40 + 2.10)}$$

$$= \frac{6.7}{6.1}$$

$$= 1.09 \text{ (Mesokurtic)}$$

Sample D – 85cm

$$\text{Mean} = \frac{\Phi16 + \Phi50 + \Phi84}{3}$$

$$= \frac{-2.60 - 0.50 + 3.70}{3}$$

$$= 0.2$$

$$\text{S. D.} = \frac{\Phi84 - \Phi16}{4} + \frac{\Phi95 - \Phi5}{6.6}$$

$$= \frac{1.50 + 2.60}{4} + \frac{3.70}{6.6}$$

$$= 1.03 + 1.56$$

= 1.59 (poorly sorted)

$$\text{S. K.} = \frac{\Phi16 + \Phi84 - 2\Phi50}{2(\Phi84 - \Phi16)} + \frac{\Phi5 + \Phi95 - 2\Phi50}{2(\Phi95 - \Phi5)}$$

$$= \frac{-2.60 + 3.70 + 1}{2(1.50 + 2.60)} + \frac{0 + 3.70 + 1}{2(3.70)}$$

$$= \frac{2.1}{8.2} + 0.635$$

= - 0.89 (strongly fine skewed)

$$\text{kg} = \frac{\Phi95 - \Phi5}{2.44\,(\Phi75 - \Phi25)}$$

$$= \frac{3.70}{2.44\,(0.70 + 1.80)}$$

$$= \frac{3.70}{6.1}$$

= 0.61 (Very platykurtic)

APPENDIX III

COMPUTER PRINT OUT OF THE GEOCHEMICAL ANALYSIS

RESULTS SHOWN IN PART PER MILLION

Printed 09 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Fe	1	0.266	1184.50ppm	2	0.56ppm	12.20
2	Fe	2	0.264	1121.99ppm	2	1.35ppm	12.20
3	Fe	3	0.290	1145.54ppm	2	0.77ppm	12.21
4	Fe	4	0.461	1398.32ppm	2	2.60ppm	12.23

Printed 09 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Ca	1	0.359	23.20ppm	2	2.34ppm	12.32
2	Ca	2	0.024	20.32ppm	2	8.26ppm	12.33
3	Ca	3	0.445	25.62ppm	2	10.67ppm	12.36
4	Ca	4	0.025	20.21ppm	2	9.12ppm	12.37

Printed 09 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Mg	1	0.287	75.128ppm	2	0.046ppm	15.11
2	Mg	2	0.266	72.208ppm	2	0.176ppm	15.11
3	Mg	3	0.281	76.886ppm	2	0.062ppm	15.12
4	Mg	4	0.321	72.220ppm	2	0.066ppm	15.12

Printed 09 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Na	1	0.295	366.55ppm	2	0.82ppm	11.39
2	Na	2	0.525	338.68ppm	2	0.54ppm	11.40
3	Na	3	0.385	232.06ppm	2	18.84ppm	11.41
4	Na	4	0.426	346.72ppm	2	15.54ppm	11.42

Printed 09 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Mn	1	0.124	21.113	2	0.021	11.44
2	Mn	2	0.128	20.215	2	0.045	11.45
3	Mn	3	0.141	20.124	2	0.071	11.45
4	Mn	4	0.252	18.799	2	0.027	11.46

Printed 10 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	K	1	0.065	241.32ppm	2	0.63ppm	12.08
2	K	2	0.039	121.62ppm	2	0.68ppm	12.10
3	K	3	0.041	182.47ppm	2	0.25ppm	12.10
4	K	4	0.018	130.81ppm	2	0.54ppm	12.11

Printed 10 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Al	1	0.442	1446.8ppm	2	2.5ppm	12.15
2	Al	2	0.099	1322.4ppm	2	1.4ppm	12.17
3	Al	3	0.025	1349.2ppm	2	15.2ppm	12.17
4	Al	4	0.029	1466.6ppm	2	2.5ppm	12.19

Printed 10 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Si	1	0.168	9218.2ppm	2	9.6ppm	12.40
2	Si	2	0.174	8961.6ppm	2	423.3ppm	12.43
3	Si	3	0.225	8975.6ppm	2	452.2ppm	12.44
4	Si	4	0.276	9684.8ppm	2	413.6ppm	12.45

Printed 10 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	Ti	1	0.262	198.83ppm	2	0.51	12.50
2	Ti	2	0.224	192.22ppm	2	0.59	12.52
3	Ti	3	0.051	189.80ppm	2	0.62	12.52
4	Ti	4	0.023	199.55ppm	2	0.32	12.53

Printed 10 Oct. 02

No	Tag	Ref.	Output	Concentration	Runs	SD	Time
1	P	1	0.112	12.02ppm	2	2.52ppm	12.55
2	P	2	0.120	10.15ppm	2	1.75ppm	12.56
3	P	3	0.110	9.22ppm	2	0.88ppm	12.56
4	P	4	0.211	9.35ppm	2	0.85ppm	12.57