# Stone Age Studies in Southwest Nigeria with particular emphasis on the assessment of material from Atamora Rock Shelter

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# Zusammenfassung

Es ist eine schwierige und komplexe Aufgabe, eine allgemeine Aussage über die Art früher menschlicher Besiedlungen in den Waldgebieten Westafrikas zu machen, da die Siedlungsanzeiger weder leicht verfügbar noch hinreichend repräsentativ sind. Dies ist vor allem im Südwesten Nigerias der Fall. Obwohl Untersuchungen an Steinwerkzeugen einigen Aufschluss geben können, ist die Aussagekraft durch unzureichende Informationen über deren Fundsituation und chronostratigraphische Position eingeschränkt. Dies gilt vor allem für Freilandfundstellen. Im Grunde genommen gibt es keine Garantie dafür, dass kulturelle Interpretationen auf der Grundlage von Artefaktanalysen, selbst mit begrenzt verfügbaren Hintergrundinformationen, nicht bloße Spekulation sind.

Eine multidimensionale Auswertung, die neben weiteren Informationen Daten zu natürlichen und kulturellen Faktoren einbezieht, welche die Überlieferung von Steinartefakten und anderen kulturellen Hinterlassenschaften beeinflussen, kann wertvolle Aufschlüsse liefern. Es ist notwendig, geeignete Modelle für die Untersuchung der menschlichen Evolution in der speziellen Oköregion zu erarbeiten.

Archäologische Zeugnisse in Form von Steinartefakten, die dem Paläolitikum zuzuweisen sind, liegen aus der Regenwaldzone West- und Zentralafrikas, die das südwestliche Nigeria umschließt, in großer Menge vor. Dadurch wird das Studium der Steintechnologie zu einem unverzichtbaren Bestandteil der Erforschung prähistorischer Subsistenzweisen in der Region. Der Mangel an datierbaren stratigraphischen Abfolgen, der durch das Fehlen organischer Materialien bedingt ist, erschwert jedoch die Analyse steinerner Hinterlassenschaften, da es schwierig ist, diese Steinartefakte in einen aussagekräftigen chronologischen Rahmen zu stellen, so dass sie letztlich kaum mehr darstellen als eine Masse von Steinen. Die einzelnen technologischen Merkmale zeigen klar den Artefaktcharakter und das hohe Alter der Steinartefakte an und liefern so Indikatoren für das Studium der Verhaltensweisen früherer Bewohner des Gebietes. Eines der Hauptthemen in der Frühphase der Archäologie war die Frage, ob die Regenwaldzone in den Perioden vor der Eisenzeit zu schwierig zu besiedeln und zu nutzen war (Bailey *et al.*, 1989). War die Vegetation des Gebietes die ganze Zeit über unverändert, oder erfuhr sie im Laufe der Zeit Wechsel und Veränderungen?

Die Untersuchungsergebnisse sind ermutigend im Hinblick darauf, das Vorhandensein kultureller Hinterlassenschaften früher Besiedlungen in der Region zu bestätigen und auch im Hinblick darauf, auf der Grundlage der Artefakttypologie frühere Behauptungen zum Alter menschlicher Aktivitäten in der Waldregion zurückzuweisen.

Sowohl ein Überblick über die vorhandene Literatur, als auch Feldforschungen in Ibadan und Atamora bei Ikire sowie quantitative und qualitative Analysen von (Stein-)Artefakten aus Südwest-Nigeria liefern nützliche Einblicke in die Beschaffenheit der Umwelt im Laufe der Zeiten sowie in den Charakter der Steinartefakt-Traditionen innerhalb der Region.

Es werden Argumente dafür präsentiert, die verschiedenen früheren Annahmen und Spekulationen über die Art und Weise menschlicher Besiedlungen in der Gegend zurückzuweisen. In der Tat reichen die Besiedlungen bis in die Zeit vor dem Neolithikum zurück, und gleichzeitig wird die Tatsache bestätigt, dass die Umwelt, einschließlich der Vegetation, nicht gleich bleibend gewesen ist. Es wurde der Versuch unternommen, einen gewissen chronologischen Rahmen zu erstellen, in den einerseits die Steininventare eingehängt werden können und mit dem andererseits der Charakter der Steinbearbeitungstraditionen im Arbeitsgebiet erfasst werden kann. Während die Steintechnologie und der Gebrauch von Steinartefakten in einigen Teilen des Arbeitsgebiets fortbestanden, weist der archäologische Befund andererseits auf ein Alter von mehr als 11.000 Jahren, d.h. noch vor dem frühen Holozän, hin und auch darauf, dass die Vegetation nicht gleich bleibend war. Weitere Untersuchungen tertiärer und quartärer Ablagerungen in der Region sowie Ausgrabungen weiterer Fundplätze sind notwendig, um mit größerer Sicherheit einen chronostratigraphischen Rahmen zu schaffen, der die kulturelle Entwicklung in der Region weit reichend umfasst.

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## Abstract

Making a general statement about the nature of early human settlements in the forest zone of West Africa is very difficult and complex since the indicative settlement parameters are not readily available or adequately representative. This is particularly the case in southwest Nigeria. Although study of lithic artefacts can provide some insights, limitation stems from inadequate environmental information about their provenance and chronostratigraphy. This is particularly the case when dealing with open air sites. There is no guarantee that cultural interpretations of results of artefact analysis are no more than speculations despite limited background information. A multi-dimensional study which incorporates among other information data on natural and cultural factors that influence the survival of lithic artefacts and other cultural remains may provide useful insight. Generation of appropriate models for studying human evolution in the peculiar ecoregion is required.

Archaeological evidence in form of lithic artefacts attributable to the Palaeolithic is abundant in the rain forest zone of west and central Africa which embraces southwest Nigeria. This makes study of lithic technology an integral element in the study of prehistoric subsistence economy in the region. Lack of widespread dateable stratigraphic sequences due to absence of organic matter has rendered the lithology quite difficult to study and by implication the placement of these lithic artefacts in meaningful chronological framework thus rendering them as no more than mere lithic mass. The distinct and consistent technological attributes clearly indicate their artefactual and antiquity characters as indices for studying behaviours of past populations in the zone. Whether the rain forest zone was too difficult for habitation and exploitation in the distant past before the Iron Age (Bailey *et al*, 1989), was a major theme in the discourse of pioneer archaeologists. Has the vegetation in the zone been static all the time or had it experienced changes and variations over the time?

Study result are encouraging in terms of confirming the availability of cultural remains of early settlements in the region and also in rejecting earlier claims about the antiquity of human activities in the forest area on the basis of artefactual typology.

A survey of available literatures and field investigations at Ibadan and Atamora near Ikire, as well as quantitative and qualitative analyses of artefacts (lithic) in Southwest Nigeria provide some useful insights into the nature of the environment over time and the character of the lithic traditions in the area.

Reasons are given to repudiate these varied assumptions and speculations about the nature of human occupations in the area, which stretched farther back beyond the Neolithic, to reinforce the fact that the environment including the vegetation has not been static. An attempt was made at establishing some chronological framework to accommodate these lithic materials as well as establishing the character of lithic reduction traditions in the study area. While lithic technology and usage continued in some parts of the study area, archaeological record suggests antiquity farther beyond 11,000Kyr i.e. early Holocene and that the vegetation has not been static. More studies of tertiary and quaternary deposits in the region and excavation of more sites is required to establish with more certainty a chronostratigraphic framework that will embrace comprehensive cultural development in the region.

**Key words:** Palaeolithic, Palaeoenvironments, Lithic Reduction, Technology, *Refugia*
Behavioural Evolution, Classification - Typology

# List of Tables

## List of Fig.s.

List of plates

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# Table of Contents

## Chapter One

# 1. Introduction

The fact that not much is known about the nature of prehistoric occupations in Nigeria (Fig.s 1 & 2) is a reflection of the low intensity of investigations into the Palaeolithic and ecological history of the region. This situation calls for the employment of adequate research techniques despite the difficulties posed by diverse landscape and particularly the dense vegetation cover. This is pertinent because a proper knowledge of the landscape is required to aid better data recovery in an ecological situation such as southwest Nigeria. Proper study of landscape development in this region may provide a key to the proper appreciation of the nature of human occupation in Southwest Nigeria through time. This is more so because biological indicators of past environment do not survive well enough to reflect the actual nature of the past environment especially in the Study Area. Knowledge of physical indicators such as geomorphologic features may therefore aid the understanding of the nature and development of the landscape on the one hand and how it affected human settlements on the other. These are two principal problems facing researchers in southwest Nigeria, and proper approach to prehistoric investigations in the area calls for questions which are directed at specific issues such as:

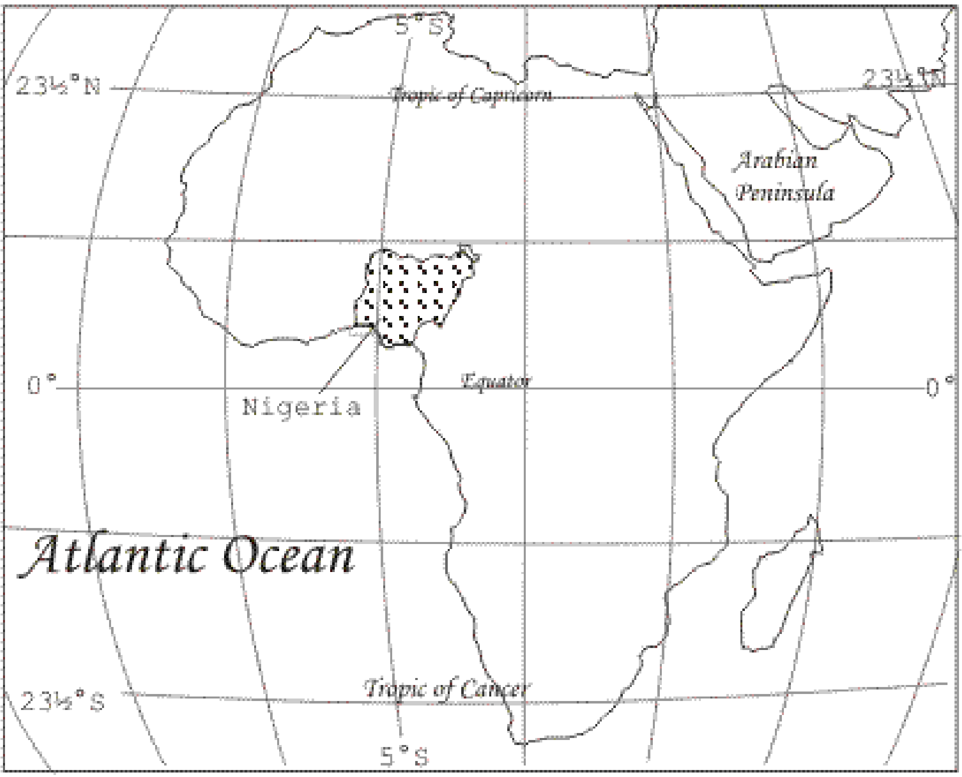



**Figure 1. Nigeria: location in the context of Africa**

i. geographical processes at play in the region and how their interaction acted to shape the past and present landscape;

ii. the nature of early human occupations in the area from the earliest to the most recent;

iii. characteristic settlements in the region in terms of phases and sequences, and;

iv. establishing of chronostratigraphic framework for all these strands of developments.

Southwest Nigeria is an ecological zone where the peculiarly forest environment affects the preservation of artefactual and non-artefactual remains associated with human occupations. This research is designed to accommodate these shortcomings by proposing a comprehensive approach to data recovery strategy. Attempt is made to understand the landscape from geographical and archaeological perspectives. We sought to understand the relationship between erosion and deposition of sediments and the nature of preservation of archaeological records. Time factor is looked at from the long-term perspective provided by archaeological and quaternary sciences. The intent here is to explore the benefit between modern day erosion processes and past dimensions which had in most cases depended on the application of modern analogues for the interpretation of past scenario. This is premised upon the fact that studies of past erosion processes could complement modern ones with longer time information than obtainable from instrumental and scientific records and even the nature of human impacts on environment. The role of humans as trigger for the commencement of erosion activity is

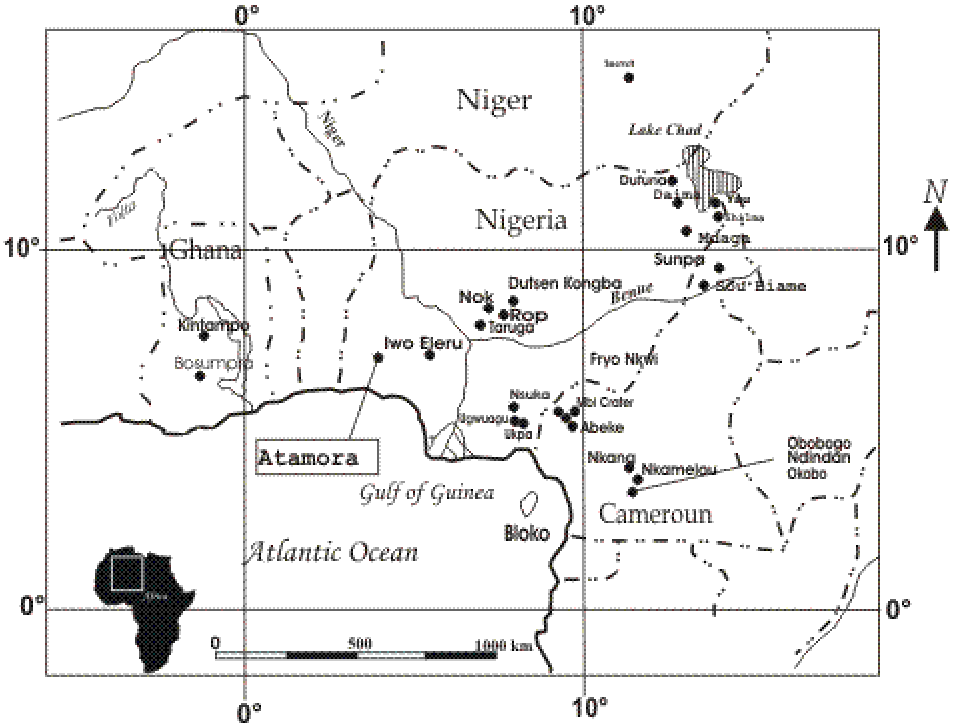



Figure 2. Nigeria in a regional context

noted. However, the objective of archaeology in this regard is to broaden the state of empirical knowledge about the relationships between humans and their natural environment in the Study Area. This is in order to provide information about different societies (beyond the immediate modern world) and periods including those for which modern analogues could not be found.

It is pertinent then to note that modern analogues do not avail the researcher with precise models for the incontestable reconstruction of past societies, which is the ultimate aim of the archaeologist. This is particularly so when viewed against the backdrop that erosion had wiped out a great chunk of the record. This shortcoming calls for a particular emphasis on the spatial character of soil deposits in any archaeological investigation in the study area.

An important aspect of landscape archaeology is the degree of continuity and the time depth involved. In conformity with the geological rhyme that the present is the key to the past, current knowledge of geomorphic processes is required for the understanding of archaeological deposits. This is because the history of landscape processes is one of episodically changing processes which at its best can be described as the contrast between stability (soil development) and instability (erosion and deposition). It is however, difficult to reconstruct erosion episodes as they in fact involve loss of evidence. Therefore the focus on soil and sediment, and analytical techniques are directed at enabling the investigation of soil and sediments in terms of their formational processes and evolution as typified by studies of lake sediments, micromorphology and magnetic susceptibility among others.

In line with the foregoing, this study has as its aim and objectives among others the following:

i. explication of the nature of prehistoric and pre-urban settlements in Southwest Nigeria;
ii. study of landscape and cultural development vis-à-vis depositional and artefactual recovery context;
iii. re-evaluation of earlier and seemingly controversial theoretical/hypothetical frameworks with respect to the nature of human habitation within the rainforest environment, and;
iv. proposition of a comprehensive approach to data recovery strategy within the rain forest ecological zone.

This chapter therefore aims to describe the environmental situations and present the background information on archaeological investigations in Southwest Nigeria within the context of West Africa. Generalised information on the environment is provided here. Detailed and site-specific information is provided in the relevant aspects where these are discussed in the context of the sites in question. The archaeological information provided here is not exhaustive. Emphasis is on those aspects of the information that are directly relevant for prehistoric studies in West Africa as it affects Southwest Nigeria and for the interpretation of data recovered in the course of this investigation.

### 1.1.1. Southwest Nigeria: Location and Environmental Preconditions in the Context of West Africa

Southwest Nigeria (Fig. 3) is defined here to include the area lying south of the Niger-Guinea Coast watershed. This watershed forms a divide between the river systems flowing southward down the Guinea slope into the Gulf of Guinea and those flowing northward into the Niger River basin.

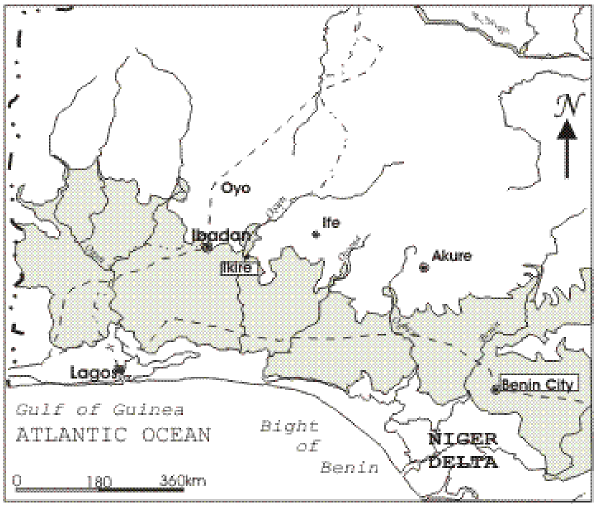



Fig 3.Southwest Ng generalised map sh river network and lowland forest Zon (shaded area)

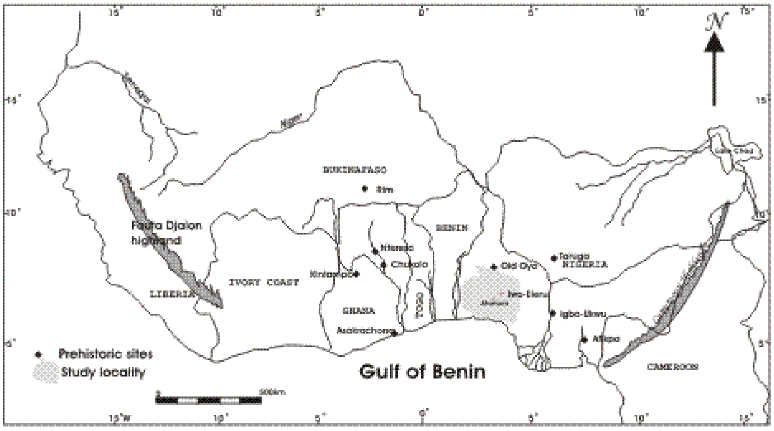



Fig.4. Prehistoric sites in Sub-Saharan Africa (adapted after Andah, 1979)

Prehistoric culture thrived in the forest zone of Southwest Nigeria (Fig.s 4 & 5) in the context of the natural environment. The natural environment had provided the performing stage upon which, humans played the varied roles of livelihood be it in terms of subsistence, social or political behaviour. Human habitations in the region are also within definable localities and are dependent on a combination of the actual needs of the prehistoric groups in terms of subsistence among other needs. Hence, such study as this will be inadequate if the environment is not adequately characterized, and by implication used as a basis for understanding the nature of prehistoric societies in the region and the nature/recovery contexts of artefacts in the sub region.

The complex nature of the relationship between ecology and economy has become evident in recent archaeological investigations. The site-settlement approach (Andah, 1995), is well emphasised in this study, knowledge of palaeo-ecology of the area is an integral part for the understanding and interpretation of archaeological data from Southwest Nigeria. This however, is inseparable from that of the West African sub-region which encompasses the study area.

For this to be put in a better perspective, it is imperative to review the West African Quaternary environments within which the study area is situated. A concise summary of the palaeo-environment of West Africa is presented in the study carried out by Tubosun (1995). This serves as an important reference material for the following review as it provides a synthesized result of researches into West Africa's palaeoecology.

To start with, West Africa as a sub-region has been defined to include the entire area lying south of the Ahagar-Tibesti plain and west of the watershed which separated Lake Chad from the Nile and Zaire basins (Petters, 1987). The geomorphology of the region includes the coastal plains, the Guinea basement shield and the Taoudêin and Chad basins in the Western Sahara. Climate in the sub-

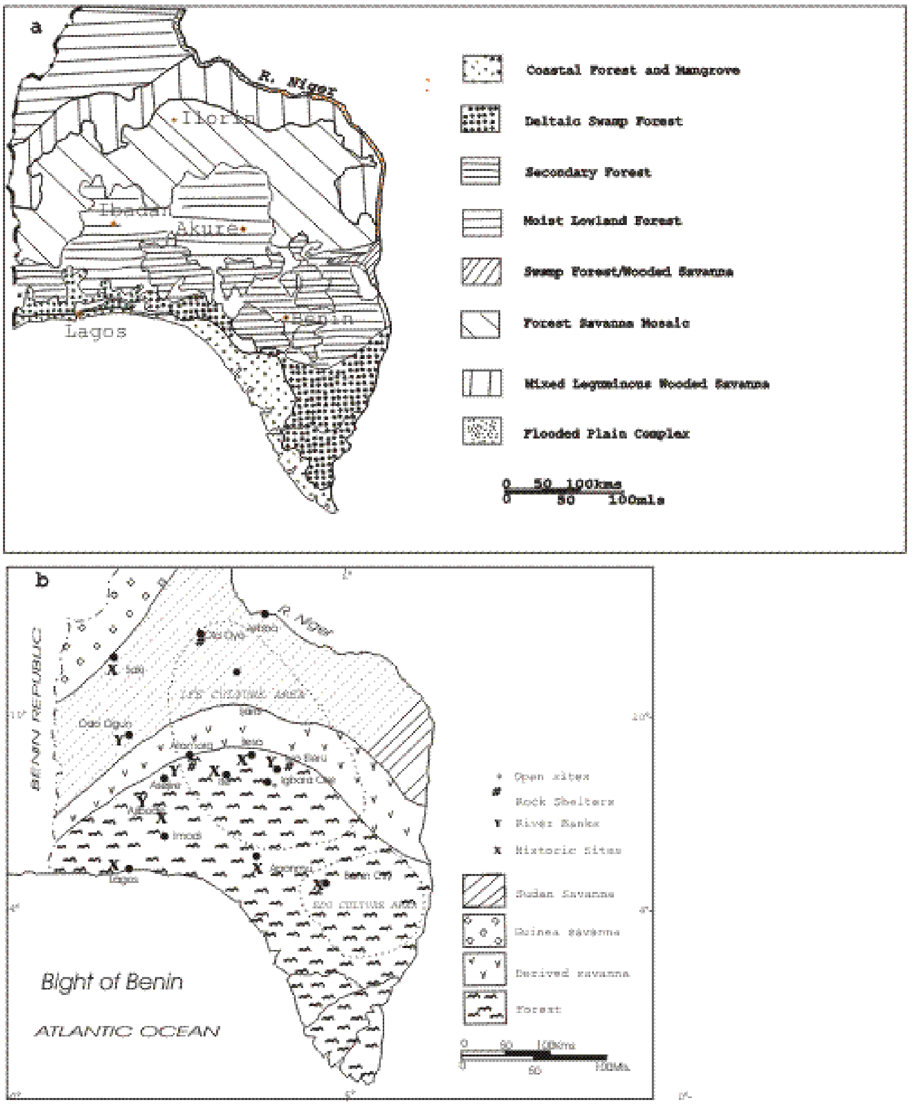



Figure 5. Southwest Nigeria: Maps showing vegetation characteristics and embedded cultural areas

15

region is principally controlled by the activities of two factors including two wind systems namely: the south westerly moisture laden monsoon and the dry North East Trade wind (also known as Hammattan) as well as the oscillation of the Inter-Tropical Discontinuity (ITD), which is in fact the meeting point of the two wind systems mentioned above (Fig.s 6 and 7 ).

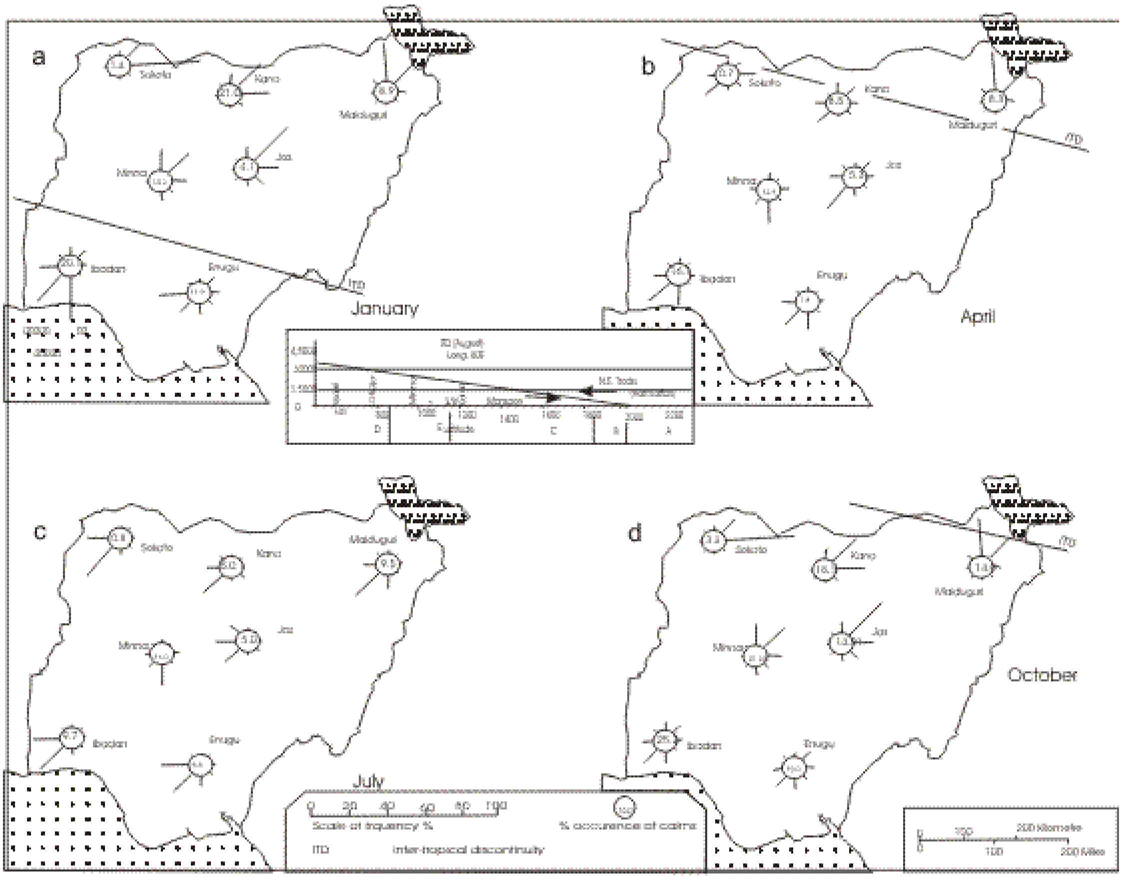



**Figure 6. Seasonal migration of the Intercontinental discontinuity(ITD) a major factor in seasonal variations in Nigeria**

Like other parts of the world, rock and sediment studies both in the field and laboratory constitute the primary sources of information about the earth's history. Attention of researchers is usually focussed on representative lithologies and the biological constituents. Features such as the phenomena of laterization, cementation and stone lines are of paramount interest to the researcher in the field. Laboratory studies usually involve identification of biological remains and studies of important indices such as particle-size, free-ion oxide (amorphous and crystalline), pH, available phosphorous, clay mineral, carbon contents among others. Palyonlogical data are the only relevant direct evidence for reconstructing the vegetation and palaeoenvironmental history of South West Nigeria especially the area that is covered today by the rain forest. Pollen evidence based on analyses of long sequences and dated by radiocarbon allows for insight into the main vegetational changes on a long-time scale. Studies of this nature according to Tubosun (1995) have enabled inferences about aspects of Quaternary environments of West Africa through local continental correlations. It should be noted however, that studies, involving the reconstruction of the palaeo-environment in West Africa, have suffered many setbacks due to some factors.

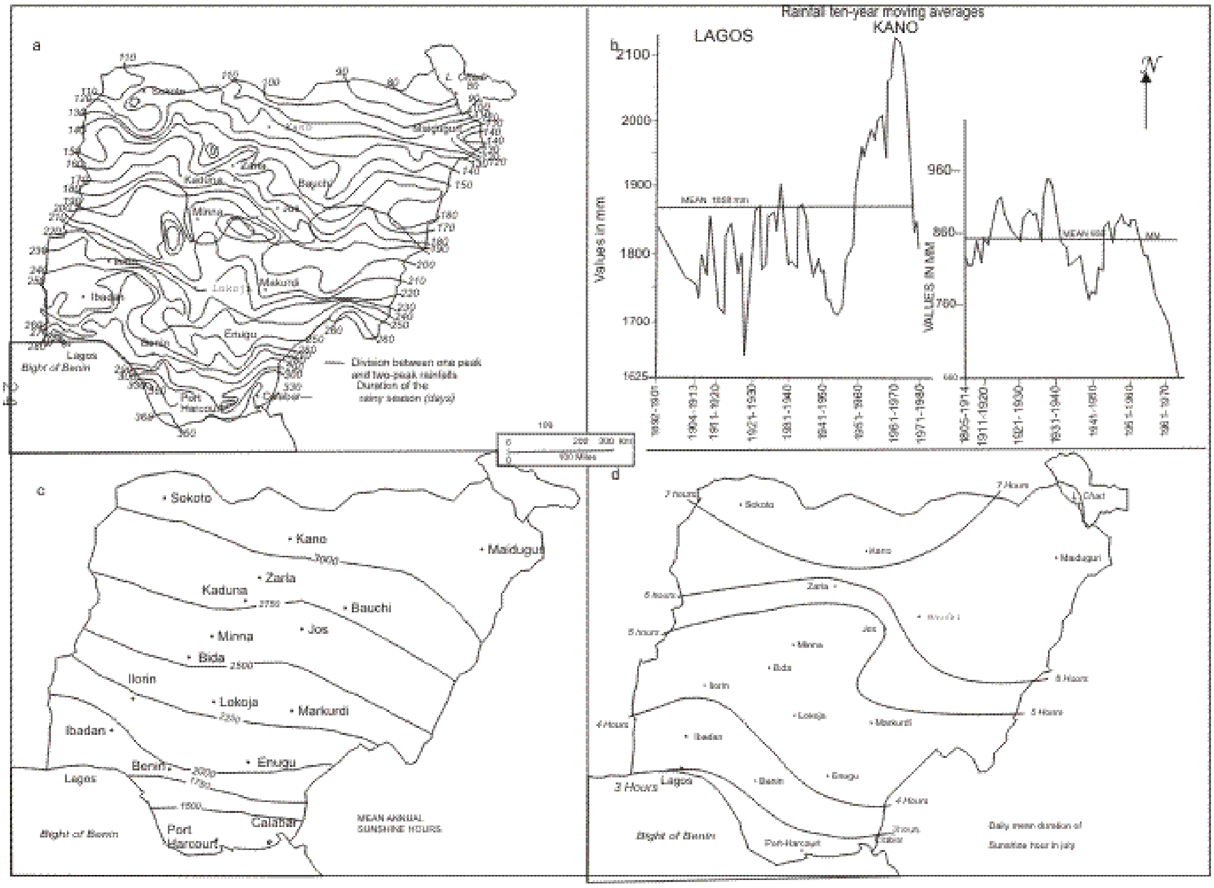



**Fig. 7. Map showing climatic characristics that reflect in seasonal variations in Nigeria**

These factors include among others the intolerable nature of the climate, which is hot and humid. This particularly hinders visitors from coming to this part of the continent. Other problems include obvious lack of spectacular hominid finds, scarcity of lacustrine and other suitable deposits notably in marginal positions where minimal changes in climate have marked effects on the rest of the environment, as well as the high species diversity. These difficulties among others prompted researchers in West African quaternary environment to focus their attention on sedimentology, geomorphology and archaeology. This can only provide indirect evidence, which must be corroborated in most cases. This stands out in high contrast to situations where direct lines of evidence are widely available in the forms of plants and animal remains.

Researchers including Brückner (1955, 1957), have approached the reconstruction of West African environment by attempting to explained the morphologies and structure within the laterite and bauxite profiles in the region by reference to several cycles of arid-humid and semi-arid climates. Aubrevile (1949, as cited in Andah 1979), was of the opinion that the forest in the sub-region was largely eliminated during the glacial phases and only survived in a few bastions along the wetter coast southwards towards Angola. Studies of slope deposits and soils on the other hand, attributed slope depositions to phases of landscape change (morphogenesis) and the period of soil formation (pedogenesis). These are believed to be indications of landscape stability and favourable climates (Andah, 1979, Folster 1969, Rhodenburg 1969, Burke and Durotoye 1971 (see Table 1.1.1) Avernard 1973, Harault 1972, Sowunmi 1989).

Proponents of climatic-geomorphology on the other hand view stratigraphic Quaternary sequences in the southern Guinea stretch of West Africa as revealing three successive cycles of dry and wet phases. Each cycle is marked by alternation of pedimentation, erosion and soil development. Artefacts contained in some of these sequences were placed in the Late Pleistocene and the Holocene on the bases of the internal structures of these deposits relative to the nature of artefacts they contained. Case points in this consideration include references to Asejire and Odo-Ogun in Southwest Nigeria; Legon, Achimota, Asokrochona and Tema in the Accra coastal plain in Ghana. Limitation in the utility of this approach lies in the fact that artefacts are mostly found in secondary dispositions with no clear chronological controls, thus, rendering them insubstantive in nature and unreliable parameters for the reconstruction of the palaeo-ecology of the sub-region. A version of this approach was proposed by Burke and Durotoye (1971), who, considered these sequences to be contemporaneous with dated elements in the southern Sahara and on these grounds inferred that their most recent soil formation phases dated to ~ 40-50,000BP and 12-8,000BP, while the two intervening dry phases were dated to before 40,000BP and 20-30,000BP. Notably these correlations by Burke and Durotoye(1971), are subjective and can not be said to have any scientific basis as the artefacts used for correlation and inference have no chronological controls as there were no relative dating elements found in the context of their investigation.

An extension to this study by Burke and Durotoye (1970, 1971), is the identification at a railway cutting east of the old airport at Ibadan of a vertical succession of deposits comprising three units which they named 'Bodija Formation' (Table 1.1.1.). This consists of members that are named according to localities including Kongi, Agodi and Orita. They were of the opinion that the climatic events are in the sequence highlighted in Table 1.1.1. below:

**Table 1.1.1. Bodija Formation (after Burke and Durotoye, 1970, 1971)**

| | |
|---|---|
| i. | A lower unit (Kongi member) composed of cemented gravel, which was supposedly formed during an alternation of humid and arid phases and without any basis, this member was subjectively dated to the mid-Pleistocene period; |
| ii. | A mid-unit (Agodi member) which is composed of uncemented gravel and was supposedly formed during an arid phase and was dated by them to the late Pleistocene and; |
| iii. | An upper unit (Orita member) consisting of sandy loam which was supposedly formed during a humid phase was dated to the Holocene. |

There were attempts at similar investigations elsewhere in the sub-region. In Sierra Leone for example, Thomas and Thorp (1980), attempted a detailed mapping of three lithologic units exposed because of mining operations in alluvial deposits, valley bottom sides and interfluves of small valleys. These units include the following in ascending order of stratigraphic succession:

i.) A lower gravely unit of quartz, whole rock pieces, pisoliths and heavy minerals which they considered was formed under humid conditions during the Early Holocene;

ii.) An undated middle alluvial deposits of sandy clay and;

iii.) An undated upper sandy loam that is largely alluvial and biogenic in origin.

They obtained four radiocarbon dates from the most recent of these 3 units consisting of black clay with finely dispersed organic debris and twigs, leaves and seed as follows:

**i.) 1,000 – modern**

**ii.) 3,300 – 1,750 BP**

**iii.) 12,500 – 7,800 BP**

**iv.) 36,000 – 20,500 BP**

In their view, the earliest period (iv) witnessed alternating phases of gravel entrainment and swamp clay accumulation and by implication it was inferred that forest conditions prevailed during this period (Thomas and Thorp 1980). They also accepted at least in general terms the interpretations by Street and Grove (1979) regarding the period between 30,000 and 20,000 BP which they characterised as having a slightly reduced overall humidity. They viewed the absence of sediments and organic matters in the period between 20 and 12,000 BP as an indication of semi-arid conditions and deforestation. A more favourable conditions post 12,000 BP in which there was diminished sediment accumulation and increased erosion activities under humid conditions followed this phase. They came to the conclusion that the gap in the radiocarbon dates obtained from the indirect evidence from Sierra Leone is strong enough evidence to suggest the destruction of rain forest in West Africa. For them, the accumulation of coarse gravel and their overlying alluvial sands between 12,500 and 7,800 BP is thought to be an indication of a return to fluvial action and by implication the alluvia l deposits of the later Holocene (3,300 BP onwards) are seen as being formed in response to periods of enhanced discharges, meander migration and man-induced deforestation activities.

Thomas and Thorp (1980) further suggested that the polished stone axes, pottery and other artefacts that were found associated with latter gravels were associated with early rice cultivation and by implication neolithization process in the region.

This conclusion should however, be viewed with certain degree of caution, even if the chronological basis for their interpretations appears to be less subjective than the ones proposed by Burke and Durotoye (1970) ant that proposed by Brückner (1957) and Davies (1964). This is more so because the $C^{14}$ dates were not from the three lithologic units they mapped but from nearby recent alluvial deposits.

Sequences in Southwest Nigeria (Fig. 3.) similar to the one in Sierra Leone have also been described by Folster (1969 a b), who was however, silent on its chronology for lack of evidence. Such is the nature of the problem in this region where lots of sites still awaits sound chronological framework as a basis for the interpretation of prehistoric data. This is why results from studies elsewhere in the sub-region are usually very relevant to interpretations of evidence from Southwest Nigeria.

It is obvious from recent surveys that there is a reasonably well established climatic sequence for the Late Quaternary period in West Africa. Such information is now available at least for some parts of the region. This is notwithstanding the fact that much of the very extensive area remains without well-dated unequivocal palaeoclimatic data. Be this as it may, it is on record that great efforts have been directed towards the reconstruction of the atmospheric conditions over West Africa during the Late Quaternary even though there were no uniform models for such study.

An example is the extensive and very comprehensive stratigraphic and sedimentological studies and interpretation of the Holocene variations of the lake levels of Lake Bosumtwi, in Ghana (Talbot & Delibrias, 1977; Stahl 1985). These studies have provided a particularly valuable palaeoclimatic tool at least for the lowland forest of West Africa. It is significant to note that the Holocene behaviour of the lake shows some similarities with lakes elsewhere in the sub-region and in East Africa. There were clear indications from their work that the lakes of the humid tropics can provide valuable palaeoclimatic information that may be less apparent from study of arid zone lakes. Result of their studies suggests that major regressions of equatorial African lakes during the Holocene may have taken place during periods of slightly higher temperatures and greater evaporation, and not a consequence of aridity.

On the basis of their analysis which, took into consideration information from historical records and data obtained from the Geological Survey Department's rain gauge at Apewu (from 1933 onwards), they attempted a reconstruction of the behaviour of the lake over the past 10,000 years as shown in the following Table 1.1.2. below:

**Table 1.1.2. Reconstruction of the behaviour of Lake Bosumtwi over the last 10,000 years after Talbot and Delibrias, 1977, as adapted from Tubosun (1995: 15)**

| | | |
|---|---|---|
| i. | 10,000 – 9,000 BP | Climate was very similar to that of today's. Abundant leaf impressions preserved in the turbidite silt indicate that although the forest flora may have been slightly different in composition from modern local forests, the climate of the Holocene must have been comparable with the present one. Although no dateable materials was obtained from the upper section of the turbidite silt, the considerable thickness (~35m) of silts above the dated horizon suggests that it continued well into the Holocene. |
| ii. | 9,000 – 3,000 BP | Following i) above was a regression that involved a considerable fall in lake level, the resultant erosion surface having been identified at elevations ranging from +2m to +18m. This period was probably coeval with the period of the decline of African lakes which commenced between 6,000 – 5,000 BP |
| iii. | 3,000 – 2,000 BP | Subsequent to ii.) above was a transgression that was coeval with positive changes in levels that are known to have occurred in lakes throughout tropical Africa around this period. |
| iv. | 2,000 – 700±90 BP | Available geological evidence shows that the moderately high level persisted until the end of this period |
| v. | $13^{th}$ – $14^{th}$ centuries AD | Rather abrupt; regression in the lake level started; probably a result of the combined efforts of a rise in temperature and accompanying slight decrease in precipitation which induced evaporattanspiration to exceed water input. |

Notwithstanding these shortcomings associated with deficiencies in works of early researchers and limitations posed by the West African climate, recent works have yielded more detailed results in the attempt to reconstruct the palaeo-environments of West Africa. Such studies employed direct lines of evidence, which have shed an appreciable degree of insight on the distant past of the sub-region during the Quaternary. This has resulted on a convergence of various lines of evidence which informed recent Quaternary palaeoecological reconstruction. A highlight of the result of this work is contained in Table 1.1.3.

Petters (1987), recognised though based on geomorphic and climatic evidence four distinct types of Quaternary sequence in West Africa. These are namely:

i.) the coastal plain sequence;

ii.) the basement sequence;

iii.) the savannah-sahel sequence, and;

iv.) the Sahara sequence.

Apparent is the fact that Petters' (1987) viewed geomorphic and climatic factors as the principal determinants of the Quaternary sequence and so relegated other factors to the background because in his view, different bedrocks undergo weathering at different rates under different climates while different erosional and depositional processes operate under different climates.

Sowunmi (1989), on the other hand, provides very comprehensive information on West African palaeo-environments during the Quaternary period, on the basis of available geomorphologic and palaeo-zoological evidences. She employed the present ecological characteristics in the area as the basis for zoning and carried out a periodization of the Quaternary based on distinctive characteristics identified by her and available chronometric dates. To this end, she recognised the following six groupings as contained in Table 1.1.3 below:

**Table1.1.3. Periodization of the Quaternary of West Africa (after Sowunmi 1989, adapted from Tubosun 1995)**

| | |
|---|---|
| **Period 1**<br>The Plio/Pleistocene Period | The early part of this period witnessed intermittent drying up of lakes in the sahelian zone. Whilst the lakes became totally dry by the early Pleistocene time. The desiccation process was accompanied by significant reduction in both vegetation and fauna terrestrial and aquatic. The present day Sudan zone remained wet for a longer period with the lakes and rivers being active. The present day forest zone was similar to that of today's while the coast line extended towards the sea as a result of sea regression. |
| **Period 2**<br>The Early Pleistocene (~1.3 – 0.8m YBP | Overall conditions appears similar to that of today's as reflected in the presence of vegetation similar to the present one (i.e. Sudan and Sahel Savannah) in Senegal. |
| **Period 3**<br>Late Pleistocene (i.) – | The whole region was characterised by aridity with the latter being more pronounced and lasting much longer in the northern than in the southern sectors of West Africa. Also the present day Sahel and Sudan zones were both characterised by extensive dunes. Vegetation was sparse and confined |

| Table1.1.3. Periodization of the Quaternary of West Africa (after Sowunmi 1989, adapted from Tubosun 1995) | |
|---|---|
| prior to 40,000BP | to inter-diurnal depressions. The period witnessed a further southwards shift of the coast with mangrove vegetation being confined to small localised strips in the creeks. |
| **Period 4**<br>The Late Pleistocene (ii.) ~40,000 – ~30,000 BP | This period witnessed remarkably wetter conditions in contrast to the previous ones. This led to the re-establishment of the savannah where present day Sahel zone was characterised by wetter Sudan type of vegetation. The present day Guinea and Sudan Savannahs and also the rain forest were much dense. The Chad basin was characterised by several lakes and Lake Chad was more extensive than it is at present and occasionally overflows into the Benue. Rivers in the Niger drainage basins also witnessed a significant increase in discharge and competence and consequently there was a rise in sea level. |
| **Period 5.**<br>The Late Pleistocene (iii.) ~30,000 - ~13,000 BP | The entire west Africa sub-region was characterised by a very dry conditions resulting in the formation of extensive dunes in the Sahel and Sudan zones. In addition to these two zones became more arid with drier Guinea Savannah replacing the hitherto wetter zones. |
| **Period 6**<br>~13,000 BP – The Present | This period witnessed a very dramatic environmental change due to an increase in monsoonal rainfall and a general warming of the atmosphere. The resultant effects of these were warmer and wetter conditions beginning from about 13,500 BP. The early to mid parts of this period were marked by the formation of lakes in the present day semi-arid to arid Sahel zones. One of such lakes is the Mega-Chad which was ten times its present size. The entire tropic was also characterised by high lake levels. At about 13,500 BP, some rivers became active and there was increase in the competence of others.<br>This period also witnessed renewed phase of pedogenesis beginning from about 11,500 BP and a rise in sea level above today's at about 5,000BP.<br>This restoration of wetter conditions was also manifested in the plant fossil record. The mangrove forest was re-established and /or expanded reaching as far as to 25km inland in Mauritania<br>Palynological evidence from Cote D'Ivoire and Ghana on the one hand and microfossil botanical evidence from the latter revealed that the lowland rainforests were re-established outside the refugia beginning from about 11,000 BP. Initially the forests were dry and open, but as climate became much wetter, through time, the species diversity and the number of individual species increased with the forest reaching its peak of development around 8,000 BP.<br>The middle Holocene period witnessed local fluctuations back to drier conditions resulting in the formation of dunes in the Sahel from between 7,000 – 5,000 BP.<br>Around 4,500 BP a more regional abrupt dry conditions began lasting till about 3,500 BP in the northern parts and this extended continental till ~2,000 BP in the northern and western parts.<br>There was an overall reduction in river flow. This was coupled with a general fall in lake levels in both the Sahel and Sudan zone. Conditions became slightly wetter in the southern and eastern parts from ~3,500 BP the Holocene climatic optimum ended around ~ 4,500 BP following which was a progressive trend towards drier conditions with vegetation zones reaching their present day boundaries by 3,500 BP |

| Table1.1.3. Periodization of the Quaternary of West Africa (after Sowunmi 1989, adapted from Tubosun 1995) | |
|---|---|
| | After 3,500BP, there were subsequent fluctuations in climate with attendant environmental changes. However, such natural changes have been compounded and aggravated by both human activities and those of his domestic animals. |

To sum up, it is obvious that there were several attempts by researchers from varied disciplines to shed light on the nature and characteristics of palaeoenvironments in West Africa during the Quaternary period. Due to the peculiar natural and human impediments imposed by the sub-region, majority of the pioneer researchers in the sub-region (Aubreville, 1949, Brückner, 1955, 1957, Davies, 1967, Folster 1969b, Rhodenburg, 1969, Burke and Durotoye 1970, 1971 *inter alia*) have tended to use identifiable geomorphic features as palaeoclimatic indicators. Notably, most of these researchers subscribed to a climatic-geomorphic thesis in which climate is considered as the primary and possibly the sole determinant of landscape evolution. This has resulted to total albeit exclusion of other factors such as ecology.

Commendable as their effort may be, and in as much as they constitute pioneer attempts, it is critical to note that they failed in realising that geomorphic palaeo-climatic indicators are often ambiguous. This is because such features including river terraces, pediments, and laterites among others could result from more than one landform processes in addition to the fact that most of the chronology lacked empirical scientific basis. Moreover, most of the sequence they referred to is isolated and located in ecotones which are not at all representative of the entire region. And lastly, their temporal correlation of deposits were based primarily on lithologic similarities without due consideration of the contained biological remains.

The foregoing notwithstanding, subsequent comprehensive synthesis of the available geomorphic, palaeobotanical, and palaeontological evidence as well as the associated chronometric dates by Petters (1987); and more recently by Sowunmi ( 1981; 1989), revealed that the Quaternary climate of West Africa experienced alternating wet and dry climatic phases. During this period, there were shifts in the vegetation communities. In view of this both vegetation and surface water were greatly reduced during the latter phases than in the earlier ones during which more favourable environmental conditions were re-established.

This is especially so, when we take into cognizance the present day biologic diversity of large parts of West Cameroon rain forest in comparison with other parts of the African rain forest. Many palaeogeographers have therefore concluded with the hypothesis that there was an important refugium, which subsisted in the West Cameroon during the Last Arid Maximum a fact which was confirmed by the analysis of pollen data. The pollen record indicated that the rain forest disappeared in Ghana, particularly in the Bosumtwi Sector during the last cold or arid phase between 20,000 to 14,000 Kyr. This was further reaffirmed by the present in lower elevation of a montane element characterised by *Olea hochstetteri* indicative of a temperature cooling (Fig. 8, Maley 1991).

It is therefore very important to note an obvious fact from the above review that the West African rain forest and by implication that of Southwest Nigeria have not been static. There were considerable evidence of climatic and vegetation shifts over a long period, such as pluvial and arid maximums. Therefore, the notion of the presence or absence of vegetation in this zone or region may not be a determinant factor in the discourse bothers on whether humans inhabited Southwest Nigeria during the prehistoric period or not. The cogent issue is one that addresses such question that pertain to the nature of habitation if any and how far back in history such occupations existed.

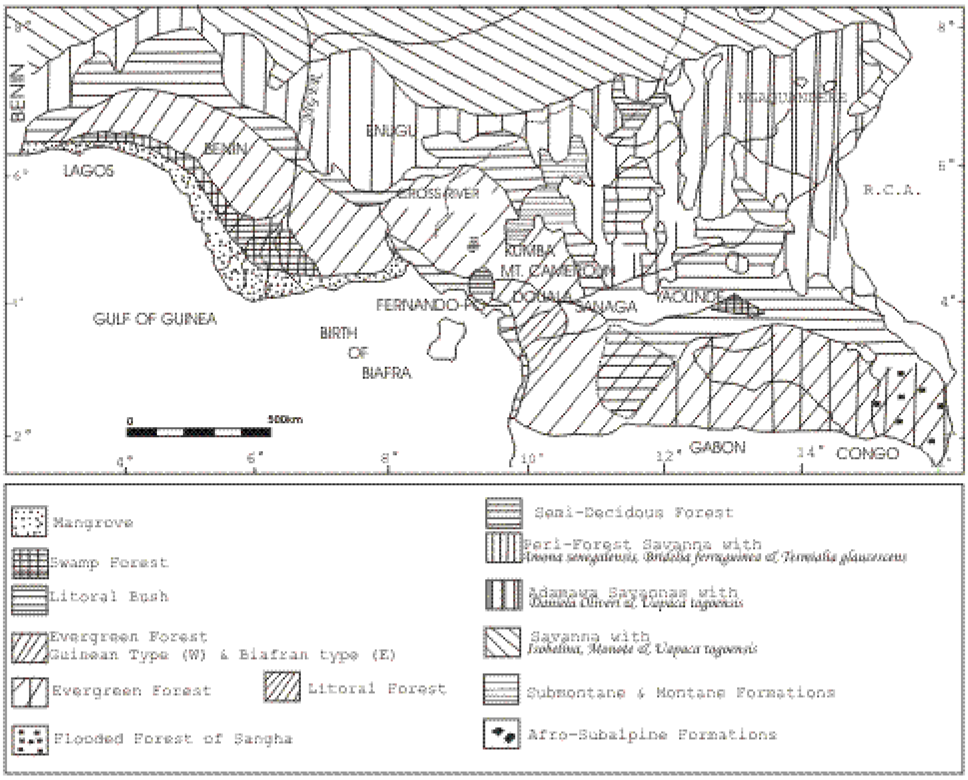



**Figure 8. Schematic map of vegetation around the Gulf of Biafra (after Maley *et al* 1990)**

It should never the less be noted that much emphasis was placed on off-site situations in coming to this conclusion. Little importance was attached to micro-sequences present at archaeological sites within these environmental settings and there was little or no attempt to characterize the nature of the artefacts assemblages found in most of the sites in West Africa. This by implication made it impossible to identify cultural entity (Conard and Fischer 2000) or industrial complexes within the sub-region. This forms the rationale and indeed the point of departure for this project.

### 1.1.2. Geology and Climate

Southwest Nigeria is located within the tropics in the context of West Africa and therefore enjoys similar tropical climatic conditions. The overriding climatic factor is therefore a function of this tropical location. The main characteristic of the climate is the marked wet and dry seasons with high temperature all year round. These two seasons respond to the pressure patterns, which are due to seasonal shifts of pressure belts associated with the apparent 'movement' of the overhead sun north and south of the equator. The commencement and end of each season is a function of the north-south migration of the Inter-Tropical Discontinuity (I.T.D.). The I.T.D. is the surface location of the boundary between the dry continental wind from the Sahara (October - March) and the moisture - bearing maritime air masses (April - September) (Oguntoyinbo, 1978, Fig. 6.).

Southwest Nigeria experiences eight months of rainfall from late March through mid-October. The wet season has relatively high relative humidity (70%). The temperature average is 27°C particularly in July and August when cloud cover affects insolation. The study area also experiences a double maxima rainfall regime with peaks in July and September. The mean annual rainfall is 1580mm. The length of the dry season is four months lasting from late December to late March. The main feature is the dry and dusty Harmattan haze, which tends to obscure the atmosphere. Early morning mists are also characteristics of this period. This however, clears at sunrise. Evapo-transpiration (Fig. 7) is greatest in February and March when insolation is greatest due to cloudless sky. The maximum mean monthly temperature is 34°C (Oguntoyinbo 1978).

### 1.1.3. General Geomorphological Features

The relevance of geomorphology as a tool in modern day archaeology lies in its usefulness as a tool for interpreting the evolution of landforms, explaining the relationship between deposits, and, in estimating the rate at which segments of the earth's surface developed through time. These are desirable information in archaeological investigation for the simple reason that the natural world constitutes the operational stage in which humans evolved physically and culturally.

Although, events operating on landforms affect the history of those landforms, there is always the existing problem of defining the exact relationship between climate and geomorphic processes. What obtains presently in some localities may be the reworking of the present-day climate on the landscape. It is in this sense that actualism runs into trouble as the present is presumed to be dependent on the past, even though it has been alleged as being the key into the past. It is a fact that similar geomorphic phenomenon may be produced by normal and catastrophic processes. For this reason, evidence of present day processes is always an adequate basis for generalising on what obtained in the past. This is particularly so when considered against the fact that the present is not necessarily a master key to past environments, which even differ in some respects when compared with modern ones. Therefore, there is the apparent need to develop appropriate strategies for comprehending situations, which differ from the existing one.

The need for a theory with proper sociological substance and orientation is pertinent. This is the case if we are to take due cognizance of the fact that socio-spatial dialectics of settlements i.e. the fact that social phenomena are both space forming and space contingent and noting specifically that spatial dialectics reflects or refers to points where physical space tie up with central facets of a people's social dialectics (Scharrtzki, 1971: 556-667 in Andah 1979).

Southwest Nigeria as said earlier includes an area located south of the Niger-Guinea Coast watershed. This watershed as has been observed, forms a divide between the river systems which flow southward down the Guinea slope into the Gulf of Guinea and those flowing northward into the Niger River basin. The geomorphic characteristics of the area has been the subject of various studies to date and this endeavour can be traced back to the pioneering days when Wilson and Bain (1922), recognised three main topographic units in the area. These include:

i. the coastal creeks and lagoons;
ii. the dissected margin and;
iii. the western plains and ranges

Jones and Hockey (1955) provided a physiographic description of part of western Nigeria to include one that consists of:

i. a physiography of the crystalline basement, and;
ii. topography of the sediments.

Latter studies have amply demonstrated the existence of five major and distinct geomorphic regions in Southwest Nigeria. These involved studies of component landform units, their characteristics, origin and their evolution as revealed from field mapping and survey, as well as analyses of geological and topographical maps as well as aerial photographs. These are highlighted by Durotoye (1972) as including:

i. the continental margin;
ii. the coastal margin;
iii. the Guinea slope of sediments;
iv. the Guinea slope of crystalline basement complex, and;

v. the Niger-Guinea Coast Watershed area.

The focus area in this survey includes the Guinea slope of continental crystalline basement complex and the Guinea slope of sediments.

There are three recognisable landform units on the crystalline rocks of the basement complex in Southwest Nigeria. These include:

i. extensive pediment surfaces,

ii. residual hills, and,

iii. rejuvenating river valleys (see Fig.s 9 and 10).

The morphology of the crystalline basement complex contained many pediment surfaces. These pediments slope very gently from a water divide to adjacent river valleys. The divide is marked in some areas by residual hills. The pediments slope gently over deeply weathered bedrocks, occasionally spotted by small outcrops. Thin superficial deposits ordinarily termed soils or regoliths cover the extensively weathered bedrocks. Three layers of such deposits have been recognized and described at different localities. The oldest consists of cemented pediment gravel, which occurs only as a small remnant on the higher part of the pediment. The second one is a very extensive cover of loose pediment gravel often used in road and other construction purposes. The lower unit is much coarse in comparison to the other two and most often referred to as stone line. It is often cemented at the bottom of the incised valleys. On this last unit is a thin layer of sand/silty deposit that is about 60cm thick. The upper part is almost invariably black because of its high humus contents.

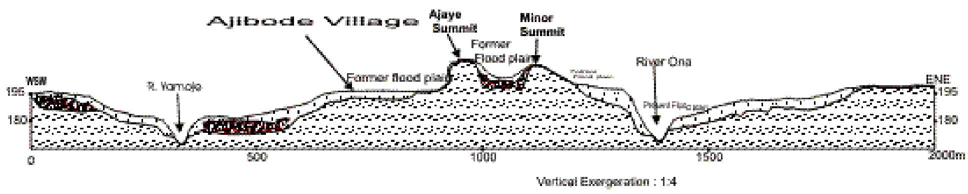



**Figure 9. A generalised profile showing characteristic landscape units at Ajibode and its immediate environ.**

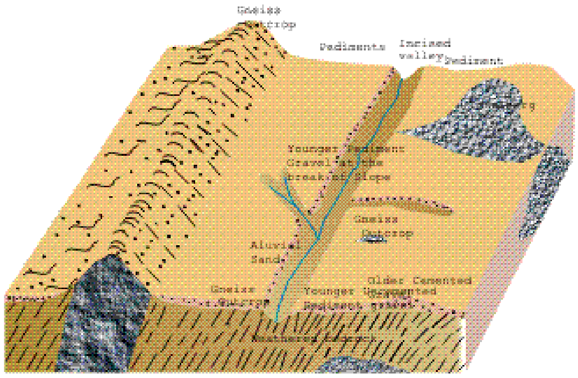



**Figure 10. Physiographic sketch showing the characteristic landforms of the pediment residual landscape on christaline rock**

The most striking features on the crystalline rock landscape are the residual hills. These hills rise abruptly over the gentle and surrounding low-lying surfaces of pediments in extremely wide ranging shapes and sizes. This attribute is responsible for the various names and description they acquired of which inselberg is the most popular. The highest of these at Idanre stands at above 600m above the surrounding country. Other forms have been described by Faniran and Hugh (1969) and include bornhardt, turtleback, tors, and kopje. The residual hills also occur as ridges, especially where they were formed on quartzite (Durotoye, 1972; Faniran, 1986).

The rejuvenating river valleys (Fig. 10), have dissected the pediment and consequently present features commonly described as 'gentle' or 'undulating' plains. The valleys are in most cases marked by V-shaped forms because they are still very active and are still cutting or incising into their beds. A break of slope marks the contact points between the shoulder of the valleys and the pediments. The valleys are in most places covered by thin layers of clean alluvial sands which are widely used in civil construction works.

The Guinea slope of sediment on the other hand lies north of the coastal plain. The topography is on Late Cretaceous, Tertiary and Quaternary sediments. The slope trend generally from north to south and therefore considered as a continuation of the Guinea slope. Jones and Hockey (1964), described four distinct morphological forms, which include the northern and southern uplands separated by the Ewekoro depression and the broad valleys of the larger rivers.

The uplands overlie epiclastic rocks while the Ewekoro depression is a karst topography, which developed on the Ewekoro limestone formation (see Durotoye, 1970; 1971 for a detailed description). The uplands and Ewekoro depression trend in a WNW-ESE. This coincides with outcrop pattern of sedimentary rocks.

The northern upland overlies the Abeokuta Formation hence its name. The southern uplands on the other hand, are developed on the Ilaro Formation and are therefore, referred to as the Ilaro Formation. The uplands are ceustas with north-facing scarp slopes. They are in fact products of dissection activities of the sedimentary uplands by the large rivers like Ogun, Osun, Ona and Shasha (Fig. 3) on their southward progression to the coast. These rivers have incised deep valleys especially during lower sea levels in the Pleistocene. Thick alluvium subsequently filled these drainage basins to form the flat bottom valley feature of today.

Weathering of the landscape is spheroidal and as such accounts for boulders along the slopes. Weathering is initiated along the well-developed joints or zone of weakness on crystalline rocks. The process involve an initial rounding off of the angles and corners and then producing, thin concentric shells or layers, which become soft and fall off gradually. The main part of the weathered material is formed as a result of such exfoliating mechanical weathering process. These are subsequently brought down as hill wash into the gullies and streams. This weathering results in black humus soils under vegetation covers in the area. Higher rainfalls and deep leaching often give rise to red or red-brown soil, latosol, and to laterites in areas of extreme leaching.

The structural geomorphology (Fig. 10) of the study area is rather complex. Landform in the study area is a function of structure, process and stages going by the opinion of geomorphologists. Three distinct landscape units can be described in the study area to include ancient crystalline rocks of Pre-Cambrian age which is part of the base of the continent of Africa. The oldest among these rocks are intensely folded schists and banded gneisses. These are less resistant than the granites, which formed inselbergs and tors in the area.

These old rocks lifted by tectonism above sea level were strongly eroded before the Cambrian period began. Various types of continental sediments also accumulated on them. Subsequent marine transgression also laid some sandstone and limestone on them. These lower Palaeozoic rocks have metamorphosed into quartzites, crystalline limestone and slate. Some of them are still standing as steep-sided ridges and escarpments. Earth movements of the Caledonian and Hercynian orogenies, caused the lower Palaeozoic rocks to tilt and fracture (Faniran and Hugh, 1969).

There is rareness of active tectonic landforms. Climate with its accompanying processes of weathering, soil formation and removal by wind, rivers and other agents must have played dominant roles than structure. Problem arose from few researches and scarce radiometric dates. This is compounded by bias and misleading interpretations of former climates from certain features, which are open to alternative interpretations and the rather misleading assumption that climatic events are synchronous and regular as well as lack of adequate climatic models.

However, some studies are relevant to the investigation. One such study is one that concerns with the Quaternary period and focus on information preserved in soils and drainage system of many places. There is for example emergence evidence that climatic changes occurred and involve drier, wetter, cooler and hotter conditions. These are changes which are not properly correlated with conditions in the continent or in other ones. These studies further throw light on a number of ‘mysterious’ features such as the presence of fixed dunes in areas presently occupied by the tropical forest.

The implication of this for the current investigation is that the West African landscape particularly that of the study area had not been static to say the least. It has been undergoing changes which have variously affected land-use and economy of the inhabitants of the region in general on the one hand

and on the other the preservation of the records left behind by these former inhabitants. The quaternary deposit (Fig. 10) in the investigated area consists of variously consolidated and mostly unfossiliferous alluvial silts, sand and gravels. These inter-bedded locally with colluvial silts and gravels. The deposits are very limited in lateral extent and mostly of late Quaternary age. Phases of erosion and rejuvenation alter phases of aggradation seemingly due to tectonic activity.

The question that follows on this addresses the relevance of such geomorphological information to a study of this nature. This can only be realised when looked upon from the angle that the environment including the landscape which is the stage upon which humans carried out the art of living have been shaped by this geomorphological processes. Understanding these processes is source of vital information for understanding how land use in the study area is conditioned by local geomorphic situation and regionality.

### 1.2. Background to Stone Age studies in Southwest Nigeria

The present study is the outcome of several seasons of fieldwork in the forest region of Southwest Nigeria. It stems from the decision and advice of Professor B.W. Andah (late) of the Archaeology and Anthropology Department of the University of Ibadan that this work commenced. Professor Nicholas J. Conard (Ph.D) of the institute of Prehistory and Quaternary Ecology of the University of Tübingen, Germany prompted the revisiting of this work following studies by the present writer in the above named Institute. Andah (1979) was keenly interested on the aspect of peopling of the West African forest zone and had investigated this phenomenon at various sites including Asokrochona in Ghana, Uguelle-Uturu in Southeast Nigeria among other places. This project is therefore an attempt to extend this investigation into the forest region of southwest Nigeria. Researchers in the department of archaeology at the University of Ibadan have found evidence of lithic technology especially ground stone axes, polyhedral cores etc. to be prevalent in the forest region of Southwest Nigeria (Shaw and Daniels, 1984). Added to these are incidences of accidental discovery of artefacts in farmlands near the University. These developments prompted the pioneer expatriate investigator to investigate a number of sites including some Late Stone Age sites by Willet (1962), Shaw and Daniels (1984) among others in a bid to understand the nature, distribution and the manufacturers of these lithic artefacts.

Lithic artefacts with attributes akin to Early Stone Age industries were encountered accidentally at the Ajibode locality (Fig. 11) in the course of farming activities albeit in secondary contexts. These are within the context of basal, coarse gravel on the surface of farmlands along Yamoje River valley. Find situation of such artefacts include the silt layer on the present flood plain, where reworking of the landscape had resulted in the redeposition of these artefacts. Andah & Momin (1993) and others (Akpobasa 1994) were therefore naturally eager to know more about the origin of theses artefacts and by implication the stratigraphic context of the fluviatile deposits of the Yamoje stream as well as that of other localities where such artefacts were recovered. The present writer was therefore, advised to make a comprehensive study of the entire landscape of the Yamoje river valley with particular emphasis on the stratigraphy of lithic artefacts and morphology and also search for points of secure stratigraphy in order to establish a chronological framework for these ubiquitous lithic artefacts.

It was in view of this that this investigator undertook a wide-ranging survey of Ajibode and its immediate surrounding. This survey embraced points as far away as Lanlate and Ikire within the forest zone of southwest Nigeria in an attempt to characterise the lithic industries of the region and place them in spatial and chronostratigraphic contexts.

This extensive survey only brought about the reality that the evidence of prehistoric occupations within the forest ecozone of southwest Nigeria is a subject of a rather complex discussion, which bothers on the intricacies of dealing with informal lithic materials with no direct association with datable material and in mostly secondary contexts. The immediate challenge then is that of placing such evidence of human activities within some chronostrtigraphic framework that could be utilised for comparative purpose of comparing assemblages at a regional level. The question arose as to the peculiar character vis-à-vis morphology of artefacts from the study area, variability in view of recognisable traditions in terms of techniques and apparent technology among other crucial questions therein. This can only be a prelude to the understanding of the wither West Africa forest zone, and as a background information for an attempt at characterising the nature of pre-urban settlements in the sub-region. A project of this nature is apparently untenable given the extensive nature of the entire region, and difficulties posed by funding and lack of expertise in this particular area. This prompted an intensive investigation of specific sites such as Atamora in order to source raw data for comparative purpose.

This is therefore an attempt to presents in some details the results of survey and excavations carried out by the investigator in selected sites in Southwest Nigeria particularly Atamora rock shelter as well as the result of the analysis of excavated material.

There is inadequate information regarding the earliest settlers in West Africa and particularly the forest zone of Southwest Nigeria (Fig.s 3 & 5). Not much is known about the kinds of habitats they first settled in, what of such habitats were preferred and why and how they settled into these habitats.

There was little information about resources they exploited, tools they utilized and social organisation as well as their affinities with early sapiens and primate apes.

It is not possible given the present state of knowledge to determine at what point in the history of human occupations in the region, when humans began to operate from fixed points and what kinds of homes or central points these early inhabitants occupied.

To grapple meaningfully with the cultural character of early man's life in southwest Nigeria, there is the need to correct the previous over-emphasis on typology and technology in prehistoric investigations. Such trend has resulted in the tendencies to infer cultural systems from identification of typological entities and the technologies associated with them. It has equally resulted in the correlation of a few representative artefact types present in an area (such as Southwest Nigeria) with well defined industrial entities present elsewhere (Clark 1963, Allsworth-Jones 1987; 1993). This situation is further complicated by the equation of cultural development with organic or biological evolution.

Rather than concentrating solely on artefacts, there is the urgent need to study systematically, the types of sites early man occupied, what these settlements contained (the activities and associated processes that took place within them) and what these tell us about the behaviour of the inhabitants (at least in terms of land-use, beliefs, regulations/rules, styles of rendition etc.). Site settlement approach proposed by Andah (1995), should in his opinion help with finding answers to such questions that concerns prehistoric life ways in sub-Saharan Africa. Questions should be directed as to whom the actors were, the nature (size, shape, content), regularity and intensity of their occupation, the people's territorial range, resource points or base (e.g. water points), the kinds of animals and plants they exploited, how and with what tools and when they began to build the types of structure they erected and how.

Desirable as this may be, it is only partially realistic and it is pertinent to point out that this can only be a theoretical ideal, which is practically untenable in all its ramifications given so many obstacles that hinder data recovery in archaeological investigation particularly in the study area.

Related to the above-specified problems is the claim that there was virtually no evidence to suggest that the hominid forms who made Acheulean type tools lived within humid forest habitats other than on the periphery of the Congo (Zaire) basin or of the West African forests. Clark (1980: 45), has specifically argued that the interglacial distribution of forest is a fair indication of the area excluded from Acheulean occupation. Therefore, going by this position, one is inclined to think that this region was unoccupied during that period in hominid history, when the Acheulean toolmaker lived. The extent to which Clark's opinion is justifiable or considered objective can not be ascertained given the scanty nature of proof or evidence. The available information on the earliest phases of human history in the region does not however, support Clark's position.

### 1.2.1. The natural context of available archaeological evidence

Southwest Nigeria (Fig.s 2 & 12) contains very few known or investigated prehistoric sites of primary context. The bulk of the finds come from secondary depositions. Consequently, it is often impossible to infer the appropriate significance and meaning of such artefact depositions and associations. Elsewhere outside the region such sites were also found in secondary contexts. They occur mainly in coastal and river valley cuttings as well as superficial deposits in virtually all parts of the Guinea region of West Africa. Prominent among these are valley cuttings in sections of the region's major rivers, including Niger, Senegal, Gambia, Volta in Ghana and Burkina Faso; the Comoe in Ivory Coast, and their tributaries. It also occur in the context of smaller rivers at sites such as along the Upper Ogun River and Asejire in Southern Nigeria and in the streams like those in the Nok valley, Hadeija and Yobe in northern Nigeria. Site occurrences in primary contexts include those in lacustrine deposits especially in the Southern Sahara (e.g. Air Region, Adrar Bous, Tenere; Rock Shelters and Cave sites like Yengema and others in Sierra Leone, Kintampo, Ntereso in Ghana; Rop and Iwo Eleru in Nigeria; Kawara and others in Burkina Faso also contain sites in primary contexts. Primary depositions of artefacts are relatively rare in the Guinea forest sectors (Fig. 2.). This may be explained by the rarity of Pliocene and Pleistocene sediments in West Africa especially to the south of the Sahara. Farther north however, such deposits are present up to 600 metres deep in the vast Chad basin. Unfortunately, exposures are limited and it seems that lot more materials lie deeply buried. Some evidence for makers of 'Oldowan' type and/or Early Acheulean tools in West Africa was mainly from surface finds. They were in rare cases obtained from test pits in river gravels or terraces where such lithic artefacts are redeposited, in raised beaches and other sites on the coast. The problem of making sense out of the materials obtained from non-primary context is very complex. The efforts of pioneer workers is quite appreciable, but the fact that they carried out in many cases unsystematic preferential collection of "diagnostic" tool types for relative dating purposes leaves every thing to be desired as far as the interpretation of such evidence is concerned.

A direct consequence is the inadequate characterization of assemblages in terms of their composition and variability. In addition, knowledge of the chronological framework for the earliest human cultural manifestations in West Africa remains extremely rudimentary. The fact that supposedly pre-Acheulean tools have been identified at a scatter of sites away from the present forest region heading towards the Sahara is however, significant. It is especially interesting in our view that this more distinctive kind of evidence is found in or near to the areas linguists have suggested to be the heartland of the Niger Congo and Nilo Saharan language *phyla*. It could well be that man the hominid lived here longest in this part of West Africa and/or most intensively, giving scope for *Homo sapiens* to emerge in these zones. There is no reason to suppose however, that the hominid populations could not have occupied other parts of West Africa where favourable/suitable ecological conditions permitted. This then leads to the question as to who these earliest occupants of West Africa were. Did they belong to the earliest known hominids such as the erectus, habilis etc.? If so, were they at least during the earliest times strictly foragers - where central place foraging is defined as scouring far and wide for food and other needs, and returning to a spot carrying a prey item or a load of food for the purpose of provisioning (food sharing). Did they or did they not systematically transport food back to their refuges? What impact did food transport and perhaps tool transport costs have on their foraging patterns? Or were they refuging foragers, who like the apes, when taking their ranging decisions often had to balance the sometimes conflicting demands of getting access to patches of food and water or limited refuges, while maintaining social contacts and avoiding predators (Sept.1994) Did Australopithecine form live in any parts of the humid tropics? If so what parts and when? Do they share resemblances with the apes or with *Homo sapiens*? What kinds of terrain did they colonize and which did they visit? Was it about the same kinds of terrains as chimpanzees as that of modern chimpanzee populations in the area? Would it be correct to surmise that by the time *Homo erectus* and the *sapiens* emerged, man was living in many parts of the evergreen forest regions?

Superficial deposits, containing early Palaeolithic artefact assemblages are significant. These are widespread on the Guinea slope region of West Africa. Most of these deposits are laterally overlapping successions of laterized and/or cemented crusts, partially truncated palaeosols buried by pedisediments in degradational landscapes. In other words, these successions are usually pediments and hill wash or terrace sequences containing stone hues, loamy sands or truncated palaeosols and cemented crusts. Indeed the prevalence of pedimentation and degradational processes largely explain why the features that are widespread in such successions include: laterite and bauxite profiles; alluvial deposits and landforms that are products of climatically induced episodes of enhanced river activity; slope deposits with associated soils/palaeosols. The trend these appear to reflect is that of a landscape whose evolution was marked by alternation between phases of instability (break-down, erosion, river incision, scouring, etc.) and stability (aggradations, soil/vegetation build up). The terracing hillwash phases represent river erosion by pedimentation, while intervening periods are marked by the development of ferruginized crusts or the re-cementation of laterite crusts. Differences in the laterites for each locality relate to age and differences in local relief and climatic conditions, but between localities, these relate to differences in bedrock, topography and drainage. At these sites what we often witness is the classic occurrence of multi concave slope profiles with concave sections (three or four) separated by distinct breaks of slope each marked by outcrops of feruginized crust, with a flat crest surmounting the whole profile.

Of interest to us is the fact that many of these profiles (Fig. 9)occur in distinct and in some cases contain Palaeolithic assemblages. Typical examples of such occurrences include Jos Plateau in northern Nigeria, Ajibode in southwestern Nigeria, Uguelle Uturu in southeast; Legon, Achimota, Asokrochona and Tema in the Accra coastal region. The site profiles containing artefacts all appear to share certain very distinctive common features some of which we now list. Their location is usually it seems in ridges at the scarp foot of escarpments or hilly slopes that are dissected by fast flowing streams, which have deeply incised valleys. These sites are usually incorporated in eroded pediments situated within well-incised valleys (e.g. Odo-Ogun, Ajibode, Uguelle-Uturu etc.). Whether the sites occur on the coast or in the hinterland, there is often present a vertical succession of paired terraces with usually one or two of the terrace levels containing early Palaeolithic artefacts (Odo-Ogun, Ajibode, Asejire, Uguelle Uturu etc.). Archaeological reconnaissance at sites like Odo-Ogun, Asejire, lseyin, Ajibode, Uguelle Uturu, in Nigeria and various points on the Volta (Ghana) generally show that the rivers grew progressively smaller over time and experienced at least three major phases of decreasing volume of water marked by features such as terrace levels, former flood plains and the presence of calciferous rocks (Fig.s 2, 3, & 4). The older terraces lie at higher topographic levels than the younger ones because these valleys incised into earlier terraces following progressive lowering of the sea relative to the land on the coastal areas. All the sites in the southern parts occur in areas which lie at the edge of the forest, but presently with derived savannah vegetation. It seems that all or most of them were located at the time in the moist lowland tropical forest region. Such sites include Asejire and Ajibode in lbadan and Uguelle-Uturu in Okigwe, southern Nigeria. The river, stream or lagoon appears to have been of central importance to the resource exploitation systems devised by prehistoric occupants of these terrains. The archaeological deposits containing "Oldowan" type of Acheulean artefacts were generally associated with the older terraces. The pediment hillslope terrains, which seem to have been favoured for early human occupation, tend to be those, which have: a) a line or lines of perennial springs or streams, and; b) possessed relatively fine-grained rocks in the surroundings. At Uguelle-Uturu, it was sandstone/shale, igneous intrusions of dolerite and diorites; at Jos, the streams overlie fine-grained biotite granite, basalt, and dolerite: at Ajibode; it is acidic gneiss, which contains basic igneous intrusions, mainly dolerite as well as feldspar veins producing quartz and quartzite. At Asokrochona, surface bedrock includes quartz veins, which cut into the Dahomeyan metamorphic basement. Pebbles mainly of vein quartz and quartzite are available from pebble beds that rest on the Dahomeyan.

Factory sites would appear to have been very prominent in the cultural landscape of early man in West Africa. These occurred generally as concentrations of artefacts at the foot of hills (Ajibode, Asokrochona, Uguelle-Uturu) but mostly found in association with the various laterite deposits (cemented or uncemented as in Ajibode). The mottled loamy deposits and crusts contained in the pediments and hill wash sequences at Asokrochona, Tema (Ghana) and Uguelle Uturu (Nigeria) contain early Acheulean and/or Sangoan like industries. On the other hand, "Oldowan" type artefacts obtain in the context of older terraces of some incised valley sequences like Beli on the northern bank of Taraba, Kontcha on the Mayo Deo in Western Cameroon and Ajibode in lbadan in Western Nigeria. Perhaps the most definitive so far of these finds are those from Ajibode (Andah & Momin 1993: 217), and Asokrochona at least on morphological criteria. For one thing, the three-paired terraces at Ajibode are quite distinct and are generally based on encrusted laterite, which enclosed remnants of old land surfaces/occupation levels. These surfaces, are well preserved where they have not yet been exposed by erosion, farming activities or sand quarrying. However, where they have been exposed on road surfaces or farmlands, they are marked by very rich scatters of stone artefacts. Nygarrd and Talbot (1984) gave regional names to the major formations in their study of Central Coastal Ghana (specifically the sites of Asokrochona, Tema).

It is worth noting the fact that that most archaeological investigations and propositions on the Stone Age of this region have focussed primarily on off-site situations. Little attempt has been made to characterize artefacts within particular site situations as a basis for the identification of cultural entities within the sub-region in general and Southwest Nigeria in particular. In view of the foregoing, it is pertinent then to put artefacts from different sites in proper temporal and typological sequence as a basis for comparative studies and establishment of cultural entities within the context of West African Palaeolithic. This is a point of departure from earlier works in the region and infact, the rationale for this work wherein the site in question is used to as a case study to attempt to characterize the internal structure of prehistoric settlements and problem posed by difficult working environment.

### 1.2.2. Cultural remains

The tropical forest region of Southwest Nigeria like the most other parts of the world has provided an environment, which is not only conducive to settlements but, where erosion permits, is one retentive of its traces. It is a substantial factor in human palaeoecology by virtue of the land surface, fertility, exploitable fauna and flora as well as the drainage network with related aquatic potentials. The potentials of this ecosystem and the degree to which it has been exploited have not been fully explored due to inadequate applied scientific investigations. Much evidence has been lost due to the activity of erosion and denudational factors. The understanding of the workings of natural forces which acted to shape the natural history of the area and by implication human evolution and cultural development is therefore predicated on a proper research design which embraces applied sciences. This is a particular call for an appropriate general research design for archaeological investigation, which takes into perspective the parameters such as site locations, long term knowledge and experience in landscape formation and degradation process.

There is little doubt as to the process of formation of this widespread landform in general outline, which involves a massive accumulation of sediments resulting from weathered outcrops whose ages range from Pre- Cambrian through to the Quaternary.

The settlement potential depends on several inherent characteristics such as vegetation and good arable lands. This potential may have been strengthened and enhanced by substantial forest resources including wildlife and aquatic resources. It is possible that these food resources supported relatively large and semi-sedentary populations. Whether such settlement as envisaged here took place is a function of the nature of deposition, redistribution and the chronology of both.

From a geomorphological point of view, this is a crucial and complex watershed in archaeological investigation, although little can be said as to deficient cultural representation.

What then are the vestige of earliest and subsequent settlements that survived the vagaries of time and space? Landscape modifications following periods of climatic amelioration have continued increasingly to date. There is for example clear evidence of submergence of such features in zones of dense vegetation and unsecured soils.

There are rich scatters of lithic artefacts bearing Stone Age attributes in southwest Nigeria. Archaeological research has shown that most of them resulted from a long history of human occupation of this area.

Southwest Nigeria has a long history of archaeological investigations. Such investigations have focussed on the immediate historic past of the present inhabitants and the distant prehistoric past. It has been established that the hunter-gatherer groups who settled in the area utilised available resources in terms of rock shelters, fauna and flora as well as other natural resources by employing varied survival strategies adapted to forest ecology.

Earlier findings include Late Stone Age settlements at Iwo Eleru in Ondo State in the tropical rain forest area of southwest Nigeria, which lasted for several millennia from around 12,000 BC. Willets (1962), among others, have also excavated a microlithic industry at Old Oyo in the forest savannah fringes in the same area within the study area. Shaw and Daniel (1984), Buck and Durotoye(1971) have also found remnants of pebble artefacts, which are morphologically similar to the Oldowan tool kits in East Africa in the Upper Ogun river banks and as surface collections in Ibadan among other localities in southwest Nigeria.

Early Stone Age artefacts were also recovered from the surface and *in situ* along the bank of river Yamoje at the site designated as Umaru Farm Site (UMF) in the Ajibode locality at the northern periphery of the University of Ibadan Campus. Others within this area include Mama Chinyere Farm (MCF) and Lawal' Farm (LWF) as well as from several other localities in Ibadan during two seasons of excavation between 1993 and 1997. In particular, the section from UMF yielded MSA(?) artefacts in series of fluvialtile sediments. The number of artefacts collected from this section is very small and are not useful in any meaningful analysis of the nature of occupation or for any chronological purpose.

Three categories of cultural remains are identifiable from the prehistoric remains recovered from the study area. These include bones, lithic and pottery. Potteries are by far the most numerous as they are ubiquitous and prevalent almost in all habitable area of southwest Nigeria. This situation has complicated the data interpretation process as far as cultural development is concerned in the study area. There is at present no way of establishing a clear-cut relationship between the remains of potteries belonging to recent cultural occupations and those of the distant past. Lithic remains are therefore the most important indicators of prehistoric occupations, at least on techno-morphological grounds. Such associations as ESA, MSA and LSA proposed for this part of the world are essentially based on morphometric ground. Lithics artefacts are therefore very important in reconstructing the history of humans in this region in as far as the distant past is at issue. This was why lithic analysis occupied a central focus in this investigation. Bone occurrences had remained at most minimal throughout this area in particular and indeed West Africa in general. This is due to environmental conditions, which did not favour the preservation of bones. They survive only in microenvironments such as caves, which are very scanty in the region and in rock shelter where there are extreme conditions not peculiar to the immediate surroundings. In the few instances where bones of any meaningful antiquity were recovered (Iwo-Eleru and Itaakpa), they were poorly preserved and fragmentary in nature. It is not surprising then that there has not been much success in West Africa in a bid to find the physical types that were responsible for the manufacture and utilisation of artefacts in the distant past. Much of the information regarding the physical population in the distant past, are subjects of speculations and conjectures which are based on information from outside the region with the exception of few instances mentioned above. Most of the analyses in this work are on the lithic materials recovered during the fieldwork exercise.

The foregoing gives a brief background into the nature of artefact occurrence in Southwest Nigeria and by implication Nigeria generally, noting the particular influence played by the environment in their recovery context. It is obvious that there is a need for better data recovery strategies, which would take into cognisance the environmental peculiarity of the region. The natural environment has acted to shape the landscape and cultural configuration of the region and should be accorded proper significance in any study of cultural developments. In addition is the need for an interdisciplinary fieldwork aimed at providing some insight into the sedimentary geology, human palaeontology, geomorphology and palaeoecology. This is in order to arrest the shortcomings posed by the nature and manner of archaeological research in the country, which leaves much in doubt in respect of the actual aims and objectives of archaeological investigations especially in the brief period following the post 1970s oil boom era in Nigeria.

Nigerian archaeology at the turn of the millennium is undergoing rapid renaissance at one level and reassessment of research strategies towards better data recovery. The Forest region of the country had suffered most, so much so, given the fact that it harbours materials, which are of great relevance in extending the history of humans and cultural development in the sub region beyond the present 12,000 BP date established at Iwo-Eleru (Shaw and Daniels 1984).

A survey of archaeological research in Nigeria had demonstrated significant achievement in historic archaeology with particular reference to early centres of civilisations such as Nok Culture area, Ile-Ife, Benin and Igbo-Ukwu with established chronological sequence going back to at least 900AD. There is equally relative success in Late Stone Age investigations. Shaw and Daniel (1984) based on findings from Iwo-Eleru characterised four phases of cultural development as follows:

A1 12,000-7000BC

A2 7000-5000BC

B1 5000-2500BC

B2 after 2500BC

The earliest of these is associated with the period of extreme aridity when temperature and precipitation in this area were lower than it is at present. Excavations at Iwo Eleru also produced human skeletal remains with Negroid features. It is dated to about 8,000 BC. So there is no questioning as to whether humans occupied the area at least through the last 8000 years BC. At issue however, are questions bothering on what happened before then or even before the inception of the Holocene.

To this end Andah B.W., K.N. Momin and others including this researcher have reported occurrence of artefacts having Middle and Early Stone Age attributes and have gone ahead to conduct excavations in order to confirm this at Ajibode village in the Ona valley. The artefacts recovered were observed to be of greater antiquity than those from Iwo Eleru and other sites within the sub region at least from techno-morphological point of view. Put in other words they are older than 12000 years and more importantly on open-air sites. This prompted the investigators to search for rock shelter or cave sites where one can find materials in stratigraphically secured context which may contain dateable materials. This is in order to shed light on the open-air sites. Atamora rock shelter therefore provides such opportunity as surface collections within the cave had produced materials similar to ones recovered during earlier investigations at Ajibode.

# Chapter Two

## 2. Southwest Nigeria: sites in perspective

### 2.1. Introduction

In this chapter, selected sites under the study focus are defined in terms of their peculiar site character, i.e. topography, research history, and stratigraphic interpretations where available. Cognisance is taken of the nature of data that formed the basis for defining the period under study with emphasis on the artefacts and other material forms of evidence used in the study.

In this regard, attention is drawn to every palaeoenvironmental data that had been employed to reconstruct the temporal spans of occupation and palaeoenvironmental conditions that framed such occupations.

### 2.2. General Observations

Prehistoric explorations in Southwest Nigeria (Fig.s 3, 5 &11), particularly, in the forest zone directly south of the Sudan savannah comprises only a few decades of speculative and scientific drives. Some impressive results derive from some of these investigations, and revealed that the area was inhabited at least as far back as the Late Stone Age. What has been achieved so far can at best be described as a drop in the ocean. This suggested to some extent the directions to look at when searching for pre-dynastic and pre-modern inhabitants of the forest zones in the study region.

The recovery of Stone Age substratum goes back to about the beginning of archaeological investigations in Nigeria. There were for example large surface scatters of artefacts reminiscent of Oldowan tool complex of the Early Stone Age.

Earlier attempts to place these finds in some sorts of chronostratigraphic frame of reference has proved abortive. This is a direct consequence of the difficult nature of the landscape which is more or less an eroding one, a situation which has rendered the recovery of artefacts *in situ* rather untenable except, in microenvironments or sediment traps which are hard to come by in a rather difficult terrain such as that of Southwest Nigeria in particular and West Africa in general.

This scanty or lack of organic remains in most archaeological assemblages further complicated the situation. It is therefore a common conclusion among the interested pioneers to suggest the need for more rigorous methodology that will help break through the palaeoecological conundrum.

Added to the foregoing problem, is the profusions of pottery artefacts and large quantity of informal tools in Southwest Nigeria. This tends to cloud the actual recovery contexts of most prehistoric finds thus, making full comprehension of prehistoric settlement settings difficult and problematic in many cases. The first stratified and informative Stone Age site excavated in the region is Iwo-Eleru. Iwo-Eleru (Fig.s 2 & 3) is close to Isarun village near Akure, the capital city of Ondo State in Nigeria. Others sites include Asejire and Mejiro which are located in the forest-savannah ecozone.

In the beginning, there was difficulty in finding formal artefacts types such as the documented Middle/Late Stone Age assemblages in other parts of the world especially in East and Southern Africa, and to a limited extent in northern Nigeria. Only a vague indication about their antiquity is possible given the morphology of the material. Moreover, the lack of radiometric dates for most of the material renders the archaeologist working in the area almost helpless.

Therefore, most archaeologists in Nigeria and especially the south have focused much of their attention on historic periods, paying lesser attention on the prehistory of the

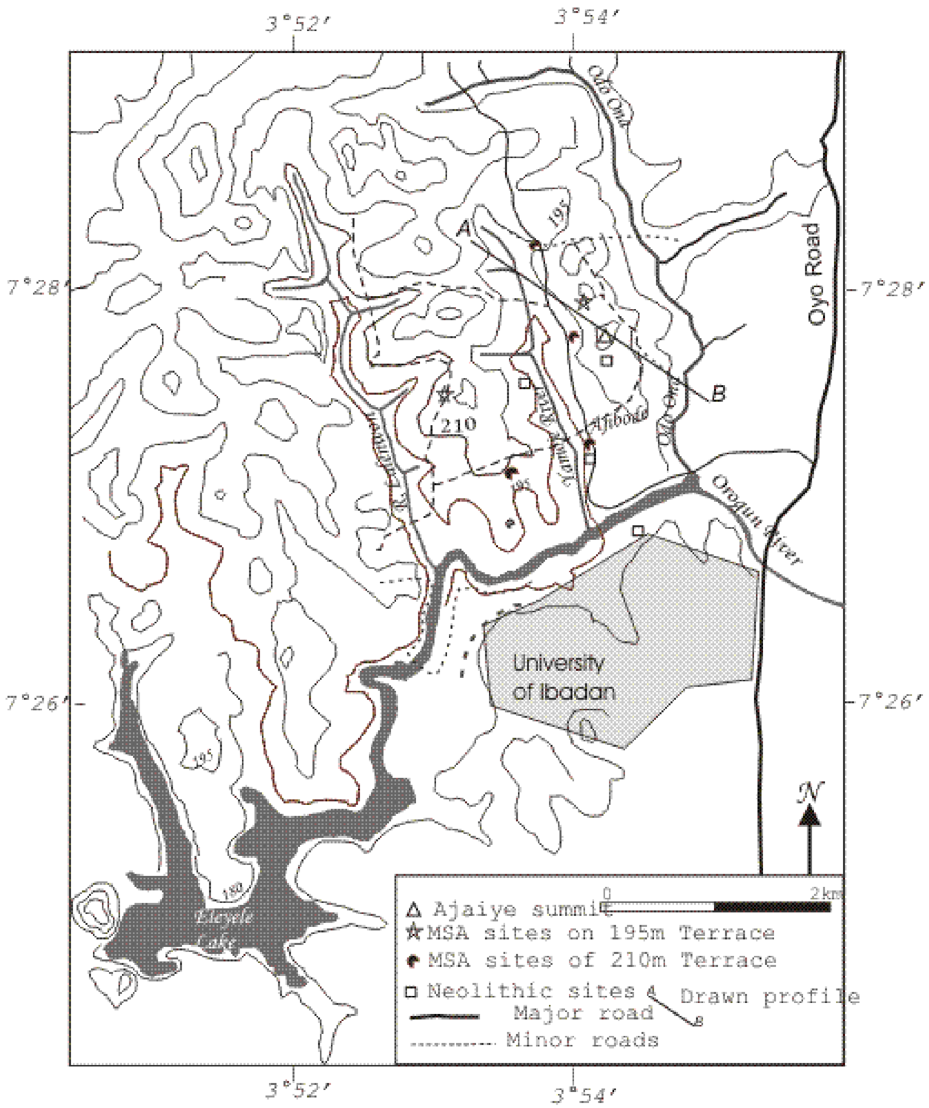



**Figure 11. Ajibode and its immediate environ: type sites.**

country. This skewness is possibly because of the huge financial overhead required in funding prehistoric research and the seemingly lack of expertise in this particular aspect of archaeological research. This has unfortunately left an existent vacuum in the general historiography of Nigeria generally and southwest Nigeria in particular.

Prehistoric investigation in southwest Nigeria is in the context of the West African sub region, which also experiences the foregoing problems. The foregoing problem has made the issue of peopling of the region in the distant past a subject of speculations in various academic discuss and a victim of inadequate data. Claims regarding the peopling of the region like other tropical forest region are therefore very many, controversial and subject of rancorous debates between the pan-African archaeologists and other counterparts who tend to view the area as a recipient region, having nothing to contribute to world civilisations in the distant past. Among the varied speculations worthy of note regarding the history of peopling of the region are:

i. Bailey's position, that the forest ecosystem could not have supported humans until the discovery of iron which enables effective exploitation of the forest ecology. This is a controversy, which extends beyond the area (Bailey *et al* 1989, Bailey and Headland 2000).

ii. Davies' (1967) claims that the occurrence of early lithic material of Oldowan affinities in the Accra coastal plain could be accounted for by the penetration into the area through the Dahomey Gap during an arid phases has not been satisfactorily contested despite spates of criticisms.

iii. Claims of stratigraphically insecure lithic artefacts by Burke and Durotoye (1971,) Shaw (1984), Akpobasa, (1994) among others from quaternary superficial deposit across the region have to be put in a chronological context.

iv. The pre-urban characteristics of the forest population particularly the early centres of civilisation are not clear in view of the rather shortsighted archaeological prospect into the period prior to their emergence.

v. Artefacts, especially lithic artefacts, which belongs to a techno-complex earlier than the last 10,000 years have been variously collected from both surface and excavated contexts throughout the forest zone of West Africa and especially the Study Area. There is the urgent need to put these materials into a proper chronological context.

vi. There is the urgent need too for an acceptable and definitive time frame for cultural developments in the area.

It is pertinent following on the above discussion to review the theoretical frame of reference employed in the reconstruction of the past. In this regard, enquiries focus on the role of archaeology in relation to other disciplines in more than 40 years of historical endeavour in southwest Nigeria.

Archaeological surveys coupled with other related disciplines have provided a chronology for the initial peopling of the area with particular emphasis on the emergence of early centres of civilisation, for example the first appearance of towns and urban centres in archaeological records. Ethnolinguistic and oral-traditional survey has equally complemented archaeology by providing insight on how indigenous populations perceived these cultural developments. Obvious from these studies is the fact that human settlements seem to have been adapted apparently to the different physical conditions in the area.

The focus of historical research has tended to lay emphasis on the migration thesis until relatively lately when schools dominated by younger archaeologist began to question this approach to the study of Nigerian history in general and that of the Yoruba race in particular. This created situations in which many urban settlements have been intensively and widely studied in contrast to the little attention on rural area especially where there is no evidence of monumental attraction regarding human occupation. This probably accounted for the lack of headways in this direction.

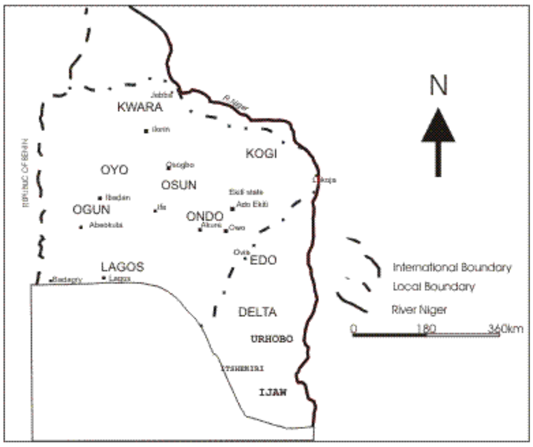



**Figure 12. Southwest Nigeria and the constotuent ethnic groups and some major Yoruba towns**

The colonial period in West Africa and Nigeria is characterised primarily by the collection of diagnostic artefacts by merchants, explorers and soldiers as well as scientists who sent their finds back to Europe where they were studied by those who never set their feet on West African soil.

This work attempts to provide a perspective on human settlements in the tropical forest zone of Southwest Nigeria. The priority is to establish/understand the complexity of human settlements throughout the region, through critical assessment of data from specific sites.

The impact of English heritage has resulted in the concentration of research in some localities to the detriment of others. This by implication created an imbalance in the reconstruction of the history of the study area. Excluding some monumental works (Andah 1979, Shaw and Daniels 1984, McIntosh and McIntosh 1980), there were no coordinated researches aimed at throwing insights on the prehistory of West Africa. This is particularly true of southwest Nigeria until quite recently and is particularly true of Palaeolithic investigations in which case the knowledge of the period beyond the Late Stone Age in West Africa is rather scanty (Isaac 1982). This is not surprising given foreseeable difficulties (Sowunmi, 1987). Such difficulties include for example lack of properly planned excavations prior to the mid-1970s. Davies' (1964, 1967), claim for an Oldowan occurrence of pebble choppers have been seriously questioned (Isaac, 1982; Nygaard and Talbot 1984). Similarly a claim for an Acheulean occurrence asserted by Davies (1967) for hundreds of hand axes, cleavers, choppers and picks was seriously questioned on the ground that only few were found together. Similar occurrences in Nigeria also drew similar criticism (Soper 1965, Anozie 1982). Few archaeologists have regarded Asokrochona as a very promising Acheulean site given the scanty nature of Davies' finds and little emerged from the intensive investigation carried out by Andah and collaborators at the site (Andah 1979, Nygaard & Talbot 1975).

There was also a claim for the presence of Sangoan Industrial tool-kits in West Africa (see Davies 1964, 1967, Soper 1962 Hugot 1967 Charnokian and Paradis 1982). Although these claims were based on morphological grounds, it is notable that Davies' definition of Sangoan was somewhat less restricted than the one adopted by Clark (1982) at Kalambo Falls, even though it was not far from that originally adopted by Kleindeinst (1962). The most characteristic Sangoan tool types identified are the heavy picks, bifaces, or less commonly, uniface made preferably on a large pebble which have unflaked butt (Alsworth-Jones, 1987). Nevertheless, Davies' claim to such occurrences in Ghana and Cap-Manuel in Dakar relied on few unsystematically collected surface materials (1964, 1967). Similar views posited for Nigeria by Soper(1962) are equally susceptible to this criticism.

It is therefore interesting to note that no significant new discovery in respect of the Sangoan have been made after the seemingly critical review by Wai-Ogosu (Andah, B.W) (1973). It is notable that the Sangoan in West Africa has a doubtful identity given the standard of comparison by J.D Clark in respect of finds from north-eastern Angola.

There is little progress in studies involving the Middle Stone Age in West Africa, as it had remained ill-defined. Presently only the Late Stone Age occurrences have had much success in West Africa (Shaw and Daniels 1984, Stahl, 1985 and recently McDonald 1997).

The problem that underlies Stone Age studies in West Africa is not surprising given the local environmental conditions. The soil condition for example does not permit the preservation of organic matter, which could have aided the reconstruction of site ecology and chronology and therefore corroborate lithic data. Complications arose from characteristically poor chronological controls during much of the earlier excavations and even the recent ones. This is a clear case of lack of expertise and collaborative efforts in these various investigations by researchers in this region. Short and incomplete sedimentological sequences tend to hinder palaeoenvironmental reconstruction of West Africa.

There are a few exceptions though, in a number of sites such as the Chad Basin in northern Nigeria, Kintampo Lake in Ghana and the Niger delta marine deposit to mention this few. The poor understanding of the local processes, which may have resulted in particular phenomena, further compounds this situation.

The occurrence of materials reminiscence of Palaeolithic industries at Ajibode along the Ona Valley is very significant and the study of this along with evidence from other sites in different situations could therefore provide additional insight about the character of Stone Age assemblages in southwest Nigeria.

This is very much the case when viewed in the light of a major project on the Bantu homeland, which aims among other objectives to find out how far back human settlements are traceable in West Africa and particularly in the tropical forest zone which encompass Southwest Nigeria, as well as the understanding of the ways and manner such settlements developed through time. There is the urgent need to study the finds at Ajibode and its environ which occurred in open sites, along with those from stratigraphically secured sites such as rock shelters in order to establish some chronological sequences for artefact occurrences in the study area. It is pertinent therefore, to find evidence for climatic and ecological changes for this region i.e. the forested area and their impact on settlements especially technology and subsistence pattern.

A rock shelter site like Atamora among other investigated sites therefore becomes very relevant as parallel source for information that may be useful as reference index to understand the nature of sedimentary units within the sub region outside the confines of archaeological sites.

The foregoing clearly highlights the obvious fact that modern archaeological investigation requires sound research design that will take cognisance of the problem and prospect of an interdisciplinary research. This is particularly so when focus is on the prehistory of the West Africa and southwest Nigeria in particular. The broadness of West Africa in terms of its geographical extent and ecological diversity clearly rules out a singular wide-ranging approach. The need to regionalise research notwithstanding, there is an equal need to design research strategies around a smaller survey universe such as that of the Ona River basin and at sites similar to Atamora rock shelter in south West Nigeria.

Prior to the excavations at Iwo-Eleru, it is popular to think that prehistoric man never got anywhere near the forest region of West Africa before the Neolithic. A major factor influencing reasoning during this period is the lack of palaeo-environmental data on the palaeo-vegetations in the tropics and especially the area occupied presently by lowland forest area in the tropics. This notion has changed of late in the light of recent findings which suggested that savannah type vegetation invaded the area at some points. Furthermore, data from Iwo-Eleru brought to light the fact that human occupations existed at least in the forest fringe of West Africa as far back as 11,000 years ago. More importantly, such group are apparent negroid-looking people whom to all intents and purposes are the biological ancestors to the present day population of the area (Shaw & Daniel, 1984). The site also contains a prolific Late Stone Age industry, which dates back to around 10,000 BC, and extending to ~1500 BC.
Nevertheless, whether the location of the rock shelter was in the evergreen forest as at the earlier phase of occupation was a subject of discussion, but certain is the fact that it was at latter dates.
Detailed classification of lithics and potteries from Iwo-Eleru using both univariate and multivariate statistical analyses given the circumstances of a weak stratigraphy to ascertain changes over time revealed no sudden break in the sequence of occupation. Observably, microlithic forms are common in earlier phases wherein scrapers and chalcedony increased over time. Ground stone axes were latter innovations, in the fourth millennium BC. Bones were not preserved, but it was interesting to note that deposit from the lowest level contains sufficient skeletal remain of a human individual which had survived in dry microenvironment and has been characterised as a proto-Negroid the earliest such evidence obtained from West Africa.
There was the conspicuous lack of evidence to suggest whether occupations at the site were either permanent or seasonal. What was obvious is the fact that different activities took place at the site a fact well amplified by the presence at the site of abundant Iron Age objects especially in the superficial layer.

### 2.3. Ajibode area – background to prehistoric Investigation

The University of Ibadan acquired Ajibode (Fig.s 2, 3 & 11) and its immediate surrounding area for agricultural teaching and research purposes in 1985. Following on this acquisition, the University authority paid compensation to the former inhabitants and those who chose to remain were resettled at a delineated area at the present location of Ajibode village at the northern periphery of the University property.

Following the decision of the department of Archaeology and Anthropology, University of Ibadan to conduct archaeological investigations to gain insights into the nature of pre-modern Yoruba settlements, the evacuated settlements in and around Ajibode were naturally available and were selected as a base for a field school for the dual purpose of research and training of students in the department on the practical and field aspects of archaeology. Research in the area has been basically historical in nature since most of the settlements under study were recently evacuated as a direct consequence of the land acquisition by the University.

The situation however, changed following the discovery of artefacts reminiscence of prehistoric occupations by late Mallam Umoru Gor a former field assistant at the Department, who until his sudden death in 1995, worked in the department as a field officer.

This discovery confirmed earlier and similar ones within the University by Professor Thurstan Shaw a former Head of the department. An intensive and purposeful investigation directed towards piecing together the scattered piece of information on the nature and extent of prehistoric occurrence within Ajibode and its immediate surrounding commenced in December 1993 under the direction of late Prof. B.W. Andah. The initial phase of investigation involved some postgraduate students in the department under the supervisions of Prof Andah and Dr. K. N. Momin from December 1993 through March 1994.

This investigation involved systematic survey of the entire landscape around the locality where such evidence of stone artefacts was first recovered. The intention was to select suitable and promising points for excavation. The team sectioned several points and dug a number of sundages.

The team in the process collected data and information, which enabled them to characterise the nature, extent and preference points for early occupations within the Ajibode locality. They attempted to view the concept of landscape and environment as they affect the preservation of settlement features and their influence on human occupation from time immemorial.

The researchers also attempted to understand human settlements and its environmental context based on artefactual distributions in different and identifiable terrace sequences. Reconnaissance survey at Ajibode and its surroundings therefore involved deliberate search for stratified sites, determining the number of terraces and their relationships and finding out artefacts and rock types which, were used as raw materials in the area. This helped to provide some insights into the topographic and geomorphologic characteristics of the study area that affected human occupations. The work at Ajibode therefore involved identification and mapping of different terraces in order to help locate their trends and promising points for stratigraphic studies. This was in order to obtain a composite picture of stream evolutions and their stratigraphic significance. The idea is to identify a combination of factors that are strategic to human occupations and in so doing proffer a model or approach that would aid in locating natural points of human activities in the study area from time *ab initio*.

Test-pits dug at Ajibode helped to determine the depth, contrast and association of artefacts. This was aided by comparative stratigraphic studies of different sites located at different terrace levels at Ajibode and its immediate surrounding. In addition to the foregoing, these test-pits also aided in establishing the level of continuity in human occupations in the area and how the climate affected such occupations.

This fieldwork helped to establish the following salient facts about the nature of the prehistoric evidence at Ajibode and the role of climatic factors in shaping the recovery contexts at least in a very long time dimension. It became apparent given this result that:

i.) there were indeed Palaeolithic occupations at the study area and their distributions are quite widespread;

ii.) the Yamoje Stream was a focal point for early human occupation/settlements and is itself tributary to the Ona River;

iii.) the above position was supported by differential artefact occurrence at the adjacent terraces that flanked the stream with older occurrence at higher terrace levels;

iv.) excavations at the 195m terrace level supported a case of gradual decline of water volume or shifts in base levels over the time. Most of the area adjacent to the upper terrace were probably submerged at some point in time in the distant past;

v.) the environment has been undergoing gradual degradation from wet to dry phases, there were indications that the water level was probably above the 210m terrace level at some point in time;

vi.) man made efficient use of the natural landscape and resources therein, and;

vii.) the study area can provide a lot of information regarding the Palaeolithic in West African archaeology if a proper data recovery model is applied.

The need to widen the scope of this investigation and issues arising from the foregoing facts as well as observations from Ajibode prompted the second phase of field investigations. This involved an extensive survey within the Ibadan region, and in much broader area outside Ajibode to include specific points like the immediate surroundings of Ajibode, Gbanda and Olude-Araromi area within the middle Ona Valley in the context of Ibadan Northeast demarcation.

The fieldwork spanned two weeks in December 1996, January and February 1997. It involved the collection of data on landscape evolution in the study area (including the surface geology), characteristic drainage pattern and the distinct geomorphic units as well as the associated features including archaeological components for comparative assessment at a regional level.

The investigation also entailed detailed review of relevant maps and literature on the area as a prelude to field activities which involved identifying and mapping of distinctive natural/cultural features in the surveyed area. Literature review in particular provided relevant geological and geomorphic information about the area. The investigation also involved photographic documentation of features. Topographic maps (particularly the 1:50,000cm) were found to be very useful and helpful in the identification of the various landscape units and features of natural and sometimes cultural relevance. Direct field evidence obtained in the course of field walking at the area helped to confirm and corroborate map details (Faniran and Hugh, 1969; Andah & Momin, 1993; Akpobasa, 1994).

Reconnaissance survey involved reconnoitring the entire area along important trajectories such as river courses, and road tracks. Detailed observation of particular structures or features of both natural and cultural significance in terms of raw material base for artefact manufacture, probable points of attraction for gaming and hunting activities, and probable home base or residential points where social activities probably took place in the distant past.

Result of the study carried out in this area are summarised under the appropriate sub-heading below. Nevertheless, it suffices to say at this stage that the results from the preliminary study at Ajibode was the very starting point for the expansion of prehistoric investigations from the area to other parts including Atamora in an attempt to regionalise the investigation and place recovered data within a chronological framework.

### 2.3.1. Ajibode: location and geophysical descriptions

The study area including Ajibode is located within two local administrative units (Akinyele and Iddo Local Government Areas), in Oyo State. Oyo state is a larger administrative unit of provincial level in Southwest Nigeria. It is located within the following coordinates: 7°26' and 7°30' N, and 3°50' and 3°56'E (Fig. 11). The extent of the area is about 48km$^2$ (Ibadan N.E. Sheet 261 NE) and it included the area covered by the University of Ibadan and its immediate northwest neighbourhoods up to the Polytechnic and Eleyele water reservoir in Ibadan town.

The area is underlain by undifferentiated Basement Complex of Pre-Cambrian origin which, are mainly metamorphic types. There are also a few numbers of intrusions of granites and porphyrites of

Jurassic age. The major rock types in the immediate area include quartzites of the meta-sedimentary series and migmatite complex comprising banded and augen gneisses and migmatites. There are also minor rock types and these include pegmatites, quartz vein, diorites, amphibolites and xenoliths. A detailed survey of the geology of the area is presented in Akintola (1990) (see also Akpobasa 1994; Uwalaka 1993). Weathered materials cover most of the rock types; there are however, residual and obtrusive points such as quartzite ridges and gneissic inselbergs. The minor rock types in most cases occur as intrusions.

The landscape geomorphology of the entire area is characterised by three major geomorphic units namely: valleys, plains and hills. The general elevation ranges between 150m and 250m above sea level. The landform is that of eroded pediment with well-incised valleys forming a denderitic drainage pattern.

The original vegetation is that of a lowland tropical forest with climax vegetation being a semi-deciduous forest type. In most of the surveyed area, this climax vegetation type has given way to derived ones. This is due to intense human exploitation of the natural environment in his survival strategies.

The climate is a direct reflection of the tropical position of the region in the tropics where the oscillations of two prevailing wind systems namely: the North East Trade and the South West monsoon determine the climatic conditions. The entire area lies like most of Nigeria and West Africa within the transition zone of the humid and sub-humid tropical climate. The rainfall is heavy and characterised by bimodal distributions with peaks in June and September and a period of lower precipitation in August usually referred to as the "August Break". The dry season occur between December and February. Significant portion of the rain comes in relatively intense thundershowers often with moderate to strong gusty winds. The annual rainfall varies from 788mm to 1800mm. this lower rainfall for Ibadan is not surprising given its position as an eastward extension of the 'Dahomey Gap' which is a zone of climatic peculiarity.

The annual temperature ranges from an average minimum of 21.3°C to an average maximum of 31.2°C. There are however, extreme diurnal minimum and maximum for the area; 8.3°C and 38°C have been recorded. Mean monthly relative humidity is generally high with a maximum in August and minimum in February (Bassey-Duke, 1981).

Three principal geomorphic units obtain in the study area. These are the plains, valleys and hills. The hills stand out in the landscape while the plains are more extensive (Fig. 10). The hills include quartzite ridges and granite inselbergs. The ridges are the most prominent, occurring in the western section of the study area and outcropping at points like the Lawal Farm (LWF) along Sode Road in the surroundings of Ajibode village, Polytechnic and Technology ridge, Akere and along Aiyegun road in the Olude-Araromi area. The gneissic inselbergs are concentrated in the northeast part around Ajaiye Hill, at Ajibode and Gbanda Hill off Moniya road at Ojoo area in Ibadan. The slope angles are quite striking. In the quartzite ridges, slopes of about 20° have been measure using contour maps (1:50,000), while slopes of near vertical angles were measured on the inselbergs. The Gbanda Hill for example has a slope of 45° at about 300m above sea level (Faniran, 1990). The quartzite ridges are well fractured and often contain pockets of soil along joints, which support vegetation covers. The gneisses are in most cases bare rock surfaces except along joints which hold pockets of soil. Rock pits or grooves obtain on the granite outcrops in nearly all points visited. These occur also at an outcrop close to St. Mathew Anglican Primary School in Ajibode village, at the University botanical garden in a Teak forest reserve and at the C.A.C Church near Abadina College and also around Olude-Araromi area, as observed on the outcrop visited close to the road at Alapata village.

The plains are by far the most extensive of the geomorphic units. The general elevation is between 180m and 210m above sea level. This is particularly so in the southern and western sections of the study area. The plains cover areas between hill bases, footslopes and valley bottoms. These were most probably etched surfaces.

The river valleys are apparently the narrowest landscape unit in the area under survey. It is however, an important landform feature which has contributed greatly in shaping the general landscape. This is obvious from the down-cutting activities of the streams. Virtually all the stream in the locality have incised into the flood plains or river beds and some have even cut into the parent materials. These features of the drainage are apparent evidence of drops in sea levels following major climatic changes (Burke *et al*, 1969; Faniran 1990).

The principal drainage feature in the area is the Ona River which enters into the study area as a fourth order stream and gradually evolved into a fifth order stream at the Eleyele water reservoir. The Ona River entered the area from the north-east, took a south west course south bye-passing Ajibode village at the southern extent of the village and then entered the Eleyele reservoir through Ibadan Polytechnic where it became a fifth order river. This river constitutes a collection point for many tributaries, which empty their water into this channel forming a denderitic drainage pattern. Important tributaries include: Orogun, Yamoje, Lalenwo, Alapata and Awba. These tributaries in turn served as collection points for many other perennial streams and rivulets as well as run-offs. A drainage pattern that is characterised by irregular branching in all directions with tributaries joining at all possible angles conforms to denderitic pattern in the opinion of Faniran (1990:37).

The analysis of the entire study area using contour maps and direct observation provided the following data. The mean height of the area is 230m ASL, while, the height between 230m and 260m is prevalent. The scatter plot of height within the area (see also Faniran, 1990:40) shows clusters around certain heights:

| | |
|---|---|
| 160-175m | 166-183m |
| 190-205m | 200-216m |
| 220-240m | 233-250m |
| 250-270m | 266-283m |

This scatter plot has made it possible to establish four commonly occurring levels. These were probably erosion surfaces and perhaps correspond to past geologic episodes especially periods of climatic changes.

The elevation suggested a trend with the lowest area around the big river valley Ona at Eleyele reservoir area. The elevation increases from this lowest points along this river valleys north and northeast up to the watershed. These common levels constitute platforms, separated by footslopes and contain the different terrace levels. Three such platforms were represented at Ajibode and in the immediate surroundings along Sode Road and Umaru Farm (UMF). These four sequences we identified at the Olude Araromi where much of the former landscape survived *in situ* until very recently.

Thus, the profile picture of the study area shows the close relationship between three landscape (Fig. 10) units. The major river (Ona) and its tributaries have considerable influence on the evolution of the landscape. The erosion and deposition activities were very evident in the nature and sorting of sediment deposits in the terrain. Gully erosions were very much evident. Beside this, the rivers have evidently avoided zones of active resistance in its movement over the terrain. Older river courses have been abandoned and new ones created by stream rejuvenation activities that accompanied falls in base levels. This has resulted in river capture by younger streams cutting into older flood plains in many cases.

The dynamics in landscape development in the study area is apparent from the foregoing and the evident inter-connection between these three landscape units readily comes to the fore. And it is apparent that courses of river flow in the area has been influenced by the nature of the bedrock as they tend to avoid zone of active resistance on the one hand, while on the other, fluvial activity has degradational and aggradational effects on landscape configuration.

### 2.3.2. The sites

**AJIBODE (UMF)**

As noted earlier, Ajibode lies approximately within 3° 54?E and 7° 27? N (Fig. 11) in the context of Ibadan North East (Survey Ordinance Map 1964). The study area is quite extensive covering an area approximately 3.5 square kilometres. It is located directly on the northern flank of the University of Ibadan.

Reconnaissance survey involved visual inspection of the terrain to identify obtrusive archaeological features (i.e. artefacts) and environmentally significant features (terrace sequences) in the context of Yamoje Stream, which is a tributary to the Ona River. Field walking involved an exploratory traversing of the entire terrain along trajectories such as road cuttings and also along river courses that could have been focal point for the former or prehistoric residents of the area in terms of available aquatic and peri-aquatic resources connected with probable prehistoric activities.

Three terrace levels were identified at Ajibode and labelled 195m, 210m and 225m terraces all above sea level. They also occur in pairs at both sides of Yamoje stream. The different terraces are marked by distinctive laterite crusts, which appear to be older than Pliocene laterite formation. Notable differences in the crusts of the various terrace levels ranged from loose and gravely types to semi-cemented ones. The compactness of the deposits increases away from the present flood plain. On each of these terraces, archaeological materials and sites were identified albeit in secondary contexts. Those identified include UMF, MCF and LWF. Terrace I (AJB $T_1$) is located on the 195m terrace level, which also conforms to the contour interval of similar elevation on the Ordinance survey map of Ibadan North East. It is the youngest of the three units and is directly adjacent to the Yamoje stream. It was observed that this could have constituted an old land or occupational surface, which was later laterized to form the present incrustation observable at the site. Stone lines of artefacts are readily visible on this terrace. One such site (UMF, $T_1$) was identified at a point so named at Umaru's Farm. $T_1$ was located at both sides of the stream and a sondage was sunk at the above-specified site (Units A, B, C and D; Fig. 11).

Terrace II (AJB $T_{II}$) overlays Terrace I (AJB $T_I$) at the 210m contour level. The distinctive feature of this terrace is the embedded artefacts, which were unlike those in the lower terrace level rather crude and based on granitic raw materials. Terrace III, is located at the study area close to the highest point on the terrain, along the road to Sode village, where it overlies the 225m contour level. Recovered materials were found to be pseudo-artefacts after detail examinations and comparison with other formal types. They did not reach the threshold of artefactual attributes. Only materials from the lower terrace level could pass for artefacts of possible early or Middle Stone Age period basically on morphometric grounds through visual inspection and some degree of correlational comparison which are circumspective in view of such doubtful association. There is the need for much detailed exploration and further analyses to reliably establish a character for the artefactual composition of Ajibode and its immediate surroundings. This in effect prompted the need to extend the search farther away from Ajibode in order to find secure sites from which reliable stratigraphic, environmental as well as quantitative data could be gotten that might be helpful in ascertaining the validity of any ascribed age or period for these stratigraphically insecure materials from sites in and around Ajibode.

The foregoing notwithstanding, the relicts of human activities recovered from Ajibode include scatters of potsherds and mud walls which are still *in situ* at some points. These are features and structures, which belong to the historic phase of human occupations at the study area.

**Excavations at Ajibode**

Excavations at Ajibode were directed at finding points where complete cultural/terrace sequences could be obtained. Points were identified in the three identifiable terrace levels mentioned in the foregoing. They include UMF at the 195m terrace level, STF, a road cutting located 170m west of Yamoje stream on the 210m terrace level along Sode road and LWF on the 225m terrace. The excavation also attempted to get some insight into the nature of the terrace sequence and the artefacts embedded in

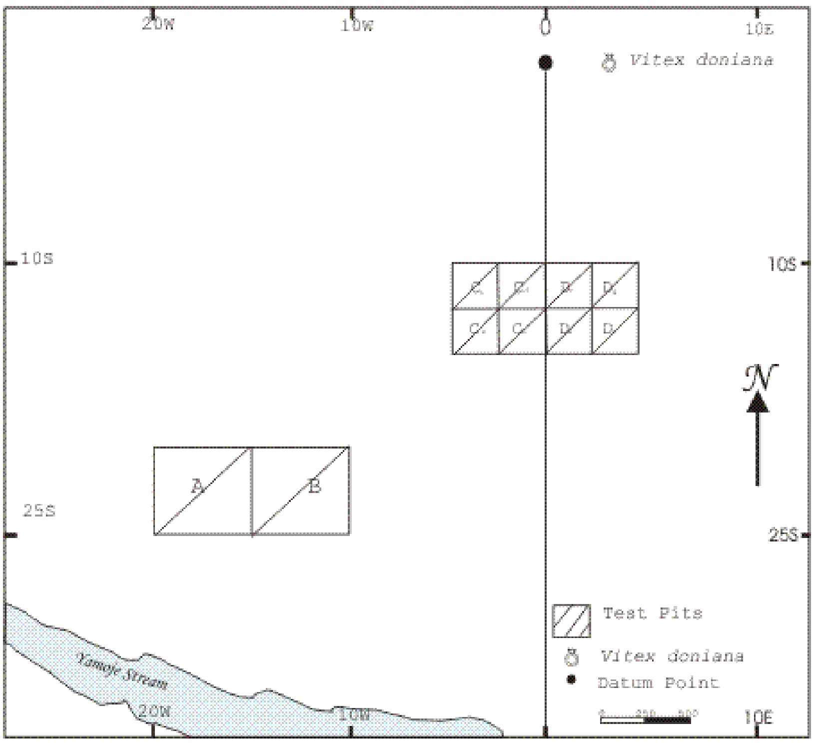



Figure 13.Umaru Farm, Ajibode(UMF)plan showing excavated units

them in terms of their chronostratigraphic distributions. Of the three units mentioned earlier, only the first site produced sufficient data of any Palaeolithic relevance. The other did not yield diagnostic artefacts to warrant their inclusion in this work.

At UMF Fig. 13), the original plan was to run exploratory trenches to determine the limits of artefact occurrence and its contextual relationship with the terrace sequence. Two spots were selected for test pits. The first one was sited at the southwest end of the site and a second was sited on a mound, which was later discovered to be an old land surface that survived sand quarrying activities at the site. The site was gridded using an infinite gridding system into series of 10m squares. Units A and B are located at the southwest corner of the site between 20m and 25m south and 10m and 20m west respectively in relation to the reference point. Units C and D were located between 5m west and 5m east and 10m and 15m south respectively in relation to the reference point. The reference point is located at approximately 2.7m west of a tree *(Vitex doniana)* at Umaru's farm (see Fig.s 11 & 14).

Digging method in the case of units A&B involved scraping the soil with the aid of hand trowels and picks. The process involved careful exposure of cultural materials and occupational floors. Artefacts were collected labelled and bagged in the process. In the case of units C digging was along stratigraphic layers and the colour and texture of the deposits was used to determine each of the layers.

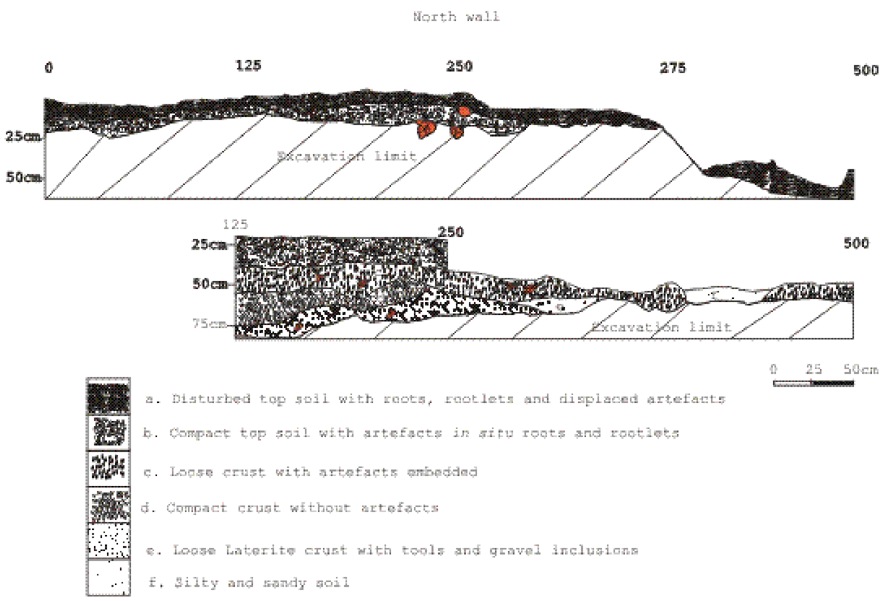



Figure 14.Umaru Farm, Ajibode:Profile drawing of excavated units

A single occupational level (see Plate 1) was identified in Units A and B, the others having been eroded and removed by both human(sand quarrying) and natural factors. This is apparently the lowest level of occupations at the site. The sediment deposit includes a zone of overburden, which includes rather loose gravels and non-cemented laterite crust. Silt was the embedding medium from which artefacts were recovered. The nearby stream obviously deposited the silt over a long period. Artefact scatter were secondary in nature and the bulk of the deposit must have been stripped off by subsequent quarrying activities at the site. So the so-called floor at these units is secondary and of recent creation. At Unit C (Fig. 14), at least two occupational phases were directly identified in the stratigraphic sequence exposed in the course of our excavation. The stratigraphic situation is described below:

i.) Layer 1 is loose and disturbed topsoil (which was removed as overburden in the course of digging). It contains roots and rootlets and some displaced artefacts.

ii.) Layer 2 is much compact greyish subsurface soil which also contains artefacts and also some roots and rootlets

iii.) Layer 3 consists of loose laterite crusts with artefacts embedded

iv.) Layer 4 is a very compact laterite crusts without artefacts embedded

v.) Layer 5 consists of laterite crust with gravely inclusions as well as artefact embedment

vi.) Layer 6 is Silty sand, which, was probably deposited by the river.

### 2.3.3. Ajibode: stratigraphy and artefact contexts

The natural stratigraphy of Terrace I at Ajibode is reconstructed from the units exposed at the UMF site as follows:

**a.) Loose and disturbed top soil**

This is a very dark greyish brown soil (10YR 3/2 Munsell). It contains lots of roots and rootlets in addition to abundant humus and detritus. Thickness varied from 5cm at some points to 20cm and contained a number of displaced artefacts as well as charcoal specks from frequent slash and burn techniques of farming in the locality.

**b.) Compact top soil**

The compactness of this unit separates it from the one above it. It is reddish brown (5YR 4/4 Munsell) and contained reduced level of humus and detritus materials. Roots and rootlets still persisted. It is moderately sorted and contained fine to medium grained sediments. Artefacts were recovered within the context of loose laterite crusts which appear mainly as lenses and the general thickness of the unit ranged between 3 cm and 10cm.

**c.) Loose crusts with tools**

This is a non-gravely laterite crusts. It is generally loose in nature and non-cemented. It was in the form of angular lumps with no roots but containing artefacts. It is moderate finely sorted and contained silt and fine sand. The thickness is 15cm on the average

**d.) Compact laterite crust**

This constitutes a break from the top occupational levels described in the above. It is a weakly consolidated unit containing semi-cemented iron pans. It is friable and poorly sorted with gravely texture. The colour is yellowish red and the thickness varies from 10cm to 20cm in the section.

**e.) Loose laterite crusts with gravel inclusions**

This is less compact compared with (d.) above it. The distinctive feature is the gravel inclusions and the embedded artefacts. The gravel was probably deposited by fluvial activities. Presence of alluvial pebbles is indicative of the possibility that the site was a floodplain at some point in the past. It is reddish in colour (10YR 4/6 Munsell) and the average thickness is 10cm.

**f.) Silt sandy layer**

This layer of sand and silt was deposited at the site by fluvial activities associated with the stream at the point in time when the environmental condition was much wetter than present and the water body was very extensive compared with its present level. It is generally light yellowish brown in colour (10YR 6/4 Munsell) and compares very well with the lowest levels at units A&B where there are mostly displaced artefacts. It is sterile in Unit C where it underlies a-e. Similarities in the spot heights level of this layer at C and that of A&B help to establish the fact that they belong together as a layer on a plain level surface.

**Chronology and environmental status of the site**

Observably, organic matters were not recovered in the course of field investigation. Therefore absolute dates for the materials recovered from Ajibode were not tenable. Formal lithostratigraphic successions was therefore established as in the foregoing and this was combined with the cultural successions to establish the palaeoenvironmental conditions in the distant past albeit a reasonable guess. Two distinct cultural phases were immediately identifiable in the successions at Ajibode. These include an older phase underlying the compact crust (AHI), and a younger one embedded in a loose crust and compact top soil (AHII).

To put this picture in a chronostratigraphic perspective, we attempted to correlate the layers with that described in the Bodija formation mentioned in the earlier section of this work. In the process it was observed that layers (a) and (b) at Ajibode corresponds to the Orita member of the Bodija formation, whereas Layer (c) at Ajibode is the equivalent of Agodi member and d corresponds to the Kongi member. On this basis we may conclude only tentatively that the artefacts embedded belong to the MSA at least on morphometric and lithostratigraphic grounds. This is only tentative because the morphometric characters of these materials are still questionable if similar standard are applied to them as those from central and eastern Africa. So not much can be said with any reasonable certainty as to how old these materials really are.

A brief attempt at palaeoenvironmental reconstruction indicates a complex depositional sequence with distinct phases when deposits underwent weathering. The following stages appear probable for the accumulation of both natural and cultural deposits.

i) There was a period of sedimentation after an arid phase, when silty sand accumulated at the bottom of the gentle flowing stream.

ii) This was followed by a relatively wet phase occasioned by heavy rainfall regime that is accompanied by active erosion and flooding activities. This was probably responsible for the deposition of gravel and pebbles on top of the underlying silt layer.

iii) Thereafter, was a period of declining wet conditions, which, caused a sharp reduction in the water volume. This was probably when the flood plain shifted to the 180m level and also the period when man first occupied this area with the appearance of artefacts (AHI) embedded in the gravely concretion just above the silt level.

iv) Thereafter was a sharp break in occupation and stratigraphic successions indicative of a phase characterised by sharp seasonal differences a condition, which is very much similar to the present one. This is evidenced in the deep weathering of the deposit and laterisation process responsible for the incrustations observed at this level.

v) There was thereafter the re-emergence of human occupations at the site (AHII) following possibly a period of climatic amelioration when conditions favour human occupation.

**Description of artefacts**

Formal description of artefacts recovered from the 1993/94 field session was based on morphological attributes. Morphology and functionality are the criteria for the descriptive analysis presented here. Recovered artefacts were primarily classified into cores and flakes. Attributes employed include the presence of a bulb of percussion, dorsal and ventral surfaces as well as determination of working edges. Among the cores, the following categories including polyhedral and trihedral cores (Andah, Pers. Comm.) and bifaces were identifiable. Choppers, picks and points were identified (See Fig. 37).

Thus far, three major terrace sequences were identified at Ajibode and its surrounding areas including Olude-Araromi (Fig. 11). These have been established at Ajibode village along the road to Sode. They were marked by distinctive laterite crust, which appears to be pre-Pleistocene laterite formation. The differences in crusts belonging to each level range from a loose and gravely nature to semi-cemented ones. The compactness increases further away from the present flood plain. At Ajibode, these terraces were described and labelled $T_{1,}$ $T_{2,}$ and $T_3$ and these correspond with 195m, 210m, and 225m levels respectively (see also Akpobasa, 1994:10-11). Two of these terrace units contained cultural material and were identified at MCF and UMF.

Archaeological materials identified to date are basically lithic artefacts. These include artefacts that are mostly based on quartz and quartzite raw materials in $T_1$. These are more refined compared with those which are based on granite found on the $T_2$ which are rather crude and less refined. There were also rich artefact scatters in secondary contexts which are mixed and non-homogenous in nature.

There is no evidence to support the occupation of the third terrace level at Ajibode. However, it was observed to have been occupied at Olude-Araromi where it was among the four occupational platforms identified in the locality.

Issues that arose following these investigation is one which bothers on locating viable points for proper characterisation of prehistoric occupations in terms of human behaviour vis-à-vis settlement features, subsistence as reflected in the land-use pattern, mobility etc. Observations points to the platforms in between the footslopes and subsequent flood plains as most probable points for human habitations in the distant pasts. So artefacts are more likely to be found *in situ* in such platforms. Indeed sondage was dug to test this proposition at UMF (Akpobasa, 1994) and MCF. And UMF was subsequently excavated by Akpobasa and Bagodo in March 1997. These excavations have revealed considerable data regarding human occupations in the study area.

In line with the initial objective then, it is imperative to identify these archaeologically relevant platforms or natural points such as meander points along river courses and natural shelters, which possibly served as refuge for humans in several area or localities. The intention is to obtain maximum primary information on the nature of past occupations in Ajibode and its immediate surroundings as well as outside this area as an attempt at a much broader regional approach to the investigation of the earliest facets of human occupation especially in the forest region of Southwest Nigeria.

At Ajibode and in the Olude-Araromi areas, lithic materials, which are definite evidence of past human occupation were recovered from specific points and levels. These points include 166-183m and 190-205m terrace levels at Ajibode. At Olude-Araromi, artefacts were also recovered from 266-283m.

The most widespread occurrence were in the first two terrace levels which have been identified and mapped at the railway cutting at Kongi east of former Ibadan Airport (Burke and Durotoye 1970). The probable locations of sites have been highlighted below in Fig. 11. This is rather hypothetical and is based on the consideration of certain locational parameters, which are tied to the natural environmental situation as well as the landscape distribution and evolution processes.

It is apparent that River Ona and its tributaries played dominant roles in the evolution of the landscape. It witnessed a series of contraction owing to changes in base levels which are themselves, evidence of climatic changes or oscillations from good and bad conditions through time. This in effect, determined points which, human populations occupied in the area through time. Evidently, humans were very selective from the very beginning in terms of where they chose to inhabit, territorial range etc. Their choice of occupational surfaces for example conforms to natural disposition. Nature has shaped the landscape and this is a continuous process even though it may have varied over the time. It was observed that the rivers in the locality have for instance avoided zones of active resistance in its regime and had had degradational effects in the evolution of the landscape, which is still very much the case as at present. The climate had become rather worsen over the time as evidenced by the continuous contraction of the major river and its tributaries through time.

### 2.4. Atamora rock shelter

The site (Fig. 2., plates 2, 4, 5) was first mentioned by Eluyemi (1985) during his investigation of terra cotta traditions in the Egbejoda area among other sites, which, he investigated for this purpose. Although he alluded to it no attempt was made to investigate its potential for Stone Age investigation. The interesting thing about the site is the evident scatter of lithic artefacts and potsherds on the floor of the rock shelter and the rather large sheltered area created by the massive overhang. The lithic artefacts are mostly fresh and unweathered though in some cases they have been partinated due to long time exposure to surface weather condition.

Preliminary examination of the area suggested that the lithic artefacts derived from the floor deposits of the rock shelter. These were exposed by gradual erosion of the surface by seepage water and runoff activities from the northern section in a southward direction.

Atamora rock shelter is named after the village of that name. It is one of the numerous farming communities that belong to the Iwata people who owned the land upon which this rock shelter is situated.

This was the first archaeological excavation at the rock shelter. The fieldwork in line with the major theme of this project was intended to shed light on major questions relating to human occupation within the forest area of southwest Nigeria. It was directed at a critical examination of the contention that man was unable to inhabit the ecological zone until the emergence of metal. It was believed that the forest ecology presents an impediment to human survival in view of the difficult nature of the terrain and issue is equally raised about the productivity of the forest ecosystem in meeting human day to day needs compared with other ecological zones.

### 2.4.1. Location and human geography

Located at approximately 7°25?N and 4°18?E, Atamora village, as mentioned earlier is one of the numerous farmsteads, owned by the Iwata people. Iwata is a Yoruba settlement located in the heartland of the Yoruba speaking people of southwest Nigeria. (Fig.s 2, 3 & 12). Atamora is located approximately 30 and 10 kilometres east of Ibadan and Ikire respectively, along Ibadan - Ile-Ife major Highway. The village and rock shelter are located within the forested area at about 3.5km south of the Highway just about a kilometre before Wasimi another settlement in the locality along the same Highway from Ibadan. Atamora village is presently settled by farming populations from diverse origin including some Iwata descendants and Yoruba peoples from other neighbouring towns including Ikire, Ile-Ife, Apomu, Owu as well as migrant groups from as farther away as Togo and Ghana who engage in local gin manufacture and other menial labour.

Access to the village is through a very poorly graded road, which is accessible by a four-wheel drive vehicle during the dry season months between October and late March. It is poorly drained and as a result is waterlogged for most of the rainy season during which access to the village is only by trekking. The local populations engage mainly in cash crops production of crops like cocoa, cola-nuts and oranges. They also engage in palm-oil production, a fact evidenced by the abundance of palm trees in the area. Other activities include lumbering and hunting of game animals such as dears, antelopes, and cane-rats to mention these few. Hunting is popular here especially during the dry season months when there is relatively little to engage the young men in the plantation farms. Another population group noticeable in the area is the Fulani herdsmen and their families who have settled in the open land north of the tree crops plantations. They graze their cattle in this open land and are responsible for the frequent bush fires in the area with which they use to enhance the growth of fresh grasses in order to sustain their livestock especially during the hash dry seasons. This is usually a source of conflict between this group and the local farming population as fire do at times spread into adjacent plantations causing great losses to the poor farmers whose life depend on the plantations which are highly inflammable inspite of the presence of dry leaf litters on the plantation floor.

### 2.4.2. Atamora: geophysical setting

The rock shelter, (see plates 2 & 3) is located at about 500m east of the village. It consists of a major over-hang (Plate 4) that is rooted to the ground at the northern extremity of the floor. It rests on two minor rocks to the southwest and southeast of it. This overhang created the main sheltered area (hall) which is more or less in the form of a pavilion facing south (Fig. 15 &16). There are two other chambers, one under the south-eastern support (Chamber I,) and another under the major over-hang at the northernmost extremity where it is rooted in a very steep slope. The slope is a function of the topography of the immediate surrounding land area. The shelter itself is part of an East-West running granite ridge of granite of metasedimentary series. It provides the main watershed for rivulets, which took their sources from it. The rock has been under intense chemical and physical weathering over time. And such action may have resulted in the formation of the rock shelter at the centre of this investigation. Physical weathering is more or less connected to both tectonic and biological events which are further compounded by chemical weathering which took advantage of the weaknesses created by them. Rainwater acts as the catalyst, which break down and dissolve the acidic components on the rock and loosening the iron elements in the rock, which in turn combines with the oxygen present in the water to form iron-oxides. This process has resulted in the formation of shallow hollows on top of the inselberg like mountain. These potholes have become collection reservoirs for rainwater, some even retain water all year round (see plate 5).

The vegetation is that of dense tropical forests with characteristic forest tree species, which are more or less remnant, or refugial in nature, a fact owing to intense lumbering and forest clearing activities in the area.

Drainage in the area is perennial in nature. Most of the streams dry up in the dry season and commence flow in May when rainfall may have intensified. These streams flow westward to serve as tributaries to the Oba River, which flow southward in a coastal bound course to link Owena River.

### 2.4.3. Excavations

Fieldwork at Atamora was primarily intended to study sites under sealed or undisturbed context in contrast to the open-air sites like the ones at Ajibode and its immediate surrounding. The idea was therefore to provide some stratigraphic insight for understanding the open-air sites and their formation processes.

The first phase of the fieldwork lasted for eight weeks between 15 January and 19 March 2003. The site was excavated by the present investigator in collaboration with the Department of Archaeology and Anthropology, University of Ibadan, Ibadan and with assistance from Mr. B. A. Ogunfolakan of the Natural History Museum at the Obafemi Awolowo University, Ile-Ife in Nigeria. During the fieldwork exercise the rock shelter was mapped in the context of its immediate environ for locational purpose and relationship with the entire landscape. The second phase of fieldwork is more or less complimentary and aimed at answering some questions, which arose, from the previous exercise and issues arising from the analysis of the data from the first phase of excavations at the site. It commenced on 25th March and lasted until 8th April 2004. Fieldwork at Atamora rock shelter includes the following among other activities:

i. Survey and excavation at the rock shelter to collect and characterize the nature and distributions of artefacts as well as collection of environmentally significant data;
ii. Establishing and drawing of stratigraphic sequence of the deposits and superficial quaternary deposits in the immediate environ of the site, and;
iii. Intensive survey of the adjacent landscape for possible points for further excavations, extensive profile drawing along river banks road cuttings, gullies and collection of On-site and Off-site soil samples for further analysis in the laboratory.

The field exercise involves collecting adequate field data that will aid in providing information on:

i. site formation processes in the Study Area in particular and the West African sub region in general;
ii. spatial and temporal distribution of artefacts through the establishment of stratigraphic sequences with chronological integrity and;
iii. the nature and the extent of human occupations in the forested area of West Africa prior to the commencement of the Iron Age, especially on the aspects of subsistence and exploitation of resources and thus contribute to the on-going debate about the nature of human occupation in the forest area of the world.

**The cuttings/plans** (Fig. 15 & 16)

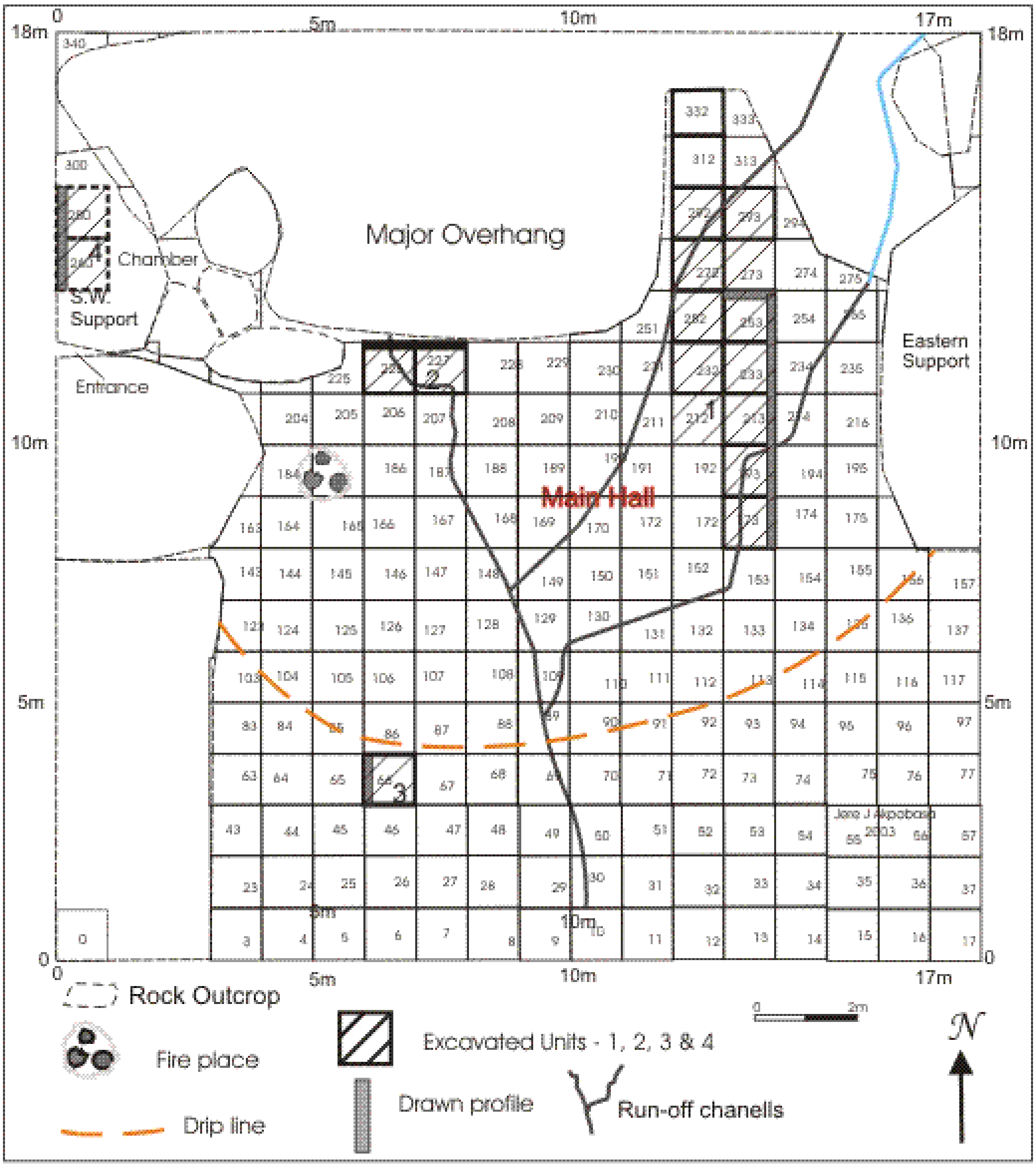



**Fig. 15. Atamora: General site plan including excavated units(hatched area) and drawn profile**

One exploratory trench (Unit 1) was sited in the main hall under the pavilion. A second trench (Unit 3) was sited in the mini-chamber in the western side along the corridor leading to northern extremity of the rock shelter. While a third one was sited directly underneath the huge overhang near the point of contact with floor of the shelter and one directly under the huge overhang at the northern extremity of the dome (Fig. 16&17).

A trench directly under the overhang at the northern extremity was not realistic for logistic reason. This requires huge overhead cost than could be raised under the circumstances. Two main units were opened in the first phase of excavation in 2003. Unit 1includes a long trench 1x5m (squares173, 193, 213, 233 & 253) sunk on the sheltered area under the pavilion at the eastern section running in a north-south direction. This was extended by a metre to the west to include 232, 252, 272, 292, 312 & 332. It also includes a $1x2m^2$ and 293 directly north of the initial trench. The intent was to obtain a complete profile of the deposition from the point of higher elevation down to the lower point on the floor of the rock shelter. Unit 2 ($1x2m^2$) was sunk near the point of contact of the overhang with the floor adjacent to the corridor that links the hall to the northwest part of the site.

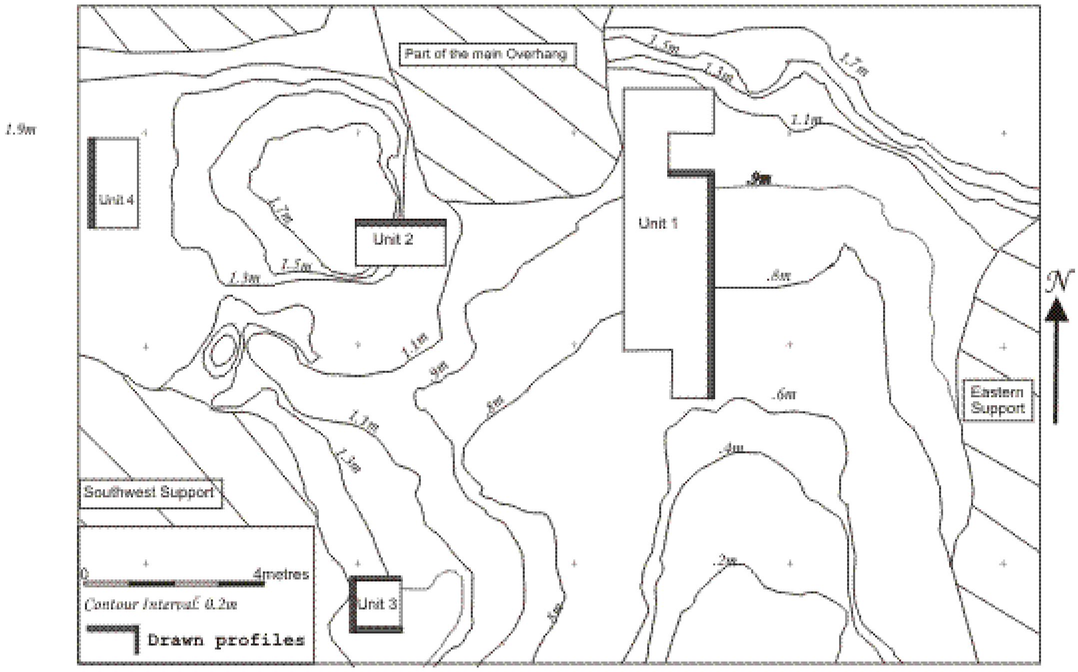



Figure16. Atamora: General site plan showing relief features and excavation units at Atamora

In the event however, there was insufficient time and resources to carry out a lateral excavation at the main hall and further excavation had to be postponed for logistic reasons. The main hall including much of the area to its immediate south was laid out in series of $1x1m^2$ grids (squares), designated by Roman Numerals starting from the southwest corner and running from west to the east in a northward direction. The north-south trench in the eastern section of the main hall therefore includes squares 173, 183, 213, 233 & 253. The second one north of it includes 292, 293 and 312 and the last comprises of 226& 227 (see Fig.s 16 & 17).

Other than excavations, systematic surface collection of lithic artefacts was carried out on the site especially on the entire floor under the overhang.

Our intention during the second phase of excavation was to dig the southernmost square (173) in Unit 1 to get to the sterile level, open the backfill on the open area in front of the pavilion and excavate a unit in one of the chambers to the west along the corridor leading to the northern extremity of the rock shelter. In the event however, only the additional two units were excavated. Square 173 was destroyed by activities of some local inhabitants who thought gold could be found at the site. Unit 3, (66) was located on a mound, which is more of a remnant soil deposit preserved from erosion by vegetation over the years just outside the shelter line on the southwestern section. Unit 4 (260 & 280) is sited in the mini-chamber directly under the western boulder that supports the main overhang off the corridor that led to the northwest extent of the rock shelter.

**Digging method**

The soil was loosen with the aid of hand trowels by gentle scraping and shovelled into buckets. The collected soil was subsequently dry-sieved with a ¼ mm mesh. Although, digging along natural layers was contemplated, but this was untenable due to the natures of the exploratory pit at Square 293 The more or less homogenous nature of the deposition coupled with poor visibility and relative inexperience of the field hands rendered this impracticable. Digging was therefore done by spits of 5cm intervals.

The finds recovered in the course of the excavation were given separate identification numbers, there provenience were recorded in terms of x, y & z coordinates. Thus, provenience of any artefact recovered could be placed with particular accuracy. Where such artefacts were too small and numerous to warrant separate identity, such were collected jointly and given singular identity within a ¼ square.

A square is divided into 4 quarter-squares for convenience and for provenience purpose. And the reference point for any measurement along the x & y axes, is at the Southwest corner of each square. All measurements for depths relate to an initial zero point or nail head, established with the aid of the quickset level. Soil samples were collected from every spit from Quarter-Squares (*a)* and (*d).*

In the course of this excavation, sketches of artefacts were drawn to show their spatial characteristics.

**The Stratigraphy**

It is very difficult to differentiate any distinct stratigraphic layer during the digging process other than the superficial covering and a layer of heavily burnt/ashy deposit. So there is no total confidence made in the drawn section even though it was carefully and thoroughly scrutinised by one of the more experienced excavator and the investigator. The stratigraphy is discussed in detail in the relevant section of this work (Fig.s 18, 19 & 20).

However, it suffices to say that the deposit remains heavily homogenous and this position is attested to by result of granulometric analysis and infra-red spectrometry carried out in order to adequately describe the soils and define variations in the various levels.

The Top soil (Layer 1) is black, (7.5YR 2/N/2 Munsell), averaged between 6cm and 13cm in thickness, is well developed and preserved in Unit 3 where it overlies layer 2. It contains several roots and rootlets. This appears to make the soil break in lumpy clods. It is loose, porous and is composed of angular sand grains with predominant humus content. Inclusive occupational features are pottery and few lithic artefacts; and the point of departure from the lower units is its compactness and sharp change in soil colour as well as textural composition.

Layer 1A is not present in unit 3. It consists of iguana from resident bats, which sleep hanging on the rocks at night in unit 4 where it averaged 5cm to 23cm. At units 1 and 2 it consists of thin (<4cm) layer of humus and wind-deposited dust. Artefactual contents include few displaced lithic and modern pottery sherds mostly in secondary context. It is generally mixed and thickness varied across the exposed sections from 2cm to 5cm and have been stripped completely off at some points such that layer 2 is laid bare.

Layer 2, light olive brown (2.5YR5/5/4 Munsell), averages between 6cm and 34cm in thickness, is also very well developed and preserved in unit 3. The deposit is much compact and contains uniformly coarse and angular sand grains with several white specks – feldspar. The dark colour is indicative of the leaching of humus from the topsoil. Cultural materials include flakes, chips, few core fragments and weathered potsherds.

Layer 3 is Light Yellowish Brown (10YR6/6/4 Munsell ). It underlies Layers 1A and 2 in units 1; in unit 3 it underlies layer 2. It is however, absent in units 2 and 4 where it had been stripped off. It is a cultural layer and contains widespread and very thick ash deposit in units 1 and 2.

Layer 4 is light yellowish brown in colour (2.5YR 6/4 Munsell) and is a densely packed cultural layer. It contains prolific microlithic industry based essentially on quartz raw material with few instances of chalcedony.

#### 2.4.4. Stratigraphy and artefact contexts

It was clear from the very beginning that we are dealing with rather complex deposit, which composed of series of more or less horizontal strata. Few major ones were represented in most of the exposed sections. There were in between these series, minor strata whose horizontal limits tended to correspond to vertical features most of which are remains of previous activities on the site such as fires and remains of structures. These are in most cases subordinate strata composing of cultural remains that belonged to different occupational phases in this rock shelter.

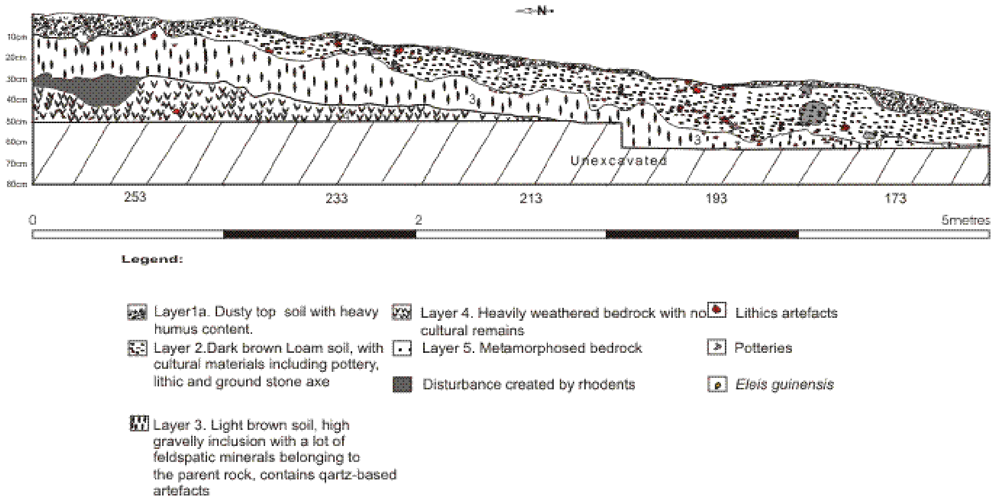



**Figure 17. Ajibode: Stratigraphic section showing the eastern wall of AT 03 Unit1**

Another feature that is quite noticeable given the nature of finds and artefact scatters on the site is the series of remixing activities, which follow the abandonment of the site. This has subsequently modified the original deposit. These modifications are possibly a function of two major factors vis-à-vis nature and humans. In nearly all the exposed units, the deposit was covered by a thin layer of fine particles dust and in some cases humus soil in square 3. In unit 4 it was covered by iguana from bats, which inhabit the rock shelter. The thickness of this layer varies across the excavated units depending on how much of it is still preserved. Stratigraphy within this deposit is very complex. Serious mixing of artefacts was observed in these strata. This makes it rather difficult to associate artefacts with particular archaeological horizons during the excavation process, although attempts were made *ex post* excavation analyses to associate particular artefact type to different occupational phases as could be observed in the differences of occupational characteristics. This was particularly noticeable in the area of lower elevation (Unit173), where reworking by erosion from higher points had resulted in the accumulation of all the varied artefacts observable in the site and wherein lithic artefacts of an earlier phase are in close association with historic objects of latter periods.

Another major internal disturbance on the site is the activities of burrowing animals, chiefly, the giant African rat, which for an extended period made their homes in the nooks and crevices of the rock shelter and the depth of their activities, are variable with the vertical distribution of shells from oil-palm nuts in the site. This has made a reliable reconstruction of the utilisation of oil-palm fruits in the site untenable and it must be assumed from the onset that much of the evidence has been internally redistributed both horizontally and vertically.

While the general outline of the formative processes in the site was under the above circumstances clear, it was less clear at many points during the excavation and subsequent analysis less clear regarding particular part of the sequence that is involved. This is very obvious from visual inspections of the strata which shows great similarities in lieu of soil colour and texture, a fact which militated against the precise association of artefacts to particular geological horizon.

In the approach to the study of the site the following assumptions was therefore made in view of the foregoing peculiarity which arose from the mixed distribution of artefacts and occupational phases. And following on the fact that the site embraces a vertical sequence of occupations of more than one period, the lithic, pottery and other artefacts will tend to be concentrated in horizons usually consistent with, and always related to the main living surfaces. Lithic (basically quartz)

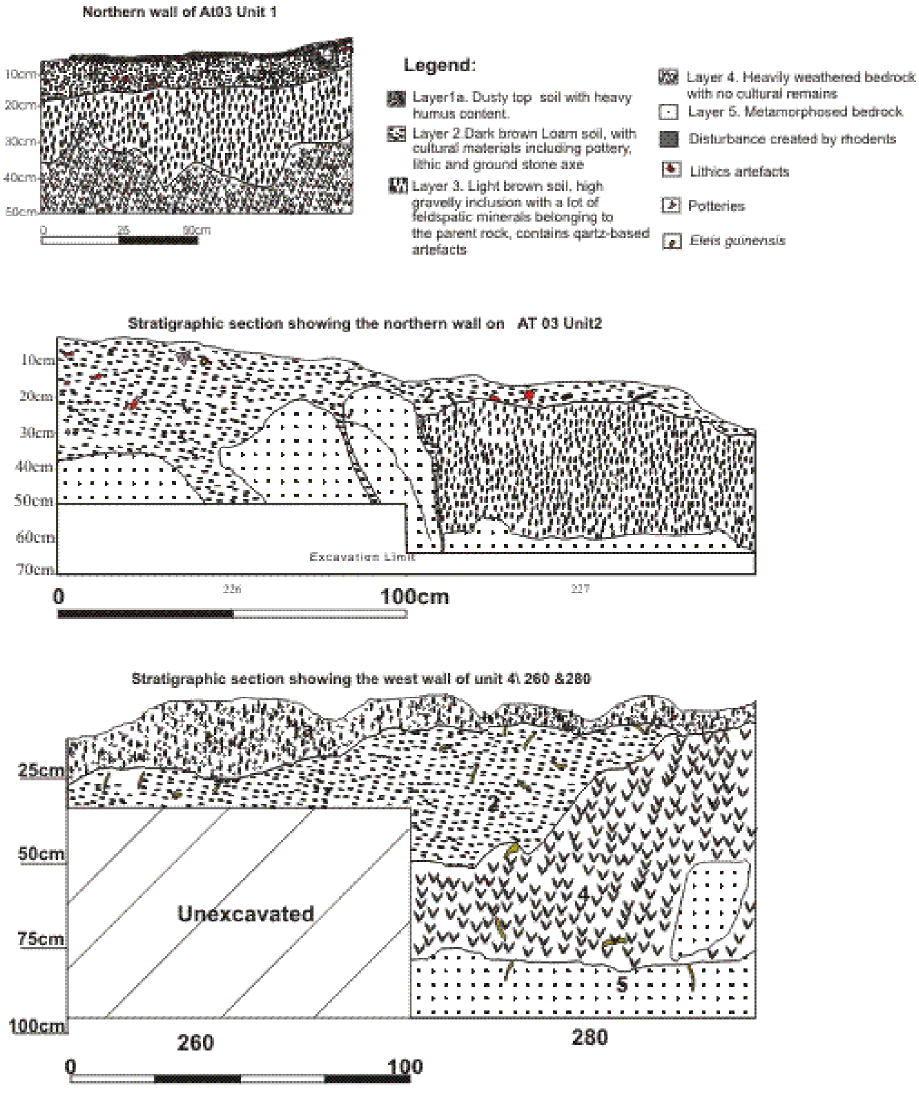



Figure 18. Atamora Section drawing of excavated units

and pottery are by far the most predominant artefact categories and it is not possible to dig vertically across the occupation deposit without striking any occupation level wherein any of these two are not present at all. It is usually true that any density of a type population will fluctuate in phase with the appearance of successive living surfaces. It is possible without taking into account the typology of artefacts present to recognise major horizon from the share density or increase in the population of such artefacts. Therefore, a typological population may be taken largely as the index of the intensity of occupation. Thus, the density of a particular artefact type may be taken as a useful factor for delineating occupation horizons in the site. This has become very relevant in as much as the stratigraphic section cannot be taken wholesale as reliable enough indices for occupational differentiation in the site.

There however, remains the problem of valid standard for comparison notwithstanding the foregoing assumptions. The arbitrary excavation of the site according to spit levels was obviously a problem as it was not possible to excavate along natural layers given the test case in square 293 and there is the obvious fact that vertical and horizontal dimensions of each stratigraphic unit are not similar across the site.

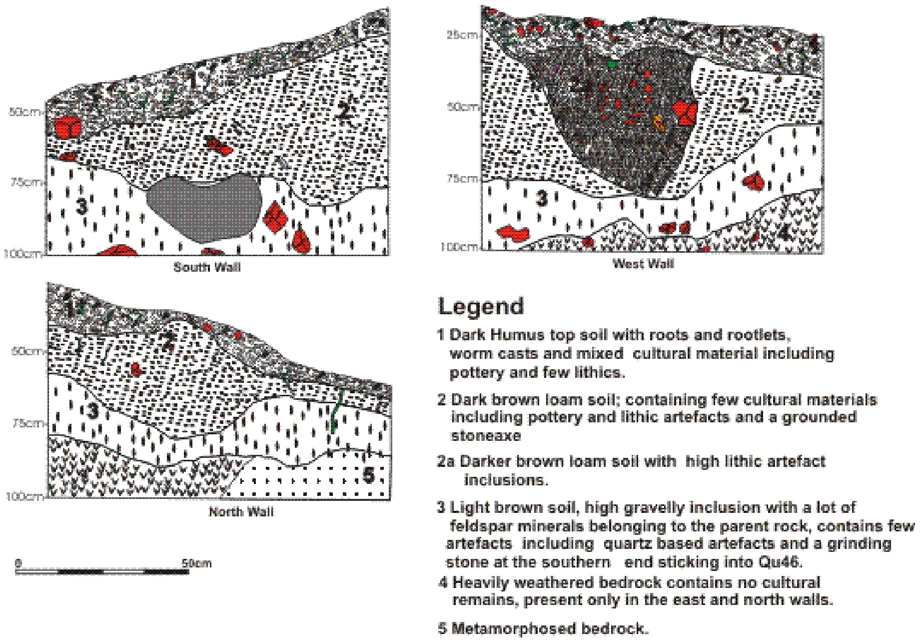



Figure 19. Ajibode: Section Drawing of Unit 3 / 66 showing south, west and north walls

**Period identification by Depth/Density ratio**

There are observable differentiations in the artefact stratigraphy as shown in the plot of vertical distribution of lithic distribution in the area exposed during the excavation. This is very much so in Units 1 where excavation to a depth of about 60cm below the surface area contains a large concentration of artefacts. The main categories include flakes and cores among the recovered data. The situation is different in Unit 2 where there was the notable absence of materials in the upper 50cm wherein majority of lithic artefacts are concentrated under this level. The concentration here is far lesser compared with that of unit 1 at the eastern section specified in the above. There are however, abundance of pottery, which includes those deposited upon those in primary deposition because of secondary deposition activities of erosion or runoff. Although it was observed that pottery scatter in Square 173 in unit 1 is remnants of evident firing activities that could probably be attributed to pottery production activities. A detail of artefactual distribution is discussed in the following section in Chapter three below.

# Chapter Three

## 3. Artefact analysis

### 3.1. Introduction

Adequate classification of artefacts from Atamora is inhibited by numerous problems, which have to be resolved. Such problems bother on the utility of such artefacts, morphological characteristics and raw material utilisation.

Although it is not possible to rule out subjective error in a work of this nature, it can nevertheless be minimised. The intention therefore is to work out a standardised scheme, which will take into consideration the aim of this researcher in his intent to characterise the nature of Stone Age occupations in Southwest Nigeria as well as the related problem of typology and classification generally.

This is viewed against the backdrop of an earlier observation by Shaw & Daniel(1984) that the classification of small artefacts made from quartz is very problematic because the fracture characteristics produce effects which could be deceptive and similar to secondary workings. The industry at Atamora hardly contained well-defined tool forms with established formal character. It contains large quantity of debitage, a fact, which makes one, want to conclude at least tentatively that it was an activity site for manufacture of artefacts at some point in time. This makes formal typology impossible.

In the event of classification, every item was tabulated according to their provenience. Three main classes of material were immediately recognised as lithic, pottery and other materials. The result of artefactual classification is highlighted in the following section.

**Lithic**

The basis for classifying the lithic assemblage from Atamora is purely morphological. This involved the sequential grouping of the chipped lithic collections into the categories highlighted below. These categories are counted as primary product of lithic technology. Fig.s in related tables are based on actual counts and weight of individual category. This was adopted in order to communicate the result of our findings to other scholars involved in the prehistory of West Africa. It was observed right from the onset of the classification that many of the untrimmed flakes might probably have been utilised as tools. The example to support this position comes from a display in the Khartoum Museum, which highlighted the fact that undifferentiated quartz flakes from Heiban were used by the Nuba for cutting meat and cicatrising themselves. Piece of flint, which would otherwise have been neglected by archaeologists, were used for sharpening and carving arrows among the mountain people of New Guinea (Shaw & Daniels, 1984). Proper consideration of the possible usage of untrimmed flakes requires edge-wear analysis.

Technology of artefact manufacture was the primary consideration in this classification. So, morphology of artefacts is only of secondary importance. This approach was chosen in order to establish the technical tradition guiding artefact production at the site. It was equally intended to establish whether flakes were results of deliberate and intentional flaking techniques designed to meet particular specifications in the template of the manufacturer or whether it was as a results of indiscriminate and non-pattern flaking habit. It is hoped that a critical assessment of the flakes would help identify some regularities, which clearly and distinctly establish their artefactual characters. Flake tool complex was obviously the dominant artefactual types observed at the site and their production involved variety of techniques of detaching flakes from variously prepared cores and unprepared ones. This clearly illustrates the advance level of technical skills attained by the occupants of the rock shelter in the production of tools.

Other artefacts recognised within the assemblage include varieties of debitages consisting of remnants of tools or lithic production including cores, untrimmed flakes, fragments among others (which are collectively referred to as debris), hammer stones, ground stone axes or adzes and preforms.

The rationale for this system of classification derives to a great extent from the one provided by Shaw and Daniel (1984) in their classification of the Iwo-Eleru materials and to a lesser extent Debenath and Dibble (1994) in their useful handbook on Palaeolithic typology. In so doing, complete flakes were observed to have certain characteristic or landmarks, which are useful for typological classification. Such characteristics, which are described below are directly relevant to this work. They include the character of the exterior (dorsal) and interior (ventral) surfaces of the flakes. The interior of individual flake has been observed to exhibit varied fracture mechanics, which are present in varying degrees on the flakes. They include the following among others:

i.) points of percussion which is the actual point of impact in the removal of the flake from the core
ii.) Core
iii.) Bulb of percussion

iv.) Concentric ripples which radiate distally from the point of percussion and reflecting the direction of the blow on the core

On the dorsal side, these characteristics are present in the forms of:

i.) cortex, either full or partial remains

ii.) flake scars

iii.) ridges between scars

iv.) proximal end

v.) distal end

vi.) medial position

vii.) lateral margins

Other attributes taken into consideration in the classification of the artefacts from the site include the following:

i.) Platform surface whether it is plain, cortical, prepared or facetted

ii.) Angles of the interior and exterior platforms

iii.) Nature of termination of the distal end viz: normal or feather termination, hinge, or plunging terminations

iv.) Flake axes - flaking axis (technological ), which is the vector that originates at the point of percussion, proceeds distally perpendicular to the surface and dissecting the bulb of percussion, or axis of piece(morphological) which is simply the longest axis of symmetry

There are innumerable numbers of metrical observations that can be taken of flakes as well as of retouched artefacts. In line with Debennath and Dibble (1994), the choice of measurements was dictated by the research questions. Measurement is not an easy task as few of the varied factors that affect the morphology are not understood to any great extent, a fact which makes it rather difficult to get standardized measurements required of an epistemological or exact science. This makes comparability or results almost improbable. Morphometric measurement of categories of material obtained from the site is still in progress and the result is not included here. The above criteria however, aided in the categorisation of the lithic composition of the assemblage into the scheme described below.

The meaning and variation of lithic artefacts recovered from southwest Nigeria among other regions of West Africa is not adequately clear. This poses a lot of limitations in using them as epistemological tool for hominid behavioural reconstruction. This is further compounded by the fact that little has been done with respect to the assessment of technological, morphological and functional distinctions among raw materials and related artefacts. The object of this analysis as carried out in this work is to assess the level of variability in the lithic artefacts from the selected site and the extent to which such variability as obtained from this site can be used as a basis for characterising other assemblages in the study area. Furthermore, analysis is aimed to find out whether such variations are attributable to ecological factor of raw material availability. In other words, it is an attempt at regional characterisation of lithic technology from Southwest Nigeria. The lithic landscape is micro-environmentally unique, nonreplicable, non-universal, and therefore ecosystemically relative. Thus, in the course of exploiting resources within a particular habitat, the hunter-gatherer or toolmaker had to make do with the lithic specific provisions and limitations

The physical environment (i.e. in term of its constituent raw materials), play particular role among other multiple factors in explaining artefact variability at the site. The analysis of artefactual remains may provide some insights on the behavioural aspects of early humans in terms of mobility, subsistence and economy. Although analysis of lithic artefacts can provide a better understanding of past human behaviours, it will be rather simplistic to assume that different lithic types and technology reflects different cultural traditions which has been tempered to some extent by functional needs and it is equally simplistic to suppose that lithic assemblages represent accumulated remains of a single group of inhabitants. It is a truism therefore, that Palaeolithic assemblage infact represents a complex history of manufacture, use and re-use, import and exportation of different materials and products as people came and went out of the site and infact the behaviour that took place over the scale of geological time when the site was occupied. Within this context, it is obvious that lithic technologies responded to differences in raw material qualities and accessibilities and this apparently affects the forms of lithic artefacts over time.

Analysis of lithic artefacts from the standpoint of sources where the lithic raw materials were obtained presents the Palaeolithic from a geographical perspective, which involved the direct assessment of land-use patterns in the distant past. Examination of the technological stages in which the stones from differing sources appeared reflects aspects of movements within this geographical realm.

Dividing the Stone Age in Southwest Nigeria into LSA, MSA and ESA is, at least theoretically based on fundamental differences in subsistence (and or technological) behaviour within each successive group of inhabitants. These differences are better understood for Europe to the extent that many discussions now centre around the establishment of cultural entities for artefacts from different regions based on technological attributes discernible in the production of artefacts (Conard and Fischer 2000). Desirable as this may be in the case of Southwest Nigeria, such a position is at present unrealistic. This is because of the fact that not much ground has been covered in terms of prehistoric research in the region. This is particularly the case in the area of artefacts typology and tradition of artefacts production. As a result, there is no sufficient basis for the recognition of cultural entities or technological traditions within the sub-region as a whole. Moreover, the forested ecology of Southwest Nigeria do not provide the same environmental conditions as obtainable elsewhere and cultural evolution in the area may have evolved according to some unknown principles. It is on this ground that such terms like Mesolithic and Neolithic has limited applications in the following attempts at characterisation of assemblages from Southwest Nigeria. LSA in Southwest Nigeria incorporates the post-Pleistocene period down to the inception of the Iron Age. Shaw and Daniels (1984) have dealt to a considerable degree with the internal structure of the LSA in the area. Constant references to their work derive from the monumental importance attached to their contributions at Iwo-Eleru, which is a celebrated example of the investigation of a Stone Age occupation site and by implication the fundamental basis for other works in the area.

They have for example defined a number of units, which succeed each other chronologically at Iwo-Eleru on the basis of typological similarities. Although, these were defined by the lack of typical implements or tools. Morphological characteristics of artefactual remains were however, predominant in their typological analysis of finds from the site. It is nevertheless, a very good starting point for the discussion on such a complex subject that pertains to lithic classification in West Africa and southwest Nigeria in particular. This is because of the very troubling fact that artefacts from this region exhibit no such formal character which can be used to define them on the basis of morphological similarities with others from elsewhere in the country and the African continent generally. What is important is whether such phases as established at Iwo Eleru could stand the test of time and whether such types in the typological propositions by Shaw and Daniels at Iwo Eleru could be corroborated in other sites in the same region, all things being equal. This therefore constitutes the rationale basis for the classification of lithic artefacts obtained in the course of two excavations at Atamora rock shelter.

It should be noted from the onset that any approach based on typology alone will always remain unsatisfactory. Therefore, formal typology was rejected from the onset given the lack of definable or formal tool types in the assemblage. An attempt was however, made to classify functionally identifiable classes. In so doing, cognizance is taken of their formal character that distinguished them as a tool or implement where this is obvious.

In an attempt to overcome the limits of formal typology, complete quantification of discrete (separate) lithic offers a solution. We realise however, and agree with Uerpmann (1992), that, meaningful quantification requires defined assemblages that represent meaningful archaeological units. A standard for this is very rare or absent in Southwest Nigeria. Excavated assemblages defined by vertical and horizontal boundaries of excavation are rare to come by in the study area. Surface collections were excluded in order to constrain selected artefacts to horizontal and vertical boundaries/establish some levels of chronological uniformity that is ascertainable on the basis of formal artefactual or tool characteristics. In essence every item is included to make for meaningful quantification.

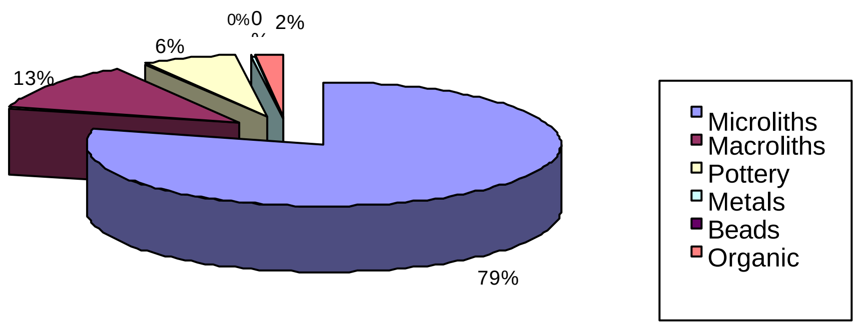
### 3.2. Typology and description

Diversity within an artefact assemblage can be characterised in different ways. One such is the richness of the assemblage in term of the number of artefact types represented in it. It could also be characterised in term of manufacture techniques based on observable variables or attributes. Most of the classificatory schemes employed in West Africa are heavily reliant on Desmond Clark (1963). We recognised right away that culture amounts to interrelated network of subsystems each of which can be studied independent of the aggregate whole into which artefacts belong to such subsystems. Differences between artefact types may arise from any number of causes having to do principally with where in time system trajectory the maximal constraint is located and also in the nature of constraint.

**Table 3.2.1. Basic categories of materials recovered from Atamora**

| **Lithic** | | | |
|---|---|---|---|
| Microliths | Flakes – Quartz, Chalcedony debitage | 5714 | 79% |
| Macroliths | Hammerstones, Mullers– Quartzite | 916 | 13% |
| **Non-lithic** | | | |
| Pottery | Terra-cotta, potsherds | 465 | 6.4% |
| Metals | | 11 | .2% |
| Beads | | 2 | 0.02% |
| Organic | Bones, cowry shell, nuts | 140 | 1.9% |

Fig. 20. Pie Chart of artefact categories from Atamora rock shelter




Classification holds a prime of place in any archaeological data analysis as a basis for any meaningful inference about the life ways of the people under investigation who are not there to attest to the accuracy of such inferences and interpretation. These are by and large well informed guess work that are subject to the variables employed by the investigator. This is particularly the case as independent check is not available to attest for the existence of such pattern as he claimed – the dead can surely not speak out for themselves.

Classification as carried out here is in two stages. The first step involved the building of temporary analytic scheme based on observed morphometric description of artefactual attributes. These analytic types were then employed to develop hypothesis for testing, re-evaluating and explaining the variability within the artefact assemblage.

To recognise the integrating propensity of lithic artefacts within the assemblage we tried to design a descriptive and classificatory scheme, which recognised these. This involved the deliberate attempt to distinguish elements of formal variation that stem from technical process of artefact utilisation such as working edge, edge wear (even though such wear was based on macroscopic examination). Attribute sets were built for each category.

This helped to identify the pattern of implement manufactured at the site. To this end, much of our attention is focussed on explicit attribute recognition. This is a clear departure from related works, as we did not identify artefacts along the formal types identified elsewhere along the line of Desmond Clark (1963). This is in consonance with Andah (1979)however, which recognised culturally imposed variations in respect of overall size and shape differences on the one hand, and how artefacts were produced and character of edge modification, worked faces, and nature of working, types of blanks produced, overall intents of worked pieces and the distribution of artefacts in particular area. Note is taken of deep and large flake scars over the entire body of artefacts and battering and crushing evidence left on part or entire body of artefacts.

Consequently, the following categories were identified in the classification of lithic-based artefacts at the site. Cross-references are provided to the illustrations. The illustrated cases represent each of the range or variation in each category as opposed to typical specimens.

1. **Axes/Adzes**

These include categories have at least one grinded facet. No attempt was made to distinguish between these two because many of these grinded axes could have been hafted and used as adzes. A ground stone tool in which the cutting edge is not on the central longitudinal axis but to one side of it indicative of an adze, (Shaw &Daniel 1984), when hafted, it is mounted at right angles to the cutting edge. This conforms to what the French archaeologists termed *herminette*, as opposed to *hache*. A *herminette* hafted as an axe would be unbalanced and difficult to use. At this macro level, other categories of ground stones were also lumped in to this category. These include rubbed stone, which may also pass for a chisel since it was made out of indurated quartz (Fig. 48 Plate 10 b).

2. **Blades**

These are flakes of variable shapes ranging from rectangular to sub-rectangular shapes(Fig. 42). In some cases, they have scars which are associated with definite core preparation on their dorsal surfaces. These also include a distinct type with a unique convergent sharp lateral edge brought about by deliberate consecutive linear removal of flakes from alternative sides of an elongated piece to obtain a very hard and sharp edge.

3. **Backed blades**

These are fairly rectangular pieces with one of the two long sides blunted due partly or wholly to backing (Fig. 41). Variability in this category includes blades and flakes with abrupt retouched edge opposite a natural, sharp cutting edge. These backing are in some cases present before the removal of the blanks. Their peculiarity is that such backing usually opposes the natural sharp edge. Shapes are of varied dimensions with length in most cases twice the width. .

4. **Chips**

This category includes wastes resulting from actual reduction activities. It is associated with tool production sequence at the site. Debitage constituted majority of the artefacts recovered at the site.

5. **Chisels**

These are in two categories - at the macro level theyinclude fairly rounded quartz pebble with one ground facet at its extremity adjacent to the longitudinal profile, having straight or near so edges (Fig. 40). At the microlithic level, they includes those thin roughly rectangular pieces with shallow invasive flaking and shattered wears along at least one straight or nearly edge. Varieties within this category include larger and thicker pieces and those which are more irregular than the standard chisel defined above, but having at least one edge with invasive flaking and shattered wear.

6. **Cobbles, Chunks and Pebbles**

These include large fragments (other than chips) and cobbles which were brought into the site probably as raw materials. Some among these categories include remnant fragments which were not suitable for tool manufacture and were not utilised for artefact production. The pebbles are water-worn, weathered and round, while some of the cobblestones are angular with some evidence of utilisation in the form of irregular chipping and blunting of the edge. These categories of artefacts bear no evidence of deliberate flaking.

7. **Fragments**

These are unworkable fragments bearing evidence of reduction to a state when it was no longer possible to work. Among these are unsuccessfully worked pieces that were abandoned most often due to poor raw material qualities.

8. **Grinding stones**

These are large boulders of dolorite, which has grinding hollow or groove at the upper surface. Associated with this grinding stone (Plate 6) are the cobbles, which were used for grinding or pounding on this large piece. It is probable too that the grinding stone was used for grinding and polishing of Celts or ground stone axe. Most of the celta and axes recovered from the site were found within very close proximity to this boulder giving the impression that they complement each other. A new archaeological horizon was assigned to the cultural materials at this level upon the appearance of this phenomenon.

9. **Heavy Points**

This category (Fig. 38 *p q r*) includes pointed pieces larger, and thicker than the standard ‘point’ and these were either bifacially worked or have invasive flaking.

10. **Hammerstones**

Two main categories were observed vis-à-vis Hammerstone and Core Hammers. The former includes those fashioned mostly from quartz cobble/Nodules of varied shapes that ranged from 50mm to 90mm in diameter. Notable among these are the egg-shaped, spherical, irregular and semi-oval forms sliced obliquely from two sides to centre at about median point of an original oval piece. Also present, but to a lesser frequency are quadrilaterally shaped pieces with quadrangular sections. Some have pitted spherical forms due to heavy duty bashing. Most however, bear minimal scars of utilisation at localised points. Core Hammers on the other hand, though are mostly based on quartz and to a lesser frequency quartzite, were originally cores that were later used as pounders (Fig. 47). Edges of the platforms and distal ends are usually battered and are rounded in many cases due to pounding action. Some are present in the form of polyhedral cores. In all cases, the core hammers have flake scars on their surfaces.

11. **Microlithic fragments**

These are irregular broken pieces which have clear evidence of some backing and in some cases evidence of core preparations prior to their removal. They are not definitely assignable to any of the other microlithic categories in the scheme presented here.

12. **Notch**

This category includes the entire end struck quartz flakes with a single notch on the side at the end opposite the flake's proximal end. Most of the notches were produced by inverse retouch on the ventral surface and by trimming of localised section of the dorsal surface.

13. **Points**

Very few materials belonging to this category were recovered from the excavation (Fig. 38). They were based on long narrow blade of vein quartz. The typical point tapers markedly towards the distal end of the flakes and are extensively retouched on either sides. There are also few instances of broken fragments also based on vein quartz having Plano-convex cross-section. These are characterised by rough flaking on both faces with the edge merging or converging to form prominent dull tips. Among this category are those with pointed extremity due to bilateral trimmings. It has been observed that trimmings as in the case of Iwo Eleru is along one side of the point and from one face only, in some others trimming is on both sides of the point and on both sides of the flake.

14. **Triangles**

This category includes those artefacts that are practically isosceles in form. The longest side is sharp and unretouched while the opposing edge is blunt with at least one edge retouched. This compares favourably with type 20 defined by Shaw and Daniel (1984), at Iwo Eleru and type 3 along the line of Debennath & Dibble (1994). Variants in this category include ones with central or medial ridges and which sometimes have triangular bases.

15. **Scraper**

This category includes those with morphomeric attributes consistent with oval or round quartz cobbles and ranging from triangular to semi-circular micro-core quartz fragments with flat ventral surfaces as well as convex dorsal surfaces giving a Plano-convex form. A broad type of invasive steep parallel near vertical retouch was employed. This often covers the entire circumferences of the specimen.

16. **Sector**

This category includes flakes with one backed edge (usually curved, but occasionally straight). The opposite edge consists of intersection of primary ventral and dorsal surfaces and is always greater in length than the backed edge.

17. **Segments**

This consists of artefacts with one straight cutting edge. The remainder of the perimeter consists of a single curved and blunt edge, which is produced by deliberate or natural retouching. The length of the cutting edge exceeds the maximum width of the artefact at right angle to the cutting edge. This conforms to a certain extent to type 38 (Fig. 4.40) described by Debennath & Dibble (1994) where the cutting edge was described as abrupt retouch opposite a natural sharp edge.

18. **Biconical, Discoidal cores and Discs**

Biconical cores are flat radial cores **(**Figs. 44-45)with two opposing platforms with workings adjacent to the platforms. Discoid on the other hand are high backed dome-shaped radial cores, worked in two different directions from the periphery to produce a jagged edge. Included in this category are varieties of cores with one or more platform surfaces. It has at least three or more scars indicating flake removal. Discs are slightly different from discoids being on the average smaller in size.

From the foregoing categories, it is possible at the technological level to distinguish between artefacts which bear marks of primary reduction for example cores, preforms, scrapers, blades and those which are direct result of reduction activities such as chips, fragmented artefacts, fragments among others. At another level, it is also possible to identify those with secondary working including invasive flaking, and polished stone axes with a clear predefined shape such as scrapers, polished ground stone axes, points and segments among others.

**Table 3.2.2. Basic frequency of lithic artefact occurrence according to depth.**

| Level | Blade | Grinding stone | Fragmented artefacts | Backed Blades | Chisels | Chips | Chunks/Nodules | Adzes/Axes | Triangles | Fragments | sectors | Scrapers | Hammerstones | Prepared cores | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0.64 - 0.88** | 71 | | 6 | 14 | 1 | 149 | 58 | | 3 | 272 | 11 | 3 | | 2 | **590** |
| **0.89 - 1.12** | 88 | | 17 | 6 | 1 | 179 | 65 | | 5 | 383 | 13 | 6 | | 20 | **783** |
| **1.13 - 1.36** | 98 | | 51 | 19 | 2 | 132 | 73 | | 9 | 722 | 18 | 6 | 1 | 33 | **1164** |
| **1.37 - 1.60** | 144 | 1 | 53 | 23 | 9 | 436 | 93 | | 16 | 978 | 31 | 15 | 1 | 155 | **1955** |
| **1.61 - 1.84** | 80 | | 2 | 9 | 7 | 69 | 38 | | 11 | 383 | 9 | 4 | 1 | 95 | **708** |
| **Totals** | **481** | **1** | **129** | **71** | **20** | **965** | **327** | | **44** | **2738** | **82** | **34** | **3** | **305** | **5200** |

**Fig. 21. Histogram showing the basic frequencies of lithic artefact occurrence at the unit1.**

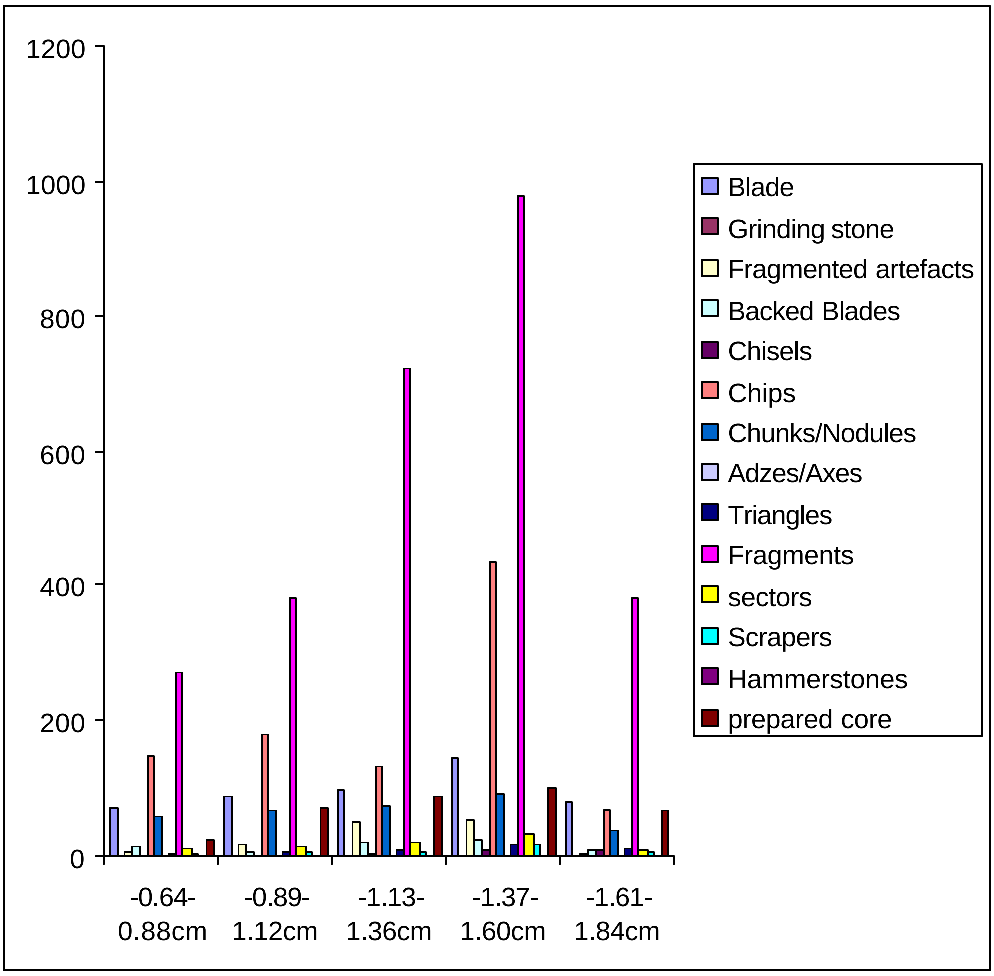


**Table 3.2.3. Volume of basic artefact categories in Unit 1**

| Level (metres) | Blade | Grinding stone | Fragmented artefacts | Backed Blades | Chisels | Chips | Chunks/Nodules | Adzes/Axes | Triangles | Fragments | sectors | Scrapers | Hammerstones | Prepared cores | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.64 - 0.88 | 272 | | 27 | 85 | 3 | 184 | 1482 | | 19 | 1691 | 35 | 103 | | 407 | **4308** |
| 0.89 - 1.12 | 385 | | 84 | 37 | 5 | 590 | 3232 | | 50 | 1992 | 54 | 48 | | 1281 | **7758** |
| 1.13 - 1.36 | 553 | | 233 | 113 | 17 | 324 | 3528 | | 55 | 6210 | 152 | 63 | 278 | 2120 | **13646** |
| 1.37 - 1.60 | 888 | 291 | 202 | | 40 | 1391 | 3634 | | 97 | 6501 | 202 | 189 | 123 | 2298 | **15856** |
| 1.61 - 1.84 | 329 | | 8 | 13 | 37 | 342 | 2107 | | 52 | 1604 | 39 | 24 | 285 | 700 | **5540** |
| **Total** | **2427** | **291** | **554** | **248** | **102** | **2831** | **13983** | | **273** | **17998** | **482** | **427** | **686** | **6806** | **47108** |

**Fig. 22. Histogram showing the volume of artefacts in unit 1 according to depth**

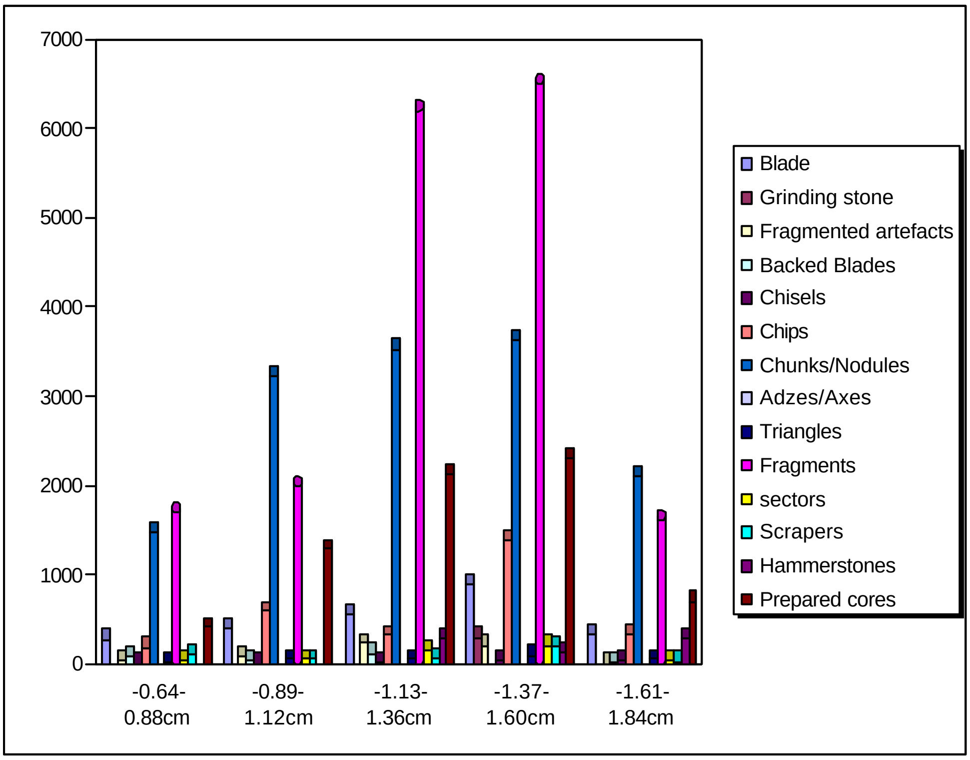



**Figure 23. Histogram showing the volume of artefacts in unit 1 according to depth**

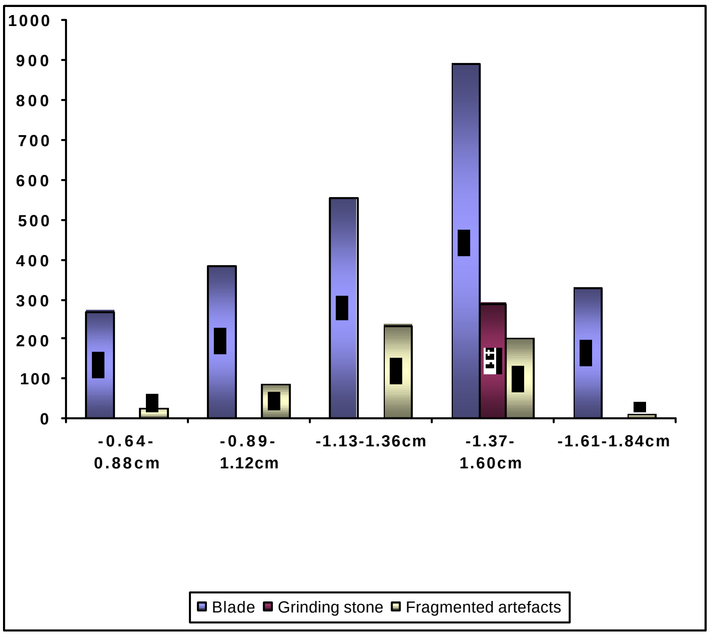


**Figure 24. Histogram showing the volume of artefacts in unit according to depth**

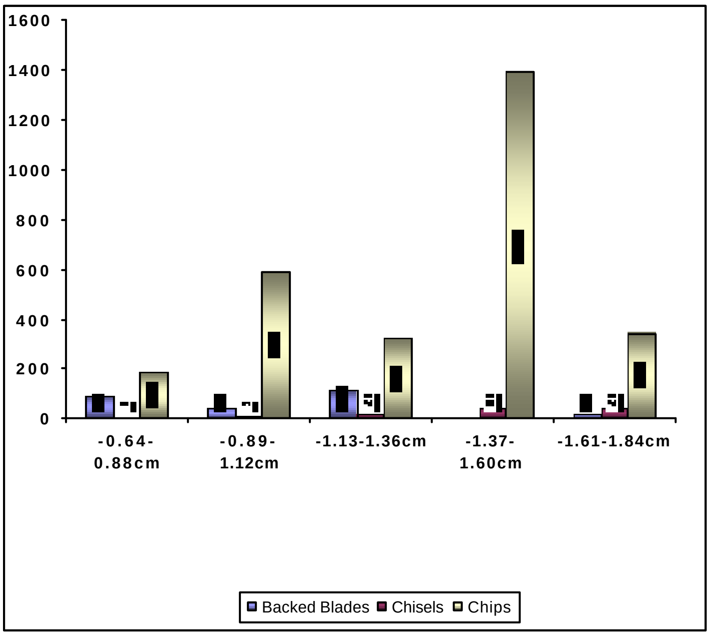



**Figure 25. Histogram showing the volume of artefacts in unit 1 according to depth**

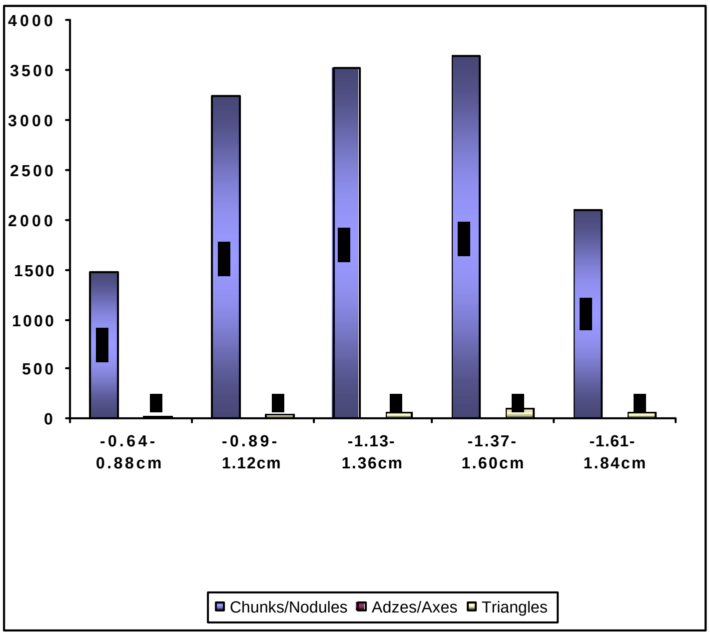


**Figure 26. Histogram showing the volume of artefacts in unit 1 accoding to depth**

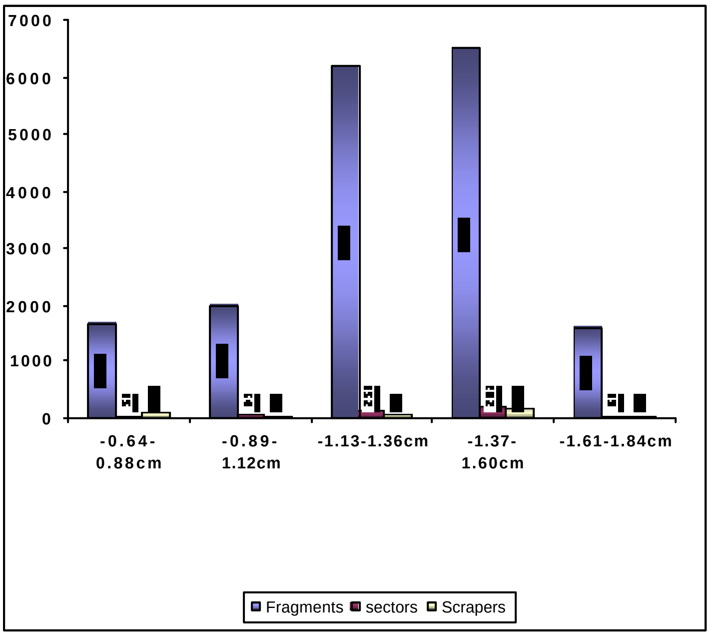



**Figure 27. Histogram showing the volume of artefacts in unit 1 according to depth**

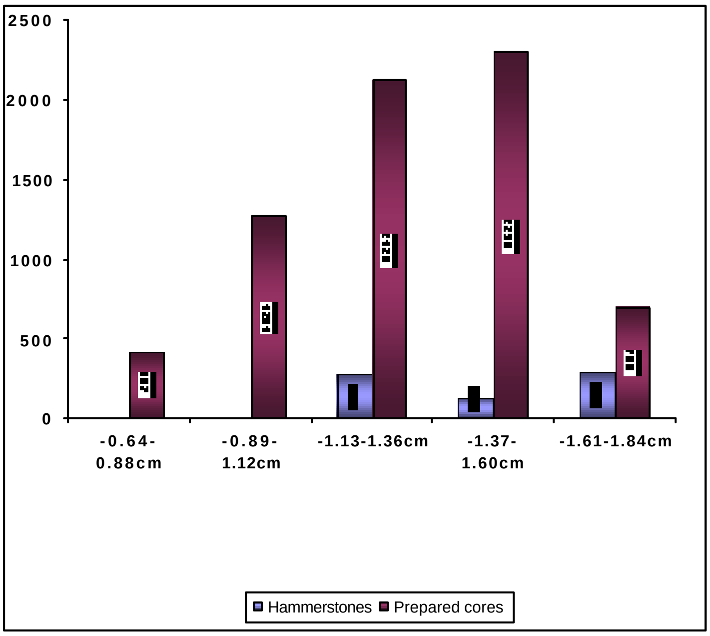


**Table 3.2.4. Frequencies of basic raw materials at Atamora unit 1 according to depth**

| Level | Blade | Grinding stone | Fragmented artefacts | Backed Blades | Chisels | Chips | Chunks/Nodules | Adzes/Axes | Triangles | Fragments | sectors | Scrapers | Hammerstones | Prepared cores | Total | %ot Lithics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -0.64-0.88cm | 71 | | 6 | 14 | 1 | 149 | 58 | | 3 | 272 | 11 | 3 | | 25 | 613 | 11.6 |
| -0.89-1.12cm | 88 | | 17 | 6 | 1 | 179 | 65 | | 5 | 383 | 13 | 6 | | 71 | 834 | 15.8 |
| -1.13-1.36cm | 98 | | 51 | 19 | 2 | 132 | 73 | | 9 | 722 | 18 | 6 | 1 | 33 | 1164 | 22.1 |
| -1.37-1.60cm | 144 | 1 | 53 | 23 | 9 | 436 | 93 | | 16 | 978 | 31 | 15 | 1 | 155 | 1955 | 37.1 |
| -1.61-1.84cm | 80 | | 2 | 9 | 7 | 69 | 38 | | 11 | 383 | 9 | 4 | 1 | 95 | 708 | 13.4 |
| 481 | 481 | 1 | 129 | 71 | 20 | 965 | 327 | | 44 | 2738 | 82 | 34 | 3 | 379 | 2274 | 100 |

**Figure 28. Frequencies of basic raw materials at Atamora unit 1**

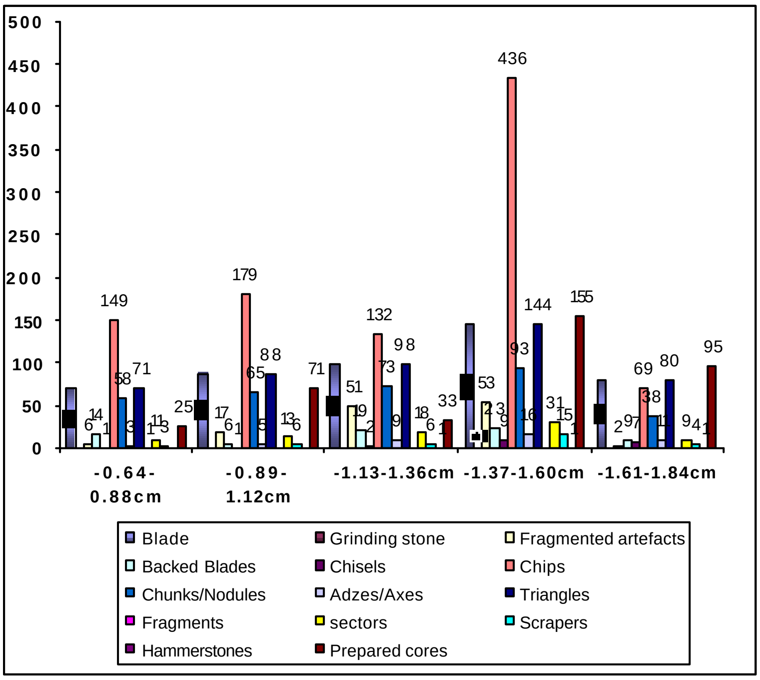



**Table 3.2.5. Relative frequencies of basic lithic raw materials**

| Raw material category | Count | % |
|---|---|---|
| Chalcedony | 3 | 0.04 |
| Clay | 460 | 6.5 |
| Dolorite | 1 | 0.01 |
| Granite | 15 | 0.2 |
| Metal | 11 | 0.2 |
| Quartzite | 481 | 6.7 |
| Quartz | 6165 | 86.3 |
| Total | 7136 | 100 |

Figure 29. Histogram showing relative frequencies of raw materials at Atamora

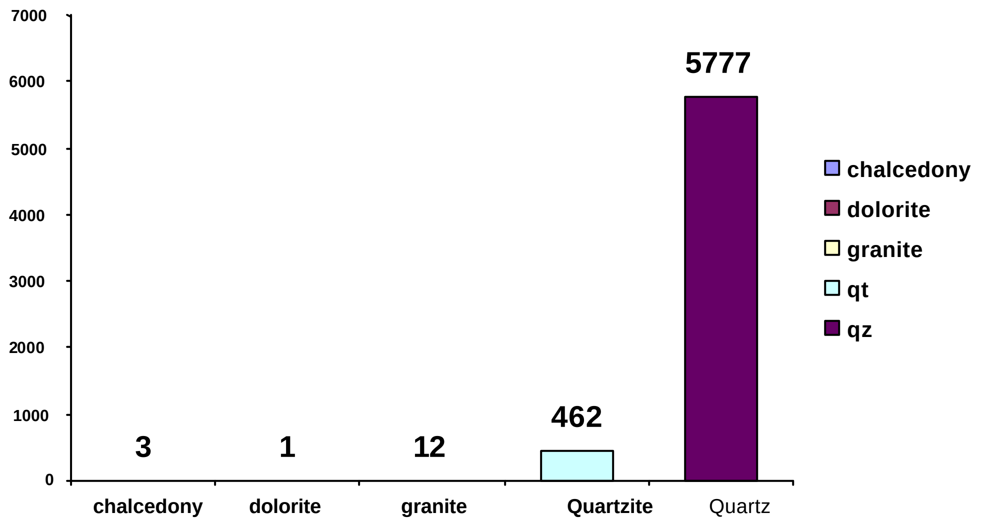
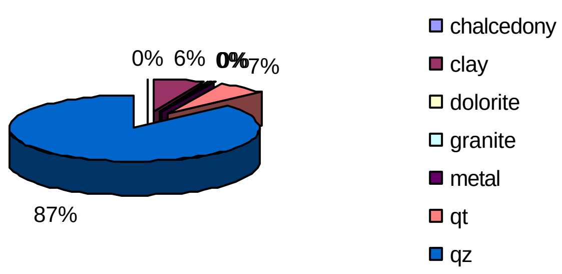



Figure 30. Categories of raw materials utilized at Atamora



## Chapter Four

# 4. Non-lithic artefacts

## 4.1. Pottery and Terra cotta

Pottery constitutes the largest categories (5.8%) of the non-lithic materials recovered from the site. In all, eleven (11) non-lithic categories were identified at the site. These are listed in Table 4.1.1. below. Large quantities of potsherds were recovered during the excavation particularly from units 1 and 2. A total of 464 pieces (5.8% of the non-lithic components) were recovered from Units 1 & 2 in the course of the excavation. Lesser quantities were recovered from units 3 and 4 but in the same proportions with those from the previous Units 1&2. Potteries recovered from the surface and the subsurface levels were in relatively good state of preservation compared with those recovered from the lower horizons. These were greatly fragmented and eroded. This poor state of preservation increased with depth of materials.

**Table 4.1.1. Basic categories of non-lithic artefacts recovered from Atamora rock shelter**

| Categories | Count | % of total artefacts |
|---|---|---|
| Shell *(Achantina achantina)* | 1 | .01 |
| Bead | 1 | .01 |
| Bone | 5 | .06 |
| Charcoal | 79 | 01 |
| Cowry shell | 34 | .42 |
| metal | 11 | .1 |
| Nuts | 12 | .2 |
| Palm kernel | 7 | .09 |
| pottery | 464 | 5.8 |
| pottery/rim | 1 | .01 |
| SEED | 2 | .03 |
| Total | 618 | 7.74 |

**Fig. 31. Vertical quantification of Pottery from Unit 1 in Atamora rock shelter**

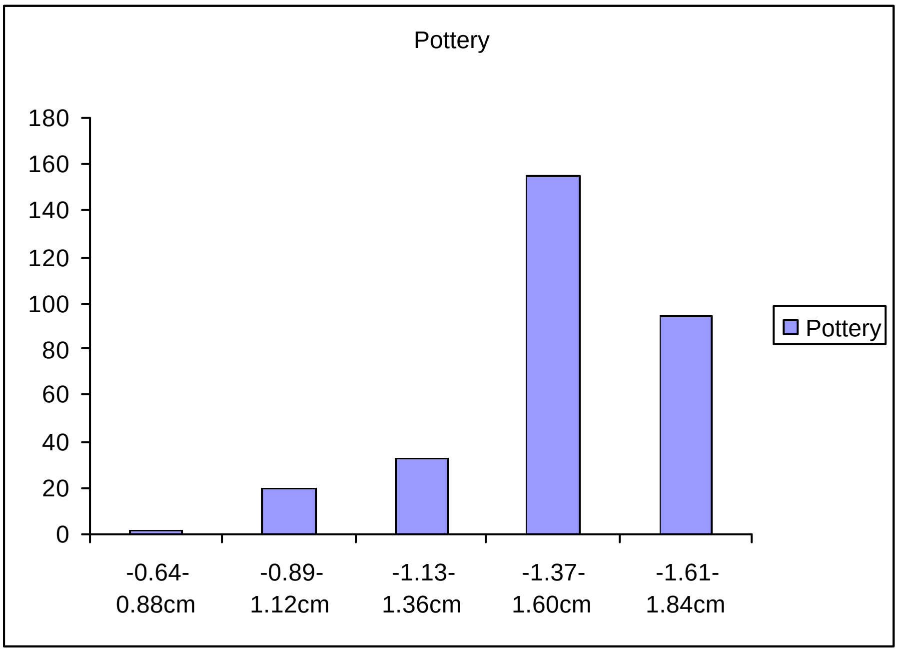
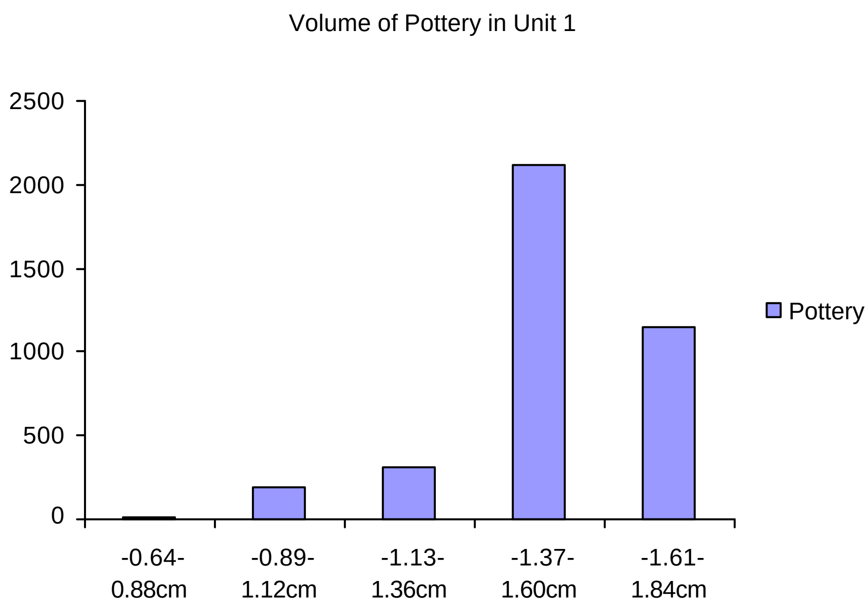



**Table 4.1.2. Vertical distribution of pottery materials in unit 1 at Atamora**

| Level (metres) | Pottery (grams) |
|---|---|
| 0.64 - 0.88 | 16 |
| 0.89 - 1.12 | 193 |
| 1.13 - 1.36 | 308 |
| 1.37 - 1.60 | 2120 |
| 1.61 - 1.84 | 1153 |

**Fig. 32. Histogram showing the vertical distribution of pottery in unit 1 at Atamora(measurement in grams)**




There was a marked difference between potteries recovered from surface collection and those recovered from actual excavation process. Analysis is focussed on the materials that were recovered from the dig. As limited part of the site have been excavated, it is not possible to give a fair estimate of the number represented at the various parts of the rock shelter. Analysis here is restricted to the description of various fabrics, shapes, size variants and decorative styles present.

Two principal fabrics were observed to be present in the pottery at the site. These include a relatively compact and fine sandy ware and a very coarse sandy grit with local material inclusions. The fine ware ranged from reddish brown to red in colour. Varied colours indicate marked difference in firing from in different categories. The red wares have dark interior, while the other have inner black surfaces or black layer on the inside.

Sherds belonging to the red ware were either burnished or slipped. In some cases, this combines with other decoration or a combination of rocker stamping, wrapped chevron of string or paddled roulette and various comb-stamping motifs. These decorations are in most cases restricted to the body with particular exceptions. An appraisal of the rim morphology of semi-complete sherds enabled us to break them down into functional types including mugs, urns, bowls, pots and storage wares of varied dimensions (see Fig. 36a b c).

The dominant and most significant category is a unique mug tradition, which is so far peculiar to the site. This phenomenon has not been investigated elsewhere in the study area. This is accompanied by varied and numerous terra cotta objects. The most important variants within this tradition include the following subtypes of mugs with:

- i) tripod stands at the base
- ii) single pointed bell-like handle at the base
- iii) combination of numerous decorations with a bell-like handle at the base
- iv) semblance of human head as base.

Various roulette motifs deriving from twisted cords were evident on some of the pottery categories particularly among the larger vessels including storage pots and bowls. Multiple incised motifs were employed in the patterns observed in the mugs to produce chevron patterns at the base of the clay-mugs (see Fig. 36a). Relief decorations including bossing were extensively employed to decorate some of these mugs. These were noticeable in the few handles recovered which in some cases gave the base of some of these cups an impression of a platted human heads or beaded crowns (Fig. 36a). These clay-cups have thick sections but the bodies are plain with the exception of few that were painted. The bases of these mugs remain the most elaborately decorated in which bossing technique was extensively used in combination with numerous wavy incisions to give a chevron pattern.

The appearance of this unique ceramic tradition is very significant in that it exhibits a unique techniques and manufacture style absent elsewhere in the study area as far as present state of investigation suggests. Technique exhibits a wide variety of styles, they have a rim diameter of 8cm and height of 11cm on the average. This tradition combines sculpture obtained by moulding and a coiling based pottery manufacture technique. It was based on clay medium with gravel inclusions, which were either used as temper to consolidate the clay or accidentally incorporated in the course of clay mixing. All the mugs placed in this category of artefacts from Atamora have a sub-cylindrical body profile. The bases varied from cylindrical to pointed handle-like projection, which gave some of them a bell shape. This represents distinct regional or localised tradition which does not conform to the types illustrated by Fatunsin (1992), but conforms to an extent with those considered by Eluyemi (1976) within the Ife classical art complex and those, which he described within the highly stylized complex that he named the Egbejoda. Even though the terra cottas from Atamora show high level of stylistic finesse in its execution, there is a wide gulf separating it from the naturalistic art of Ife. The Atamora material exhibit a high level of abstraction not seen at Ife but displayed a varied facet of life with semblance to Esie sculptures which were based on soapstone. It however, differs from the

Egbejoda materials, which are by comparison rather crudely executed without much finesse in their finishing. These dissimilarities should not be interpreted against the fact that they served different purposes in the various societies, given the fact that functionality within different culture may determine styles just in the same way an artefact may determine functions. Unlike the two traditions mentioned in the foregoing, the materials from Atamora does not emphasize human objects, it concentrates however, on mugs, which have varied bases and handles. The sculptural emphasis was on the base of the object, which varied from a flat cylindrical base to a single tapering handle at the base. This gives an impression that the cups are always placed upside down with base facing upward to protect these delicately decorated bases. There are also those, which are on tripods.

Although many of the terra cotta objects were crushed to pieces due to several factors, including natural and cultural factors, the nature of materials suggests some form of rituals in the rock shelter at some point in time in the past. The site could well have served as a shrine although there were no signs of special arrangements of objects of ritual observance to suggest this, as were the case at Ife. The haphazard distribution of materials in the site could be because they were in their secondary positions as the site was heavily disturbed.

There was strong enough reason to support the proposition that the pottery at the rock shelter outside those introduced by recent ritual activities belongs to two level of occupation at the site as far as pottery utilisation is concerned.

It is quite possible that the site was at some point in time a place of worship where ritual objects including these terra cottas were kept and worshipped and at some point a place of pottery manufacture and storage. It has been suggested by Fagg & Willet(1960); Eluyemi 1976), that the terra cottas found at Ife 'represent royal or chiefly personages' another opinion (Eyo 1970) was of the view that they were not only used as sacred furnishing, but are objects associated with royalty. On the basis of this and observations made at the Egbejoda site, Eluyemi associated these terra cotta Fig.s with the observance of a certain cult at the site. It should be noted that these interpretations were based on both ethnographic and archaeological observation on the nature and distribution of materials within the sites in question that is at Ife and at Egbejoda.

Although materials have no unique arrangement that suggests ritual activities like those in above cited examples, there is strong reason to suggest similar function for them. It has become apparent from ethnographic observations (Fatunsi 1992) that these materials are similar to modern ritual objects based on metal and not clay, which are widely used and kept in sacred places of worship by the Ogboni cult in Yorubaland.

**Metal and Bead**

The non-lithic materials also include a few metal objects. These were poorly preserved, and in most cases substantially rusted. They were recovered from the top subsurface soil in Unit 1 and from the middle layer in unit 2 where there was considerable mixing in the deposit. The diagnostic piece includes an arrow or spear tip that is heavily rusted (Plate 11). Others were unidentifiable. In all there were eleven metal objects recovered in the excavation. Only the most important of these objects were illustrated and described here.

Such metal objects were recovered from the top soil in unit 1, while only one such object was recovered from the underlying deposit. Other metal objects were recovered from the underlying deposit in unit 2. They include two variants of a kind which looks like a pointed implement. The better-preserved one is 72 mm long, 30mm in width and 4mm thick, while the other one is 98mm long, 20mm in width and 4mm thick. The first has a foliate shape with thin edges terminating in a narrow convergent tip, with thickness gradually increasing towards the opposite end (Plate 10.). This could well pass for the tip of an arrow or a spear point. The other objects from this level are two iron sheet fragments, not well preserved, broken and possibly pass for part of implement, a knife perhaps. An addition to this includes a much-rusted curved iron rod, the purpose for which could not be easily discerned.

A metal fragment however, stands out among those recovered from the rock shelter. It is a spirally metal piece for which no particular function can be immediately associated.

The bead (Plate 10) was a singular find consisting of either quartz or resinous material. This was grinded into a cylindrical shape with both ends flattened and drilled at the centre. Its maximum dimension is 10mm with a cross-section of just about 3mm.

## 4.2. Organic materials

Nuts from two principal plants palm tree (*Eleis guinensis*) and Melina were recovered from the excavation. These are mostly associated with the burrowing activities of the giant African rat (*Cricetomys emini)* which are very abundant in the vicinity of the rock shelter. This singular fact made them unsuitable for obtaining chronometric dates of reliable significance.

Other than this cowry shells, shells belonging to the giant African snail *(Achantina sp)* were recovered. Charcoal was recovered in very minute quantity across unit 1 and 2. This supports and lends credence to the proposition that pottery was probably manufactured, fired and utilised at the rock shelter.

### 4.3. Lithology

Lithology involves the study and description of the gross physical characteristics that defines a particular rock, including colour, texture, mineral composition, and grain size. Going by this definition it is obvious that it has not been adequately applied in the characterisation of the lithic assemblage in archaeological investigation in West Africa. The relevance of this to archaeological investigation can not be quantified as it provides substantial information on the ecological situations that characterized the deposition environment of artefacts. It also informs on the natural and cultural processes that shaped a site .

**Grain Shapes**

Roundness and flatness of particle shape is a significant indicator of depositional environment, stratigraphic horizons and certain palaeoclimatic conditions. They are also useful in distinguishing pebbles that belong to different populations and in determining the rate of downslope movement of sediments.

Geological meaning and interpretation of graphic statistics such as means size parameter reflects the average size of sediments and is influenced by the source of sediments, the agents and environment of deposition. Historical geomorphologists have for a long time used palaeosols and duricrusts as environmental indicators

The size of sediment particles can be measured by visual estimation or by use of a set of sieves. Experienced geologists can visually measure grain size within accuracy of the Wentworth grade scale at least down to silt grade. Silt and clay can be differentiated by whether they are crunchy or plastic between one's teeth. Claystones and siltstones cannot be subjected to size analysis from an optical microscope. Their particle size can be measured individually by electron microscopic analysis. Boulder, cobbles, and gravel are best measured manually with a tape measure or ruler.

Sands are in most cases measured by sieving. The underlying principle of this technique involves passing soil sample of known weight through a set of sieves of known mesh sizes. These sieves are arranged in downward decreasing mesh diameters. The set of sieves are mechanically vibrated for a fixed period of time. The weight of sediment retained on each sieve is measured and converted into a percentage of the total sediment sample. This method is quick and sufficiently accurate for most purposes as it measures the maximum diameter of a sediment grain. This method is useful in analysis of terrigenous sediment.

Both graphic and statistical methods of data presentation have been developed for the interpretation of sieve data. The percentage of the samples in each class can be shown graphically in bar charts or histogram. Another method of graphic display is the cumulative curve or cumulative arithmetic curve. Cumulative curves are extremely useful because many sample curves can be plotted on the same graph and differences in sorting are at once apparent. The closer a curve approaches the vertical the better sorted it is, as a major percentage of sediment occurs in one class. Significant percentages of coarse and fine end-members show up as horizontal limbs at the ends of the curve.

Sorting can be expressed by various statistical methods. The simplest of these is the measurement of the central tendency of which there are three commonly used parameters: the median, the mode, and the mean. The median grain size is that which separates 50% of the sample from the other; the median is the 50 percentile. The mode is the largest class interval.

The mean is variously defined, but a common formula is the average of the 25 and 75 percentile.

A second aspect of sieve analysis is its sorting or the measure of degree of scatter. Sorting is the tendency for the grains to all is of one class of grain size. Several formulae have been used to define this parameter for a sample.

A third property of a grain size frequency curve is termed "kurtosis" or the degree of "peakedness". Curves which are more peaked than the normal distribution curve are termed "leptokurtic"; those which are saggier than the normal are said to be 'platykurtic'.

The fourth property of a sieve analysis is its skewness, or degree of lop-sidedness. Samples weighted towards the coarse end-member are said to be positively skewed (lop-sided toward the negative phi values), samples weighted towards the fine end are said to be negatively skewed (lop-sided toward the positive phi values).

To sum up, the four statistical measurements for sieved samples consist of:

i.) a measure of central tendency (including mean, median, and mode);

ii.) a measure of the degree of scatter or sorting;

iii.) kurtosis, the degree of peakedness; and

iv.) skewness, the lop-sidedness of the curve.

Various formulae have been defined for these parameters. The set of formulae used in this work is that by Folk and Ward's (1957).

In applied geology, accurate sieve analyses are used for petrophysical studies which relate sand texture to porosity and permeability. The distribution of sediment for water wells for example requires a detailed knowledge of the sediment of aquifers. Its application in the field of archaeology is invaluable particularly in the aspects relating to environmental reconstruction. Sieve analysis data can be used as an interpretive tool to determine the depositional environment of ancient sediments and by implication cultural landscape. The philosophy behind this approach is that modern environments shaped the distribution of sediment and these differences can be quantitatively distinguished. Thus, by comparing the sieve analysis data from modern depositional environments with samples from the geologic past, the depositional environment for these ancient samples can be determined.

In most research on sediments, grain-size data is expressed in phi (f) intervals rather than in microns, millimetres, or inches. One phi unit is equal to one Udden-Wentworth grade. Phi diameter is computed by taking the negative log of the diameter in millimetres. Statistical computations and graphic presentations are much simpler when phi diameters are used.

### 4.3.1. Sequence of deposits and description of generalised section

The procedure of sediment sample analysis and findings are presented in this section. The parameters for the analysis include soil samples taken from different layers identified in the course of excavations at Atamora rock shelter. The samples include a set of samples taken from Unit 1, specifically from squares: 173, 193 and 213 from the longitudinal probe on the eastern section of the pavilion); Unit 2, in squares 226 and 227 at the western reach of the shelter near the point of contact of the major overhang with the floor. Further samples were obtained from Unit 3 (Square 66 from the backfill outside the rock shelter); and, Unit 4 (Squares 260 and 280) underneath the minor chamber by the corridor leading to the northern extremity of the rock shelter (Fig. 11). Samples were analysed in different laboratories in Nigeria and Germany. Mechanical/particle size analysis was carried out at the Geoarchaeological Laboratory at the University of Ibadan, while mineralogical analysis was carried out in the Institute of Prehistory and Quaternary Ecology in Tuebingen, Germany.

**Analytical Methods**

Mechanical/particle size analysis was aimed mainly at establishing the pattern particle-size distribution and variations in the different layers. The intention is to establish the relative proportion of sand silt and clay fractions in the number of samples collected for laboratory analysis. Mineralogical analysis involved the use of Nexus filter spectrometer at the Institute of Prehistory and Quaternary Ecology, University of Tuebingen, Germany with the assistance of Dr. Schiegle who kindly permitted the use of her laboratory at the Institute. Results of these analyses are highlighted in appendix II.

**Mechanical Particle-size Analysis**

This was designed to quantitatively determine the relative proportions of sand, silt and clay in the soil as an objective approach in the quantification and description of individual sample from different stratigraphic level. The purpose of such an analysis is to establish the depositional environments that characterize the deposition of the sediment.

Procedure is in twofold including: mechanical analysis involves the sieving of loose materials like sand and gravel; and sedimentation test on more cohesive clays and silt that involved pipette sampling and hydrometer methods. The two methods were merged in this operation to obtain a complete particle size differentiation of each sediment sample. The samples were first dry-sieved to determine the various grade of sandy fraction (2800 to 63 microns), and the pipette method was used to separate grain fraction of the samples into coarse silt, fine silt and clay categories.

The samples (weighing 40g each) were first washed in acetic acid to remove the carbonates, foster the oxidation process that follows and minimize possibility of weathered mica being exfoliated by hydrogen peroxide. Since the samples were not calcareous, they were soaked in acid for twelve hours after which they were transferred into centrifuge tubes with specified amount of acid added. The mixtures were vigorously shaken on a reciprocal shaker to dislodge the carbonates therein. The mixtures were thereafter centrifuged to allow the particles to settle.

Following on the above step, the soil samples were subjected to thorough heating using hydrogen peroxide ($H_2O_2$) in an oven to promote oxidation i.e. the removal of any organic matter.

The next step involves the dispersion and fractionation of samples into individual grains using 0.1% sodium Hexa-meta phosphate (Calgon) solution. Thereafter, the dried samples were weighed with an electronic weighing scale.

The collected samples were then sieved through a nest of sieves of meshes 2,800, 2000, 1400, 1000, 710, 500, 355, 250, 180, 125, 90 and 63 microns arranged in a descending order with a receiver pan at the base. The sieve nest was placed on top of a Ro-Tap shaker and the samples were poured in successions into the topmost sieve, which is covered with a lid. The timer on the shaker was set at 20 minutes intervals. The shaking automatically stops at the end of 20 minutes. The sediment fraction in each sieve were then collected and weighed individually.

The pipette method was employed to determine the grain-size of the fraction less than 63µ collected in the receiving pan at the base of the sieves. Though laborious and time-consuming, this method is apparently the most accurate method in particle size analysis. The process involved pipette sampling of the finer soil fractions (i.e. clay and silt) at a standard depth of 10cm from a 1000ml. cylinder at specified times according to the temperature of the suspension (see Folk and Ward 1957). The clay and silt fraction weighing less than 63µ from each sample was transferred into a 200ml. centrifuge bottle and an N/2 acetic acid was added. The bottle was then placed on a reciprocal shaker to dissolve the carbonates. The suspension was centrifuged to allow the particle to settle. After discarding the supernatant liquid, distilled water was added to the sample in the centrifuge tube while the bottle was shaken to dispersal point on a reciprocal shaker in order to wash the soil clean of the acid and the dissolved soluble salts. The sample was then transferred into a 1000ml. beaker and .20ml. Hydrogen peroxide was added. The beaker was then placed in an oven at a specified temperature and more $H_2O_2$ added until frothing ceased. After a complete evaporation of the $H_2O_2$ the sample was then transferred into a 200ml. centrifuge bottle, distilled water is then added and the bottle is shaken with a reciprocal shaker in order to wash away the $H_2O_2$ and the oxidized matter. 0.1% calgon, $_{pH}$ was added and solution shaken overnight on a reciprocal shaker to disperse the soil particles. The solution was then transferred into a 1000ml. graduated measuring cylinder and stood on a water bath at a constant temperature of 25° C and the respective weights of coarse and fine silt and clay is determined in the steps below:

**i.) Weight of coarse and fine silt and clay**

The suspension was stirred vigorously, and then allowed to settle for 4 minutes, fifteen seconds at a temperature of 25°. The pipette was then lowered into the solution to a depth of 10cm and a 25ml. sample withdrawn. The withdrawn sample was transferred to a weighing crucible and oven-dried at a temperature of 105° C. Upon drying the combined weight of the sample and crucible was determined. The difference in weight (i.e. wt soil + crucible – wt of crucible) is equal to $^{1}/_{40}{}^{th}$ (25ml. sample from 1000ml. suspension) of the weight of the coarse and fine silt and clay in the original sediment sample (Folk and Ward 1957).

**ii.) Weight of coarse silt**

After the first sample was taken at 4 minute, 15 seconds, the suspension was immediately stirred vigorously and allowed to settle for 47 minutes 20 seconds at 25°C after which another 25ml. sample was taken at the same 10cm depth and treated in similar manner as the first one to determine the weight of the coarse silt sample.

**iii.) Weight of fine silt and clay**

To obtain the weight of the fine silt and clay, the sample after vigorous shaking was allowed to settle for 7hours 6minutes at 25° and subjected to similar treatment as for the two previous samples, in order to obtain the weight of fine silt and clay in the sample.

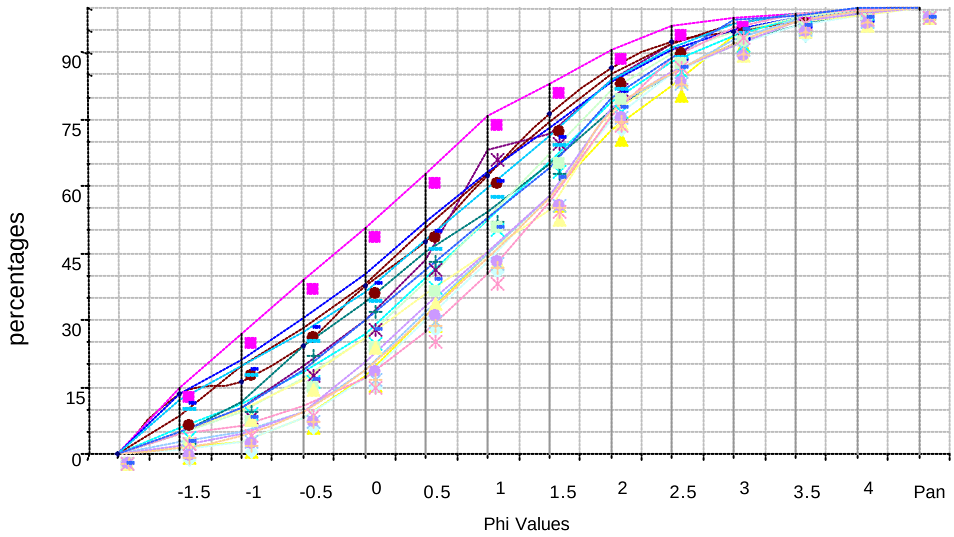
The individual weight in grams of coarse and fine silt and clay in all the soil samples were expressed as individual percentage and cumulative percentage weights of the total (Appendix I). To obtain the required parameters for effective description of the samples, the result was plotted out on arithmetic probability paper. These values of significant percentage of coarser Figs. ($5^{th}$, $16^{th}$, $25^{th}$, $50^{th}$, $75^{th}$, $84^{th}$, and $95^{th}$ % coarse figures) required for statistical analysis of the sediments were read directly from the graphs in microns and subsequently converted from micron units into phi units (see Table 4.3.1.1).

$Q_1$ include 25% of the sample larger than this value, MD include the fraction of the samples larger than 50% and $Q_3$ include fraction of the samples larger than 75%.

**Table 4.3.1.1 Phi Values from the plot of cumulative percent data on the probability graph**

| **%** | **66-01** | **66-76** | **173-30** | **173-399** | **173-533** | **233-136** | **233-320** | **233-467** | **253-2** | **253-566** | **253-655** | **253-893** | **227-2** | **233-44** | **227-153** | **227-196** | **280-01** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | -1.75 | -1.76 | -0.75 | -1.60 | -1.50 | -1.69 | -1.50 | -1.76 | -1.76 | -0.75 | -1.50 | -1.50 | -1.00 | -1.48 | -0.80 | -0.85 | -1.50 |
| 16 | -0.95 | -1.45 | -0.15 | -0.65 | -0.73 | -1.24 | -0.80 | -1.26 | -1.25 | 0.00 | -0.65 | -0.50 | -0.24 | -0.03 | -0.24 | -0.24 | -0.73 |
| 25 | -0.50 | -1.10 | 0.25 | -0.65 | -0.25 | -0.80 | -0.49 | -0.75 | -0.24 | 0.26 | -0.05 | -0.20 | 0.25 | 0.85 | 0.20 | 0.24 | -0.24 |
| 50 | 0.51 | -0.10 | 1.24 | 0.80 | 0.65 | 0.50 | 1.00 | 0.30 | 0.60 | 1.25 | 0.90 | 1.25 | 1.24 | 1.62 | 1.40 | 1.25 | 0.85 |
| 75 | 1.60 | 1.00 | 2.12 | 1.77 | 1.15 | 1.50 | 1.80 | 1.59 | 1.80 | 2.00 | 1.75 | 1.80 | 1.76 | 2.00 | 1.85 | 1.85 | 1.76 |
| 84 | 1.85 | 1.56 | 2.60 | 2.26 | 2.10 | 2.00 | 2.50 | 2.15 | 2.10 | 2.50 | 2.20 | 2.42 | 2.49 | 2.27 | 2.40 | 2.50 | 2.25 |
| 95 | 3.00 | 2.28 | 3.20 | 3.15 | 2.76 | 2.52 | 3.30 | 3.00 | 3.00 | 3.35 | 3.10 | 3.26 | 3.24 | 2.85 | 3.27 | 3.50 | 2.76 |

Figure 33. Cummulative arithmetic Curve for soil samples from Atamora




These values are used in each sample to determine the following statistical parameters:

i.) Sorting coefficient:

$$M = \frac{j16 + j50 + j84}{3}$$

The 5th, 16th, 84th and 95th percentile values (in phi) for each sediment sample were determined from the respective cumulative percentage graphs and the values obtained were then used to calculate:

(ii) the inclusive Graphic Standard Deviation (which is the measure of the degree of sorting) given as:

$$D = \frac{j84 - j16}{4} = \frac{j95 - j5}{6.6}$$

(iii.) the Inclusive Graphic Skewness (Ski) which is denoted as:

$$S = \frac{j84 + j16 - j50}{2(j84 - j16)} + \frac{j95 + j5.2(j50)}{2(j95 - j5)}$$

(iv.) the Graphic kurtosis (kg) which is given as:

$$K = \frac{j95 + j5}{2.44(j75 - j25)}$$

These four values defined the character of sediment in terms of size distribution of the particles with regard to provenience, depositional and post-depositional environments.

**Table 4.3.1.2. Size distribution characteristics of sediment samples from Atamora**

| Provenience | | Mean(M) | Standard deviation (D) | Skewness(S) | Kurtosis (K) |
|---|---|---|---|---|---|
| 66-01 | -1.00m | .47 | 1.41 | 0.02 | 0.24 |
| 66-76 | -1.14m | .003 | 1.25 | 0.13 | 0.79 |
| 173-30 | -1.49m | 1.03 | 1.45 | 0.90 | 0.87 |
| 173-399 | -1.63m | .80 | 1.45 | 0.54 | 2.12 |
| 173-533 | -1.69m | .67 | 1.35 | 0.41 | 0.90 |
| 233-136 | -1.26m | 0.42 | 1.45 | -0.66 | 0.15 |
| 233-320 | -1.41m | 0.9 | 1.55 | -0.11 | 0.56 |
| 233-467 | -1.58m | 0.4 | 1.57 | 0.57 | 0.22 |
| 253-2 | -1.46m | 0.48 | 1.56 | -0.05 | 0.25 |
| 253-566 | -1.42m | 1.25 | 1.25 | -0.05 | 0.61 |
| 253-655 | -1.25m | 1.23 | 1.88 | -0.01 | 0.36 |
| 253-893 | -1.58m | 1.06 | 1.45 | -0.50 | 0.36 |
| 227-2 | -1.06m | 1.16 | 1.32 | -0.21 | 0.61 |
| 233-44 | -1.15m | 1.29 | 1.23 | -0.45 | 0.20 |
| 227-153 | -1.38m | 1.62 | 1.28 | -0.16 | 0.49 |
| 227-196 | -1.57m | 1.17 | 1.34 | -0.14 | 0.52 |
| 280-01 | -.55m | 1.18 | 1.02 | -0.08 | 0.34 |

**Figure 34a. Composite Histogram on data from Unit 3-01 & 76**

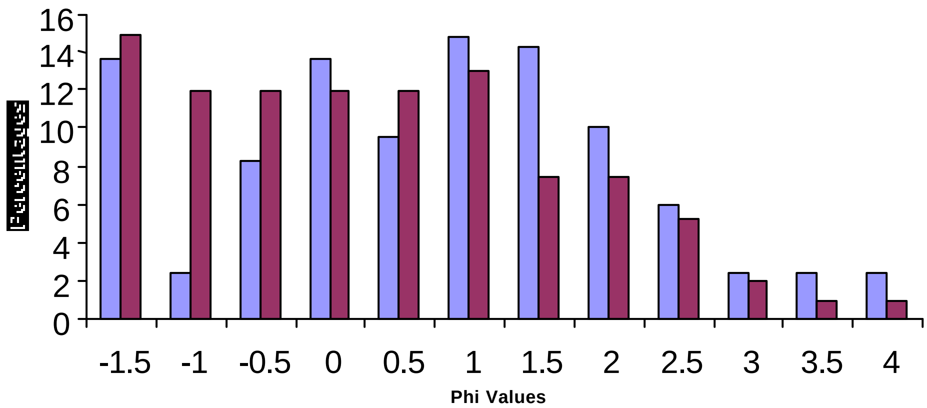
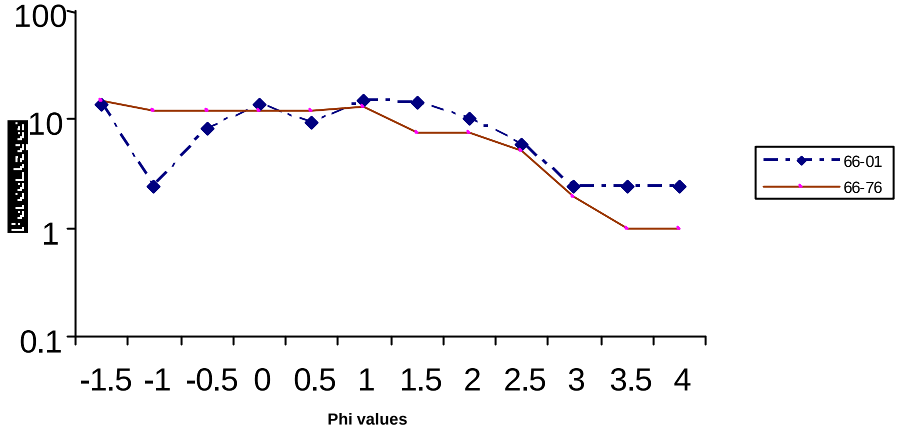
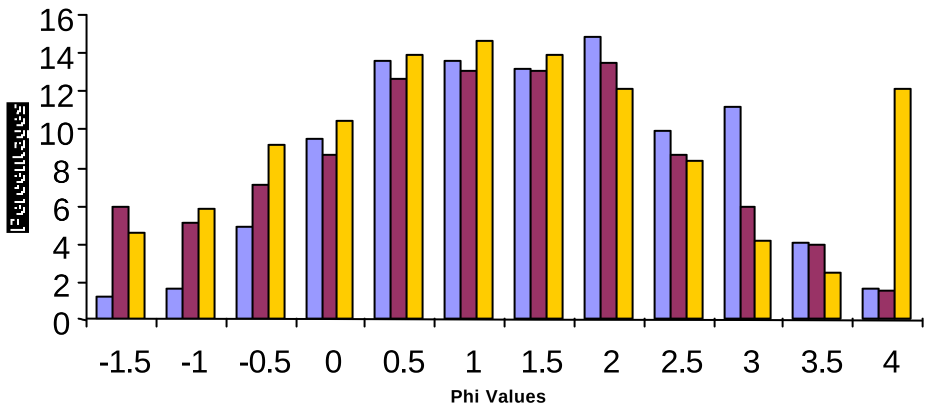


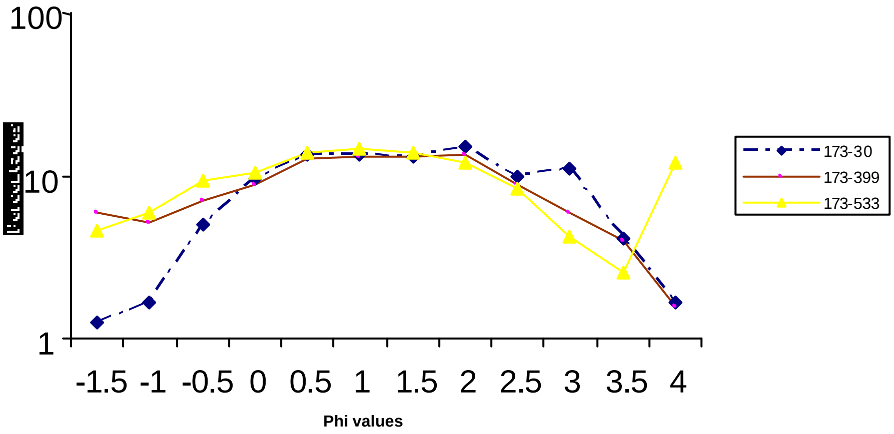
**Figure 34b. Frequency Curve on data from Unit 3 - 66/01, 76**

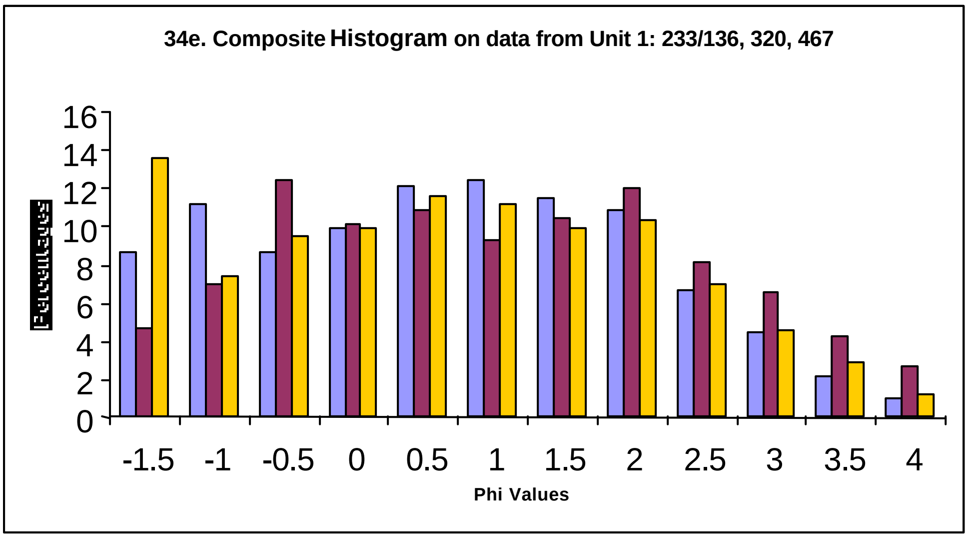



**34c. Composite Histogram on data from Unit 1: 173/30, 399, 533**



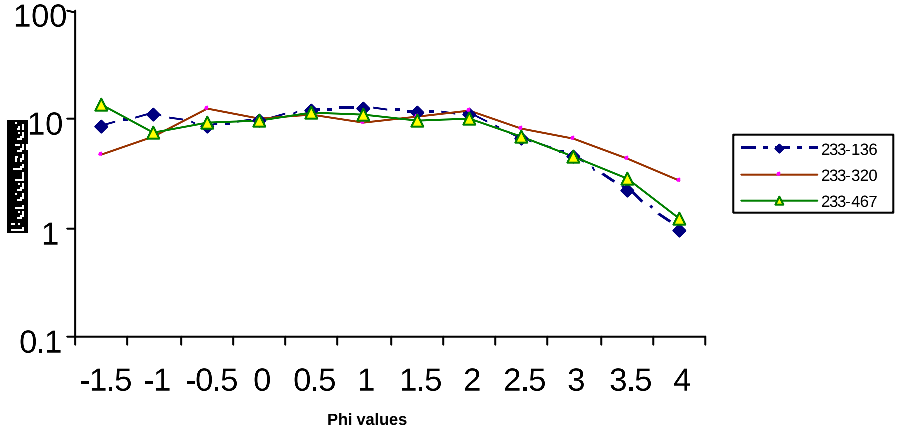
**34d. Frequency Curve on data from Unit 1 -173/30, 399, 533**



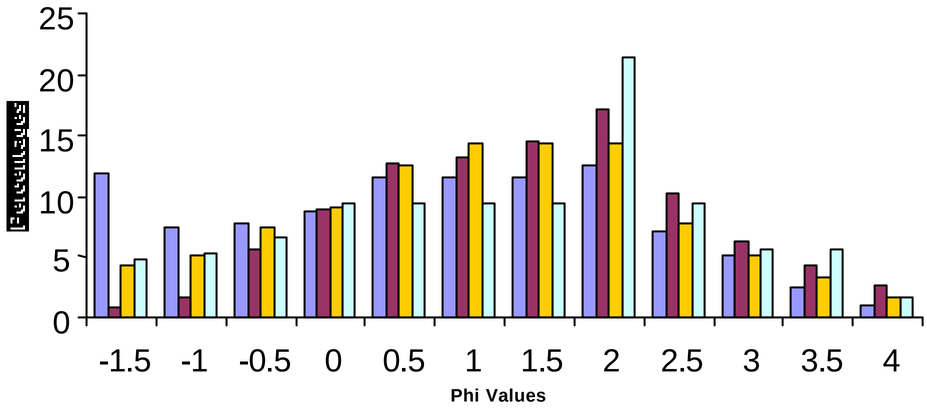




**34e. Composite Histogram on data from Unit 1: 233/136, 320, 467**

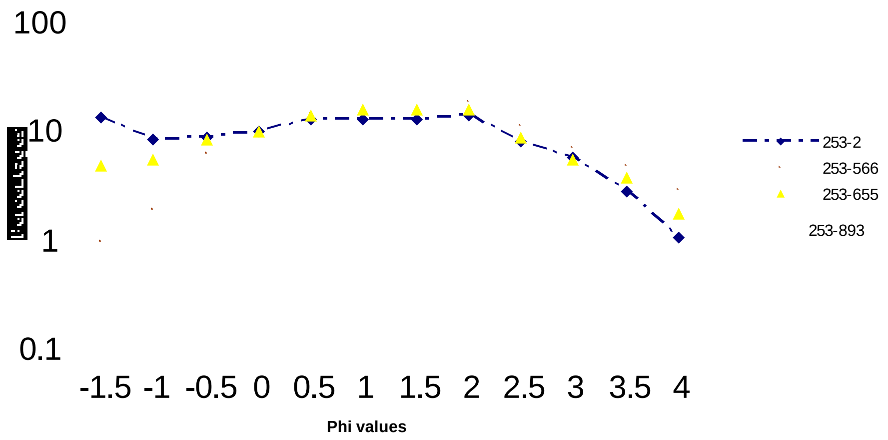
**3f. Frequency Curve on data from Unit 1 -233/136, 320, 467**



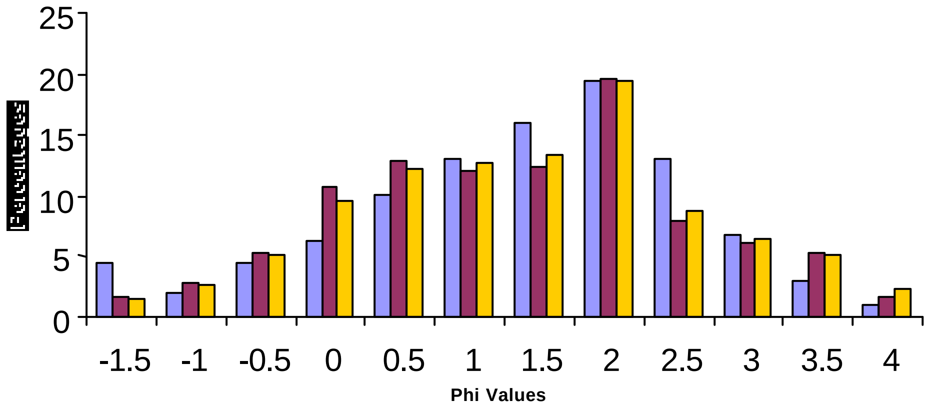

**34g. Composite Histogram on data from Unit 1: 253/2, 566, 655, 893**



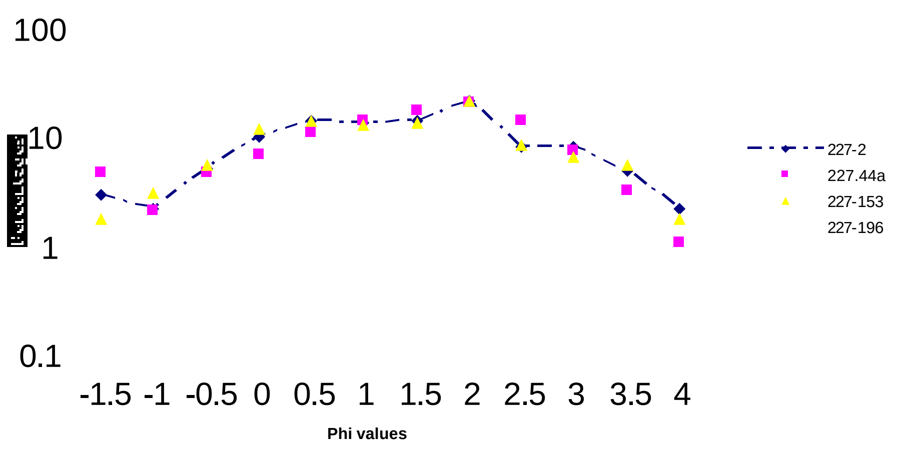
35h. Frequency Curve on data from Unit 1 -253/2, 566, 655, 893



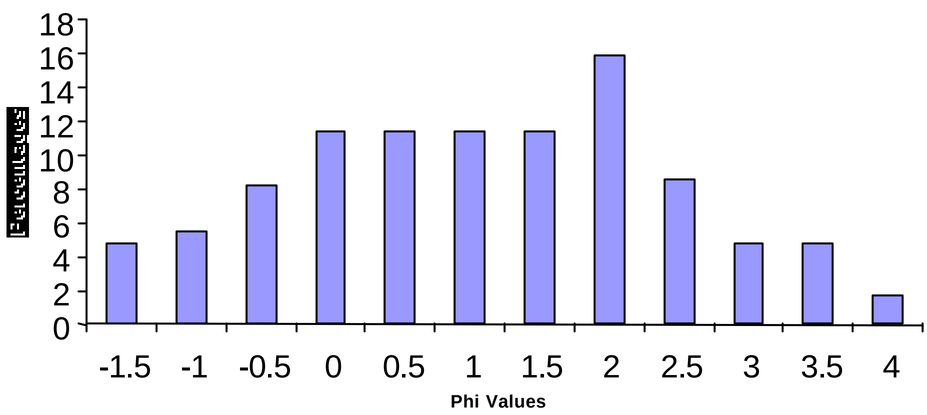

34i. Composite Histogram on data from Unit 2: 227/2, 44a, 153



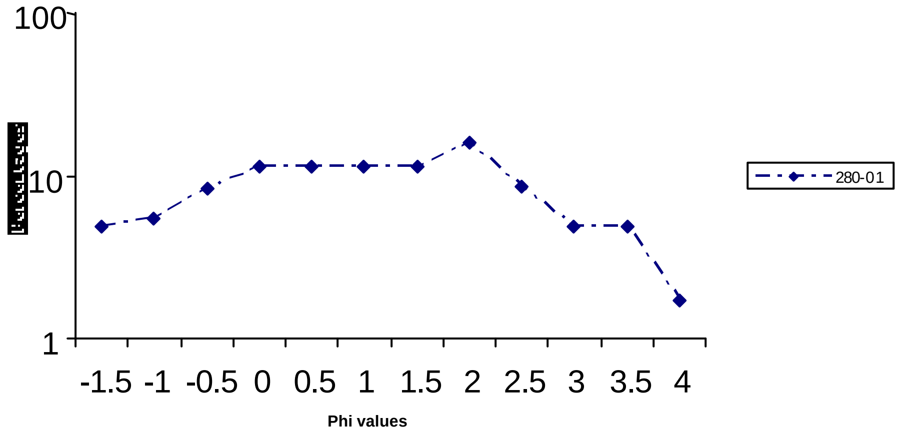
**35j. Frequency Curve on data from Unit 2- 227/2, 44a, 153, 196**




**34k. Composite Histogram on data from Unit 4: 280/01**



**35l. Frequency Curve on data from Unit 4/01:280/01**




The cumulative percentage and histogram plots for the samples from Atamora revealed the following among other information on the nature of the deposit. Firstly, virtually all the identified stratigraphic layers are similar in terms of particle size distributions showing progressive degree of coarseness from coarse sand to medium sand in ascending stratigraphic succession; secondly, the cumulative percentage probability plots for the four excavated units show one major curvature pattern. The composite cumulative histogram for the entire units show some level of progressive increase in coarseness in ascending order even though such gradation appears to be gradual and less obvious. This point is corroborated in arithmetic probability plots (Fig. 33) which is closely packed with a lot of overlaps between individual unit plots.

The general distribution of the soil across the stratigraphy shows a unimodality in both the composite cumulative histogram and, cumulative frequency plots (Fig.s: 34a–34f & 35a-35f), suggesting that the sediment sequence were formed under one major set of conditions. Furthermore, the major factors of sedimentation were probably pronounced temperature differences within the rock shelter that could have caused flaking of big chunks and occasionally large boulder from the overhang. This is followed by extensive physico-chemical weathering of these chunks into finer sand and silt particles due to capillary action of water.

Units 1& 2 at the western section of the pavilion near the run-off appears to have undergone greater degree of weathering and physico-chemical alterations which explains the slight variations exhibited by the dominance of medium sand. At unit 3, result of thermal activities seems to be getting relatively more pronounced and chemical weathering less pronounced as evidenced by the overall increase in coarseness of the particles in ascending stratigraphic order. The rate of accumulation also appears to have been faster in units 1&2, probably indicating a more pronounced physico-chemical weathering and human activities in this section of the site.

Some of the samples from the rock shelter are negatively skewed going by the result of the cumulative probability curve. This indicate the inclusion of a substantial quantity of silt and suggesting that some of the sediments have been subjected to abrasive and winnowing effects as a result of gravity, wind and run-off, which have substantially modified the physical character particularly their texture.

Sorting coefficient could not be determined for some of the samples as their lower quartile values are indeterminate and this equally applies to some of the kurtosis.

In line with the objective of this work to characterise the nature of prehistoric occupations at Atamora rock shelter, the mineralogical analysis of sediment sample was directed to resolve a major issue at the on-site level. It was intended principally to delineate the different stratigraphic layers present in the site in order to place the recovered artefactual material within delineable geological horizons. To this end result of infra-red spectrometry on selected samples from the various identified strata show a high degree of uniformity in the mineral composition in the broad spectrum of these samples with few variations. Thus, a combination of methods only suggests a very slight variation in the deposition forming processes. The deposit was very probably formed under stable low energy environment. Leaching is quite high. Rapid erosion of the top soil was intensified when the vegetation around the rock shelter was open up by human deforestation activities. Kaoline and illite appears to be dominant mineral (Appendix I).

## Chapter Five

### 5. Historical Reconstruction

Both natural and cultural stratigraphy suggests some degree of fit between the sequences at Atamora and that of Iwo Eleru. As indicated, the lower level stone industry at Atamora (AH I which is very well represented in layer 3) appears to have chronological and cultural affinities with the flake industry found elsewhere in another rock shelter Iwo-Eleru. Both are microlithic based industries with a more or less similar range of artefacts. The industry here appears to have occurred at the same relative time period as that of Iwo Eleru which occurs in the lower section of granular reddish brown sand whose upper section has some gravel cap. The industry at Atamora although mixed, due to reworking of the deposit appears to belong to the same kind of reddish brown sand. Although, the upper gravely capping was heavily eroded in many parts at the site. This is probably why microlith artefacts are recoverable from all over the site where there was not enough resistance from active wind activity and actions of other remixing agents. This deposit is however more complete in unit 3 which has a relatively complete stratigraphic sequence.

The dark brown soil (Layer 2) which disconformably overlies the yellowish brown sand (Layer 3) at Atamora contains the Neolithic industry AH II. It apparently fits into the transition zone into the Neolithic phase identified at the site, when huge granitic boulders or slabs were brought into the site and used as grinding stones either for the retooling of ground adzes/axes or for the processing of grain. Both scenarios are likely the case as obvious association of celts and mullers seems to suggest both retooling and milling activities at the same time using the same facility. Neolithic is here construed as a phase which is characterized by deliberate activities including cultivation of plants and domestication of animals. This is a period when humans actually settled in a home-base as opposed to seasonal migration following seasonal changes occasioned in this part by the north-south movements of the ITD. Culturally, this is represented in the archaeological record by the increasing presence household items such as storage facilities e.g. pottery for storing grain, water and for processing of food. Presence of metals is indicative of intensive exploitation of land resources; ground stone axe, grinding stones and mullers for milling of grains are just the few examples of characteristic artefacts. This is a phase which probably preceded the urban settlements in the study area in particular and the forest environment in general.

Although there were no direct dates for the deposits as at yet, correlation with the nearby site of Iwo Eleru, seems to suggest a relationship with some level of confidence at least, given the nature of material recovered from the site. Ground stone axes/adzes are in direct association with archaic pottery that do not belong to any known historic pottery tradition. A correlation with the initial phase of Neolithic industry seems to be apparent. Cultural development pertaining to the inception of food production and sedentary life is at best rudimentary and seems to precede the emergence of forest states and kingdoms in the entire region included in the forest zone of Southwest Nigeria.

A third phase of human occupation at the site (AH III in Layer 1) suggests the emergence of a very elaborate pottery using society. This is very much obvious from the numerous forms and styles which, also suggest the existence of an institutionalised and elaborate ritually based social system which utilised pottery either as a means for social differentiation or stratification within a well organised society. The other apparent interpretation to this particular pottery tradition points to a cultist people, which used the rock shelter as an abode for their worship. Modern pottery tradition as observed at the site can be associated on the one hand with the activities of farmers who utilised the rock shelter as a rest place and for shelter against weather elements in the course of their day-to-day activities in the neighbourhood. On the other hand, it may be traced to the activities of those who went regularly to the rock shelter for ritual and religious purposes. The oral mythology of the present inhabitants of the Iwata, a town located nearby deitified the rock shelter in series of magical myths woven around the rock shelter.

Quartz and quartzite was predominantly utilised in the lithic industry at Atamora AHI, ( to a great extent). There was minimal albeit infrequent occurrence of chalcedony. In contrast calcites was utilised at AH II along with charnokites and black marble in the production of ground stone adzes/axes industry which, replaced the microlithic industry at the lower level. Evidence is indicative of a higher reliance on macrolithic tools based on quartz and quartzite raw materials. Granite became very relevant as grinding for food or tool processing; stone and lateritic pans were brought into the rock shelter (where they were probably utilised as stands for fire places); retooling among other activities were carried out at the rock shelter at this phase. Evidence does not however, suggest an abrupt departure from microlithic industry. This may explain the peculiarity posed by the seemingly unconformable layer 2a which by all indications represented a darker variety of layer 2 but contains great quantity of debitage. At the lower occupational level, quartz is utilised exclusively ranking up to 92.4% against a meagre 7.4% for quartzite. Chalcedony, dolorite, and granite which were minimally present at the lower level became relatively pronounced at the upper occupational level (AH II), where they were employed in varied activities that were hitherto not relevant in the occupants' food procurement strategies. Several typological and morphological differences are noticeable between these two occupational levels suggesting they were not entirely related. There was observed differences for example in types and proportion of rocks used. This is more so when polished and ground stone tools are taken into consideration. These were noticeably present in AHII, but entirely absent in the lower level AHI. On the other hand, scrapers, chisels, prepared cores, blades, sectors, points etc. which employed quartz and chalcedony to a lesser extent became more important elements in AHI, making up to more than 70% of tools and artefacts recovered in the excavation. Obviously, morphological features which directly relate to the nature of raw material are the size of tools. Those at the latter phase of occupations are much heavier than those in the earlier phase that are predominantly microlithic based industry.

In attempted correlation, there is a great deal of similarity between artefacts from Atamora and those from Iwo Eleru on the one hand, while, there appears to be both spatial and temporal divergence when material from these two sites are compared with those from Ajibode. Materials from Ajibode display greater attributes that are directly associated with Early and Middle Stone Age industrial traditions. It contains particularly heavy tools. In contrast to the situationa at Ajibode and Iwo Eleru, there appears to be greater emphasis on lighter and composite tools which are adaptation to sedentary life style. The Ajibode site bears neither typological nor morphological similarities with those finds from Atamora. This rules out any technological relationship or similarity between the industries the industries at both sites. Given the present state of knowledge and indeed the present level of investigation at the sites the materials from Ajibode do not fit into any meaningfully classified Stone Age scheme short of evidence of Neolithic cultural phases typified by presence of rock hollows and grooves and a few ground stone axes found in purely secondary contexts near Ajaiye summit at Ajibode. That aside, the most important attribute of these is the apparent dominance of the irregular flaking element (67% at AHI), and the presence of the disc cores which involved the use of variety of the prepared core method at the lower level. Perhaps the fact that this latter feature appears to be much more marked at AHI (totals 25.6% of core elements) is also significant.

The industry at the uppermost phase of Atamora (AH III) which is made up of mostly pottery bears very close resemblance to the pottery elements in present day Yoruba society (Fatunsin, 1992). In the assemblage the wares are made of heavily tempered clay with quartz and feldspar inclusions. They include a few colour variants (black and dark red wares) and the decorative styles are mainly chevron roulette, bossing and matt impression, some varieties of comb stamping and incised punctuation. This is in contrast to the lower level in which there is significance absence of roulette and mat impressions although, macrolithic artefacts including hammerstones and grinding stones are present at this level. AH III unlike AHII beneath it did not contain any ground and polished tools. The absence of these cultural elements and the characteristic pottery industry belonging to AHII only suggests a partial correlation with modern relatively recent pottery tradition (Fatunsin, 1992). Although, the absence or low count of common household utensils such as storage and cooking wares, which are functional types that characterised modern pottery traditions in Southwest Nigeria including the study area, is significant in the interpretation of their function and morphology.

Even though both typological and technological features points to a possible cultural relationship between industrial phases at Atamora and the ones at Iwo-Eleru, this proposition can only be regarded as very tentative in the absence of precise dating. It is possible that the basal lithic levels at Atamora represent a Late Middle Stone Age occupation, while AHII &III, which are pottery levels, represent phases running up from the later Late Stone Age through to the Neolithic. This opinion is informed by the distinct break in the vertical sequence of artefact compositions in the Upper and lower levels as well as the internal character of the industries.

**Table 5.1. Delienable cultural phases at Atamora rock shelter**

| **Cultural Phases** | **Late MSA/LSA (AH I)** | **Neolithic Sedentary activities (AH II)** | **Historic Period: 1500-19900 (AH III)** |
|---|---|---|---|
| **Cultural Components** | **Microlith tools** | **Macrolithic tools** | **Cultural Elements** |
| | Backed Blade | Mullers | Grinding stones |
| | Segments | Grinding stones | Metals |
| | Knives | Ground stone axe | Pottery: red and Black wares; decorative styles: chevron roulette, bossing and matt impression, comb stamping and incised punctuation; ritual pottery |
| | Points | Rubbed stones | |
| | Burin | Pottery with no distinct decorations | |
| | Disc core | | |
| | Irregular flaking elements | | |
| **Raw Material Elements** | Quartz, Quartzite | Clay + inclusions, Granite, Quartz, Chalcedony, Graphite | Clay + Inclusion, Granite, Quartz, |
| **Comparative Chronology** | 12-3,000 BP | 3,000 – 1500 BP | 1500 - present |

### 5.1. Stratigraphy and chronology

History is viewed in this work from a very broad perspective that embraces not just the description of events and chronological relationships, but also the role of archaeology in a proffering a better understanding of Nigeria's history in terms of the major timeframe, technological developments such as the Stone, Ceramics and Metal Ages which, reflect stages in technological advancements from the most ancient to more recent time as well as the quantity and complexity of remains are relevant in this respect.

Little is known about the Stone Age history of the people and societies in Nigeria due to the fact that little more than stone artefacts are available for study. Although, findings from sites such as Iwo-Eleru in Western Nigeria and Ishango in Central Africa recognized Negroid as the oldest known physical type in West Africa and dating back to Late Pleistocene. It is not improbable that this could well be a local variant of *Homo sapiens*. There is however, little evidence to complement this.

The bioclimatic regions in West Africa's vegetation zones are perhaps the most important consideration in this research which in the author's opinion constitute a major source of problems in West African prehistory because of peculiar environmental context in which lithic artefacts are found.

The environmental setting of West Africa and the study area during the quaternary with particular regards to the geomorphology is by far the most problematic. This singular fact had led to many hypothesis and speculations. The other bothers on aspects of human existence during the various time frames. Of particular relevance are issues that bother on when where and what kind of activities took place and what are being done in an attempt to identify the patterns in space and time of cultural, ethnic or physical manifestations of human populations, distributions and sizes, ranges, activities, nature of environments inhabited and resources which were utilized and modified. Related to this aspect are issues bothering on how and why things were done and processes by which patterns relating to human history are perpetuated and changed.

The above issues stem from the fact that anthropologists and archaeologists alike, working in West Africa have either explicitly or implicitly concerned themselves with the same set of problems namely: dynamics and processes of cultural change in the region through space and time from both natural, physical and cultural perspectives. The pioneer workers were not too successful in identifying specifically insular processes of cultural life in West Africa's past, or even processes of nature, which have impacted on cultural life in localized area and how such processes relate in a wide regional and continental pattern. Such studies are relatively few in West Africa in contrast to the situation in other parts of the continent. Such investigations have been exploratory in nature and less fruitful with reference to proper channelling of expertise, energy and experience into effective analysis of West Africa's cultural patterns.

For example, relics of soil features, superficial deposits, lateritic crusts and gravel formation have mostly been used to erect chronological frameworks for man's cultural development in West Africa. These features have been studied basically from chronological and climatic point of view and thus their full potentials for identifying past environment, resource potentials, economics and social practices including changes through time have not been exploited. Research into quaternary environment has involved study of changes from a general, usually simplistic view. Little or no effort has been made to determine changes at local and regional levels and even the ones brought about by temperature or rainfall changes, ground water or soil condition or any combination of factors. The study of past environmental context of West Africa with regard to geomorphic features had been very simplistic and disregards the interaction of factors involved. The consequence is the lack of clarity in the kind of ecological changes that occurred in terms of when, where and how or which of the several possible factors stimulated ecological and biophysical changes.

Looking at a specific case of Early Palaeolithic settlements in West Africa, particular reference may be made to the efforts made by Davies (1964, 1967), which may be described as a premature efforts. At issue are the criteria employed for dividing the prehistoric sequence of West Africa and identification of entities such as Acheulian, Sangoan, MSA (Lupemban) Mesolithic and two Neolithics(Forest and Guinea). Notable is the fact that such sequence was based on surface collections of tool scatters mainly lithic and pottery (Allsworth-Jones, 1987).

Although it can be said that earliest cultural manifestations of man in West Africa belong apparently to Acheulian industry, there is the need however, to take a more general critical look at the practice of distinguishing different cultural entities on the basis of technology and subsistence traits. And in this regard, such claim that 'Sangoan' materials were retrieved from side-cuttings and river terraces in Ghana have been researched by B.W. Andah and Signe-Nygaard and little or nothing have been proven to verify this claim (Andah, 1979). They are at best variants of Acheulian industry. Local lithic assemblages with Middle Stone Age technological base in Mauritania, Mali and Senegal are known locally as *kalinian*. The study of Middle Palaeolithic in regions like Bauchi plateau of Nigeria has usually been restricted to technological features and is highly data oriented (Allsworth-Jones, 1987).

Late Stone Age and subsequent cultural manifestations are much better understood than the preceding periods. Rim in Burkina Faso (Fig. 4.) serves as a reference point as it offers continuity of ecological, demographic and artefactual data from late Pleistocene to ethnographic present.

Material analysis from the Atamora rockshelter have demonstrated some important points about 'traditional' usages and skills reflected in tool assemblages for example continuity alongside change and continuity as condition of change (Hallam 1972:201). It had been demonstrated that Microlithic preceded the appearance of Neolithic technology only in some though not all prehistoric sequences in West Africa (Andah among others). Such realisation as this has imposed caution in the attempt at a reconstruction of a West African regional differentiated framework of chronologies and technical and ecological contexts of the diversity of small tools. An attempt such as this calls for much more raw data in terms of independent metrical categories to be compared with supposed "standards" worked out elsewhere.

Given the nature of raw material in West Africa, one is confronted with the relevance of formal European categories of cores and flakes for tool classes such as scrapers, relative to factors of massiveness and thickness of the original blank.

Descriptive and classificatory systems has more often in practice involve the employment of very sophisticated concepts to define and trace cultural influences through the analysis of artefactual assemblage attributes and in so doing, invariably ignore the fact that one human group is capable of practising two different stylistically based cultural entities.

In similar strain, concepts such as palaeoecology, site-catchments analysis and system approaches, which though are useful, have shortcomings especially if they are uncritically applied.

# Chapter Six

## 6. Interpretation and conclusions

### 6.1. Establishing a succession at Atamora

The intent of collecting archaeological data is to obtain as much information as possible about the past inhabitants or population responsible for the remains and about changes that affected their ways of life over time. This involved a process of historical reconstruction, which involves the transformation of raw data collected in the field into historical and sociological information. This is premised on the assumption that the totality of events, which have an objective existence, is theoretically at least recoverable. This is not in fact realistic as events are by far too multifarious in nature making the totality too complex to be apprehended completely even by a contemporary observer. The investigator's perception is selective and is controlled by predetermined varieties of factors and experiences.

One cannot run away however, from the task of reading some historical meanings into the raw data from Atamora. We begin this by trying to establish some succession into the lithic remains from Atamora.

Adequate description of the cultural successions at the rock shelter is rendered difficult by a number of factors. It has been noted earlier that the stratigraphy of the deposit is not clear-cut and even where a recognisable layer was identified. The site provided only a few number of layers with subjective boundaries. During the excavation process, it was not possible to establish distinct layers until after the exercise. The exposed sections revealed that the subsurface layers could not be used to establish the ages of the cultural materials in the site *sensu stricto,* more so given the fact that the surface contours did not follow conformable interface between depositional layers. It has also been observed much earlier that the deposit was affected by natural (wind, run-off, biophysical weathering activities), and cultural activities to create the archaeological assemblage which is a deposit that has been variously mixed.

The foregoing notwithstanding, series of human occupations was evident at the site after the formation of the rock shelter.

On the basis of both typology and character of artefact scatter on the site one cannot help but conclude that the area around unit 1 appears to have witnessed series of occupational activities from the onset of the occupations at the site. It was very probably a workshop site where lithic artefacts were manufactured. Waste materials were predominant and there were very few finished products outside broken or abandoned pieces.

The principal types present include blades, hammestones, few scrapers and discoids. Multiplatformed irregular cores were especially abundant among the waste categories in addition to debitages which though includes chips and irregular fragments and what is classed here as fragmented artefacts which could not be categorised under any formal artefact categories however, but bears scars suggestive of core preparation and evidence of deliberate fracture. The majority of the artefacts were based on techniques involving systematised core preparation. Discoidal cores appear to be dominant and there was little evidence that there was deliberate intent on blade production. In other words, the core preparation technique is not levallois but involved random preparation for creating of platforms and predetermined shapes.

Most of the artefacts were of rough quartz and quartzite, exceptions were the very few ones based on calcite, chalcedony, charnokian, silimanite and dolerite. This is most probably a late Middle Stone Age or at best Late Stone Age occupation at the site going by the type definition described by Goodwin in southern Africa.

A second level of occupation was the Neolithic phase, which involved the utilisation of pottery and ground stone axes along with heavy granite grinding stone (Plates 6 & 9) and mullers (25). This was well represented in unit 3 where most of these artefacts were found in very close proximity and association. At this level of occupation, there were direct evidence of tool reworking and manufacture side by side with other activity. The shelter must have been extensively utilised at this level moving manufacturing activities outside the sheltered area.

At another level of analysis, it is pertinent to ask question as to how the prehistoric inhabitants conceived between artefact types and groupings. This makes it pertinent to determine how meaningful are the distinction we made based on the above typological attributes. Such distinctions would include those made between sectors, backed blades, blades, triangles, those between polyhedrals, adzes/axes, hammerstone; and those between the various categories of debitages including discoid, chips, chunks and fragments in other words pieces which are considered wastes but have evidence of battering, scars etc.

What is term tool applies equally to the technology of manufacture. It is clear however, that the characteristics of cores, flakes, chips and all the worked specimens from the site all bears evidence of the use of hard hammer by direct percussion technique. The predominance of multi-platforms and the presence of single ones as well as presence of irregular flakes and cores with broad and unfacetted platforms is indicative.

The fact that artefacts from the first phase of occupation at Atamora bear attributes, which are comparable to middle Stone Age technology, does not carry with it any chronological implication. The situation is that the assemblage shows a distinct typo-technological resemblance to lithic industries of MSA period. No chronological relationship is posited, given the fact that neither datable fauna materials nor human fossil that can be directly linked to these artefacts were recovered from the site. Therefore, any effort at dating this site will lean heavily on the more securely dated sites nearby such as Iwo-Eleru among others, which seemingly have closer affinity with the site in term of artefactual composition and phases of occupations. Moreover, the sediment deposit at the site bears evidence of intense mixing arising from both natural and cultural causes all of which acted in obscuring the complete history of the human occupation at the site. Human occupation at the site includes earlier hunter-gatherer populations, which probably produced and imported the lithic artefacts recovered from the rock shelter.

During this early phase of occupation at the rock shelter, it was probable that the site was used as a base camp where artefacts were manufactured, and as shelter from sun or rain. Artefact scatters at the site points to different activities in different parts within and outside the rock shelter. This may also include activities of post-Late Stone Age hunter-gatherers such as Neolithic and Iron Age settlers.

Ceramic sherds were especially abundant at the upper layers of the excavated units within the sheltered area. Their concentration thinned considerably outside this area. There were concentrations of grinding stones and grinded stone adze or axes in unit 3. These were in association with heavy scatters of discoidal flakes indicating specific form of activities in the area around Unit 3, mostly knapping and resharpening of tools.

The concentration of hammerstones, fragments and numerous debris and flakes in the rock shelter also points to other specific form of activity in that area. All these apparently suggest activities associated with Neolithic economies and by implication sedentism associated with food production. The evidence of iron usage within the rock shelter was limited to specific finds from unit 2 in the form of an arrow or spear tip amidst numerous potsherds.

The stratigraphic insecurity especially in this particular unit has not help matters in placing them within definable archaeological horizons as it was heavily affected by erosion. It is possible, given the present state of knowledge and level of research at the site that the site may well date to as far back as the Late Stone Age. It could be older, perhaps MSA, but given the present nature of information, which is worsen by non-availability of dates, this could only be confine to the level of speculation.

### 6.1.1. Social Implications

Lithic materials contained in the basal soil layer probably represented the earliest period of human occupations at the rock shelter. It indicates a phase when the prehistoric occupants were probably attempting early essays at manufacturing polished axes/adzes; stone knapping technology which employed both levallois and unprepared core techniques was very prolific and has been very much advanced. The abundance of pottery at the upper stratigraphic units points to the fact that a semi-sedentary group succeeded the earlier group of inhabitants. This group probably made and utilised pottery wares at the site. Few metal pieces were recovered with distribution restricted to unit 2 and the subsurface level in unit 1 albeit in very bad state of preservation. There was none in the other two units. The sparseness of metals at the site may be due to its rapid perishable nature and or possibly to the fact that it was not popular at all in the site. These few pieces may in fact be recent introduction into the rock shelter.

The lithic industry at the site embrace a greater diversity of techniques, which included prepared core, polishing and grinding of stones to obtained a preconceived shape. The abundance of unfinished ground axe/adze alongside huge grinding stone *in situ* in unit 3 testify directly to grinding activities associated with the manufacture of stone axes/adzes which is a reflection of a phase semi-sedentary element of the habitations at the rock shelter.

Heavy firing activity associated with most of the pottery finds strongly supports a position that the place was probably at latter time utilised as a base for the manufacture and storage of pottery at least on the one hand, and probable utilisation as a place of refuge in not too distant past. This activity was partly responsible for the mixing of archaeological horizons in the sheltered area in unit 1. It is possible that a harassed group of the latter inhabitants took a temporary abode at the rock shelter in the event of civil strife given its location. This particular response to insecurity is very popular among the Yoruba people (Rowland, 1972). Such a response has resulted in founding of important settlements like Abeokuta among other well-known examples as a particular consequence of the internecine wars of the nineteenth century. There was no evidence of any burial in the rock shelter as far as present state of its investigation permits.

### 6.2. Comprehensive evaluation of evidence

Although lithic usage may be construed as a secondary activities in support of primary activities of subsistence vis-à-vis hunting, food-gathering, and consumptions, the hunter-gatherers of the Stone Age period had to contend with several problems than searching and procurement of raw materials. These problems include decadal short-termed climatic oscillations, which characterised the quaternary period of West Africa. These were oscillations, which are well pronounced in the Pleistocene and with attendant changes in landscapes especially during the Holocene. This short-term oscillations also influenced among others, climate, seasonality, regionality and animal populations. Hunter-gatherers themselves may influence the latter. Moreover, according to some ecologists the forest ecosystems are not evolving towards a climax stadium, rather they developed in a cyclical manner, which contained several mosaics. This was the case as opposed to a natural and man-made causes and a balance of nature which had never really existed. This could have been the necessary driving force behind cultural change.

However, going by the insight of Tim Ingold that hunter-gatherers are neither optimal foragers nor economic men but *"fellow passengers in this world…, who carry on the business of life, and in doing so, develop their capacities and aspirations, within a continuing history of involvement with both human and non-human components of their environment"* (Ingold 1990); it is not out of place then to say that these hunters and gatherers have different and varied social means to cope with subsistence problems. Cultural phenomena may have more influence on travel, equipment, site location, and occupation time, construction of structure or reduction sequence involved in the production of artefacts among other thing in hunting-gathering economies. All these facet of life may not be adequately reflected in the excavation units of the archaeologist albeit making the rather conjectural opinion of the investigator more subjective in the light of varied assumptions he had to make in coming about his interpretation of the archaeological data before him.

It is therefore open to discussion as to whether the lithic raw material distribution of Stone Age culture at any particular site such as Atamora is a product of:

i. direct access to lithics raw material by mobility, special expeditions, by individuals or a group of individuals,
ii. contacts between mobile groups at one site,
iii. regular contacts between non-mobile groups at the border of their region or
iv. social behaviour.

A number of archaeological sites are being investigated in Southwest Nigeria and by extension west and central Africa. Such investigations have trended towards historic societies (neglecting Prehistoric aspects) in the not too distant past and are aimed towards unravelling the nature and origin of present settlements as an approach to the understanding of urbanisation processes at least in the West African sub-region. For the distant past, it has become rather obvious that caves and rock shelters deposits provide the best basis to find secure stratigraphies (Moeyerson 1997). Interests stemming from major change in research approach have now led archaeologists and archaeobotanists to focus their attention more on ecology wherein little attention has been placed on prehistoric economy beyond the procurement and utilisation of raw material for tool and equipment manufacture.

In the fieldwork leading to this project, both open-air sites (at Ajibode in the Ona river basin) and a rock shelter (Atamora) were investigated in terms of artefactual composition and stratigraphy as a prelude for characterisation of site sequences in Southwest Nigeria.

At Ajibode, a number of excavation units including UMF, LWF and MCF were opened. In these excavations a number of artefacts (including pseudo-artefacts?), albeit in non-proper stratigraphic provenience were recovered. These included among others a number of polyhedrals, lanceolates, scrapers and pick based on quartz utilisation, as well as a number of Celts that were based on indurated quartz. Even though these artefacts were located in secondary contexts, their recovery situations points to a great interval between the points in time when they were deposited and when they were actually recovered in the course of archaeological investigation. This is a big spatio-temporal conundrum which is yet to be adequately resolved in West African Palaeolithic investigation. Crucial questions arose from the ascription of relative dates that are based on morphological characteristics to assemblages from this sub-region to the extent that it had become a rather embarrassing issue at public forums. The fact that lithic materials from this sites bear close semblance to ones from well defined sites from elsewhere is not enough to place them in the same chronological framework. There is no justification to conclude on morphometric basis alone on such fundamental issues bothering on the age of artefacts and the in fact occupations at the sites in question. There are no unequivocal evidence for periodization of the lithic finds supported by absolute dates or associated fauna material that are directly connected with these so called stone tools. So, it is only fair to disagree on these grounds with the conclusion drawn by Bagodo (pers comm. 2003) that such materials are of MSA origin. This is a conclusion which is based on the ill-defined morphometric attributes with no unrestricted stratigraphic correlations is therefore no more than pure speculation amounting to mere academic conjecture as it lacks any meaningful scientific evaluation.

The foregoing provides the rational premise that prompted the need to find closed sites such as that of Atamora in order to investigate the character of prehistoric activities in Southwest Nigeria. Unfortunately, Atamora did not provide materials with similar morphometric attributes as those recovered at Ajibode and could not be correlated on any basis as belonging to the same period. The resolution of actual character including the age of these lithic materials still need sometimes and adequate approach that will take into consideration the shortcomings of this and other related investigations. This calls for sufficient funding and resources outside the possibility of a self-financed study such as this one. What is done here only amount to a sufficient scratch at the surface of the prehistory of the region. It suffices however, those facts stemming from this investigation points to a prehistory, which has more depth than has been earlier assumed.

Added to this is the fact that there are no data to suggest whether materials utilised in tool making were exogenous or locally derived. Little next to no information is available in this area of lithic utilisation as affected by study of catchments area of hunter-gatherers and land-usage patterns in the study area to provide any model to follow. But the little information gleaned from the Iwo-Eleru and related investigations points to some mobility tied to the derivation of raw materials that were used at the rock shelter at least for the Neolithic phase.

At Atamora, the weight and distribution of exogenous materials clearly points to one singular fact that variability within the artefact assemblage at the site is more or less a function of some intrinsic social factors rather than an intentional search for raw materials for the production of specific tool types. The variability in the raw materials employed in the flake industries at Atamora reflects a great degree of homogeneity in raw material forms, which principally utilised quartz of variable grades that are widely available within the immediate locality of the rock shelter at least within a radius of 10-20km. There is obviously the utilisation of a particular raw material type for the production of ground stone artefacts (axes/adzes) as witnessed across the cross-section of the study area. The situation either points to one of two possibilities. It reflects either the great mobility of the users or manufacturers in terms of territoriality or a deliberate search and procurement of raw material. The second seems to hold for the particular case of Atamora where these categories of tools including pre-forms were recovered in the same stratigraphic provenience i.e. the Neolithic phase of occupation with which these particular artefacts including ground Stone axes are associated.

Wide-ranging literature survey is in support of a non-static environment where there were clear evidence of movement of the forest-savannah divide north and south following climatic conditions, which varies from arid to fluvial conditions in which there were climatic ameliorations. In contrast to the opinion of Bailey *et al(1989)* that the forest was never a permanent environmental condition which did not vary over the time. This is clearly the case in West Africa generally and Southwest Nigeria in particular.

Lithic cultural evidence accompanied with few physical remains supports the fact that the West Africa sub-region including West Africa was inhabited as far back as the Palaeolithic phase of human history. What remains is to find out which condition pervades during the period they inhabited the region and the numerous sites and the actual relationship that existed between these early inhabitants and the present dwellers. In order words, question arose as to the origin of the present inhabitants. Are they settled migrants or direct descendants of previous prehistoric populations. What is certain in the light of this investigation is the presence of substantial evidence for at least Late Stone age occupations in western Nigeria, which utilized lithic technology based on flake production, and ground stone elements in their subsistence strategy. At Atamora rock shelter, ground stone technology was most probably a feature associated with Neolithic occupations and sedentism as evidenced by the preponderance of pottery ware in direct association with this category of artefacts at the site.

There is no reason whatsoever, to suppose that cultural activities in Southwest Nigeria by virtue of its position in the tropics and because of the forest environment was not significant in the debate of human origin and development. What obtains is a rather challenging phenomenon that requires far more investigative intensity that is commensurate with the challenges. The state of investigations/results presently amounts to mere scratches on the surface. Change has become a very permanent feature of the earth history and its activities over the time are having very severe impacts that tend to compound the understanding of both cultural and physical development in the region.

### 6.3. Discussion

Results of research at Atamora reveals what an *in situ* assemblage of prehistoric sites in this region looks like. In many cases, they consist of a mixed collection of artefacts belonging to different cultural phases as evidenced in the close proximity of pottery and lithic material. This brings about a problem that bothers on the need to distinguish between the acceramic and ceramic phases (Shaw and Daniel 1984; Willet 1960, 1967) of the Late Stone Age. There is also very few published excavated examples with which to compare Atamora lithic industry the nearest in the region is the one from Iwo-Eleru for which data from both acceramic and ceramic levels are available. Results of similar excavations at Mejiro by Professor Frank Willet (1967), and at Asejire (Fatunsin 1992) are not published and direct evidence is inaccessible. We are therefore left with Iwo-Eleru which served here as the compendium with which we compared data from Atamora.

Results of the foregoing investigation has enabled us to answer some questions regarding the primary aim and objectives of this work which is to clarify among other issues namely: the nature of settlements that preceded the present ones in Southwest Nigeria in other words the prelude to urbanisation in the region. First, it had become apparent in the light of data from Ajibode, Iwo-Eleru, and Atamora among other known sites with prehistoric occupations in the region, that human occupation in this region has a very great antiquity far greater than had hitherto been anticipated. On the ground of morphological attributes one can infer an MSA phase for the materials at Ajibode, while those from Atamora points to a late MSA period. Inadequate as this body of data may be, this is unequivocal evidence supporting the actual presence of Late Stone Age hunter-gathers in the region. Hunter-gatherers economies most probably transformed into Neolithic and subsequently Iron Age economies a fact evidenced by the obvious transformation from microlithic tool base to Neolithic tools in the form of ground stone adze/axes. Increased sedentism involved the greater utilisation of pottery and natural shelter in the form of rock shelters as a prelude to permanent settlements. At this level of occupation, domestic items like grinding stones for milling, mullers, and ground stone axes among other perishable items became very prominent character in the home base. These are clear characteristics of the Neolithic in West Africa (Andah, 1978).

Extensive literature review of various studies involving the reconstruction of quaternary environment in West Africa does not support a linear progression in the development of vegetation over time. What obtains, trends towards cyclical events in which environmental conditions oscillated from arid conditions to fluvial ones when vegetations thrived under ameliorated conditions.

It is apparent then that human history in southwest Nigeria is quite complex and archaeological data appears to point to a case of repopulation activities, which are associated with the emergence of the present inhabitants of the region. These repopulation activities relate very much to the emergence of sedentary settlements in the forest and the adjoining savannah zones to the immediate north. It is probably a development which is accompanied by sporadic migration episodes that lasted for a relatively brief period possibly between the $9^{th}$ and $15^{th}$ centuries AD. This tradition of migration appears to have continued well into recent history of the people as evidenced in the reactions and responses that accompanied the internecine wars among the Yoruba people in the $19^{th}$ century (Atanda, 1980; Johnson 1921). It is important nevertheless, to investigate the point of departure/transition or contact with the earliest identifiable settlement activities from/to or with present inhabitants in the area. Is it a case of replacement or a transformation process, which affected the original population in the area?

A case of assimilation is very probable given the nature of historic evidence in some areas especially in the core Yoruba heartland of Ile-Ife. If this is the case, it is not unlikely then that the arrival of a royal class with eastern heritage may have emancipated the local people into a royalty cult and the subsequent expansionism that eventually engulfed the entire Yoruba country. This influence must have spread as far away into the neighbouring enclaves of Benin Kingdom and to Dahomey countries in present day Benin and Togo Republics.

Cultural manifestations in the Southwest Nigeria are divisible into three broad phases namely the MSA/LSA phase, the Neolithic phase and Historic phase at least given the present state of knowledge. The MSA phase represents the period of great antiquity with numerous but confusing evidence. Evidence traceable to this phase of cultural development in the region are those which are on the basis of morphological attributes related to formally defined artefacts belonging to this periods elsewhere in Africa and especially in West Africa. Artefacts attributable to this stage of cultural development have been observed to include typological types bearing Acheulean, Sangoan attributes as well as varied heavy duty tool types which were probably adapted towards forest ecology exploitation. The numerous microlithic assemblages, observed at Atamora, Iwo-Eleru, Mejiro (Willet, 1960), and Asejire (Fatunsin 1987) among other places constitute part of this phase of human occupations in the forest region of Southwest Nigeria.

The character of the stratigraphic sections from Atamora rock shelter and UMF at Ajibode indicates an apparent dissimilarity in the natural strtigraphic units at both sites. The nature of human occupations at Ajibode is still not clear and it is beyond the scope of this work. However, at Atamora, three main cultural phases can be discerned and associated with the natural stratigraphy at the site.

The earliest economic activities were observed to have started towards the upper part of layer 4 and the beginning of the layer 3, where there was substantial concentration of lithic artefacts including debitages. This was a period when agriculture was probably unknown at the site. There was little to suggest that the raw materials for artefact production were sourced from farther affield outside the immediate surroundings of the rock shelter within a 20–kilometre perimeter of the rock shelter. The raw material composition at this level was rather homogenous and is based on quartz which is locally available in the form of vein. Vein quartz occurs in the form of intrusions in the major rock types including gneissic outcrops. Quartz also obtains locally as alluvial ferns, which were deposited in the event of past fluvial activities. This occupation was in fact the most intensive within the rock shelter.

The second phase witnessed the introduction of ground stone adze/axes, grinding stones, mullers in association with pottery. All these are indicative of a period when agriculture was probably practised at the site. It could have been rudimentary involving the collection and utilisation of semi-domesticated plant species. This opinion is informed by numerous polished stone artefacts indicative of Neolithic economies/settlement features. Utilisation of grinding stones, mullers and the numerous rock-hollows are associated features. This was also in association with use of fire at the site. These fires were made on non-permanent structures and pottery was recovered in close proximity with the fire and ashe materials encountered on this layer. It is becoming very much apparent that such settlements were semi-sedentary in nature which evidently concentrated much effort into food processing and possibly preservation.

The third occupational phase in the study area revolved around the scattered settlements which dotted most of the landscape and evidence for this are the rich scatter of potsherd with unique pottery tradition, which is in our opinion the hallmark of new permanent settlement. This is a phase, which witnessed the introduction of terracotta sculptures based on the manufacture of these unique clay-cups with varied bases. Some have bell-shaped bases with singular bell handles. Some were slipped with white paints. One stone bead was also recovered from this level. There was no more need to travel from location to locations along seasonal climatic patterns. Intensive hunting and plant domestication may have accompanied this phase of human occupation. It is then apparent that the inception of permanent settlements in the study area has much relationship with the development of storage facilities such as pottery and the ability to collect sizable plant and animal resources.

Human disturbance have affected the site considerably and have led to great distortion of the natural history of the site. There was for example indication that the site was at some point in time used for manufacture or storage of pottery. The large quantity of terracotta in the latter phases of cultural occupations at the site is very indicative. There was no connection between the nearby village named Atamora with the rock shelter. The village and land belong to the Iwata people who settled at a town so named some few kilometres south of the rock shelter. It is among this people that the rock shelter is revered as an important religious centre.

Dating the sequence at Atamora is a complex problem. Not much was achieved in this direction. What is obtained is an association of the different phases identified at Atamora with those from nearby sites with known dates wherein Iwo-Eleru and Egbejoda readily comes to mind.

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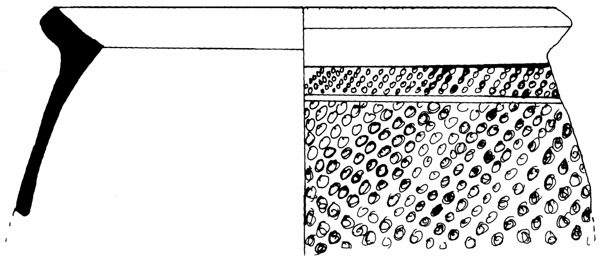
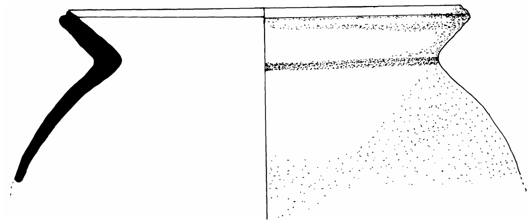
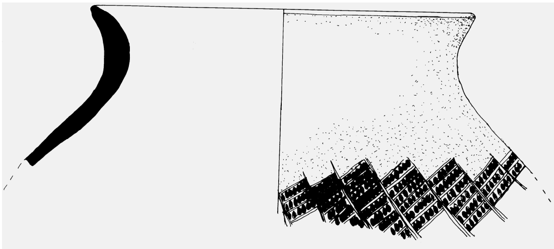


a

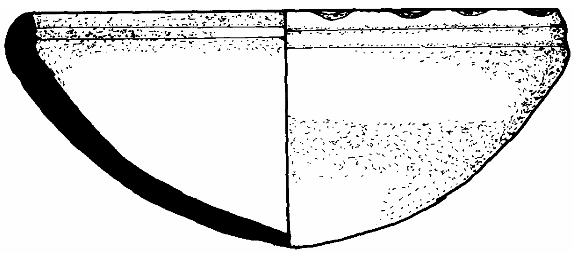


b



c

**Fig. 36a. Atamora, categories of large pots excavated at the site**



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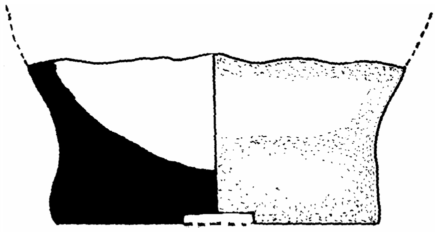


e

**Fig. 36b. . Atamora, type bowls recovered from the excavation**

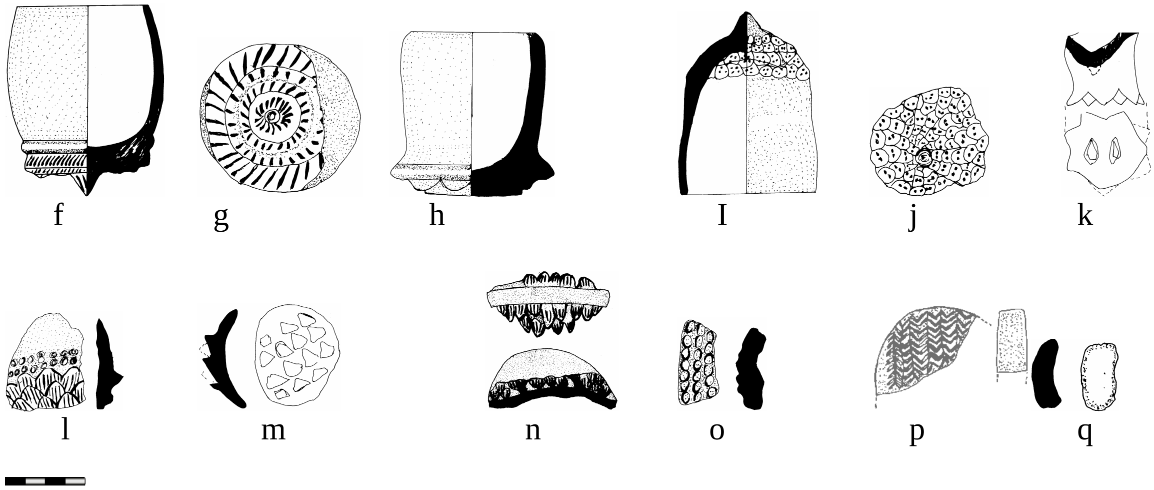



**Fig. 36c. Atamora, ritual vessels including sacred mugs with elaborate decorations.**

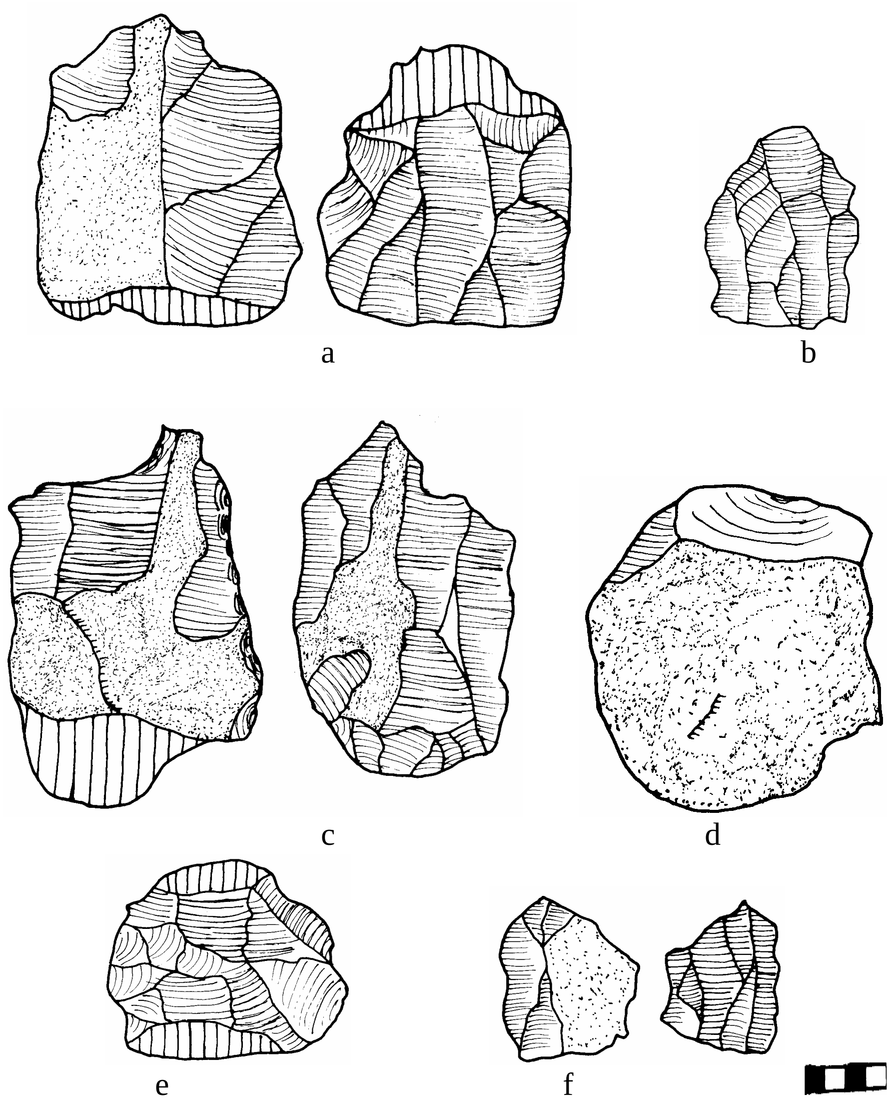



**Fig. 37. Artefacts recovered from Ajibode**

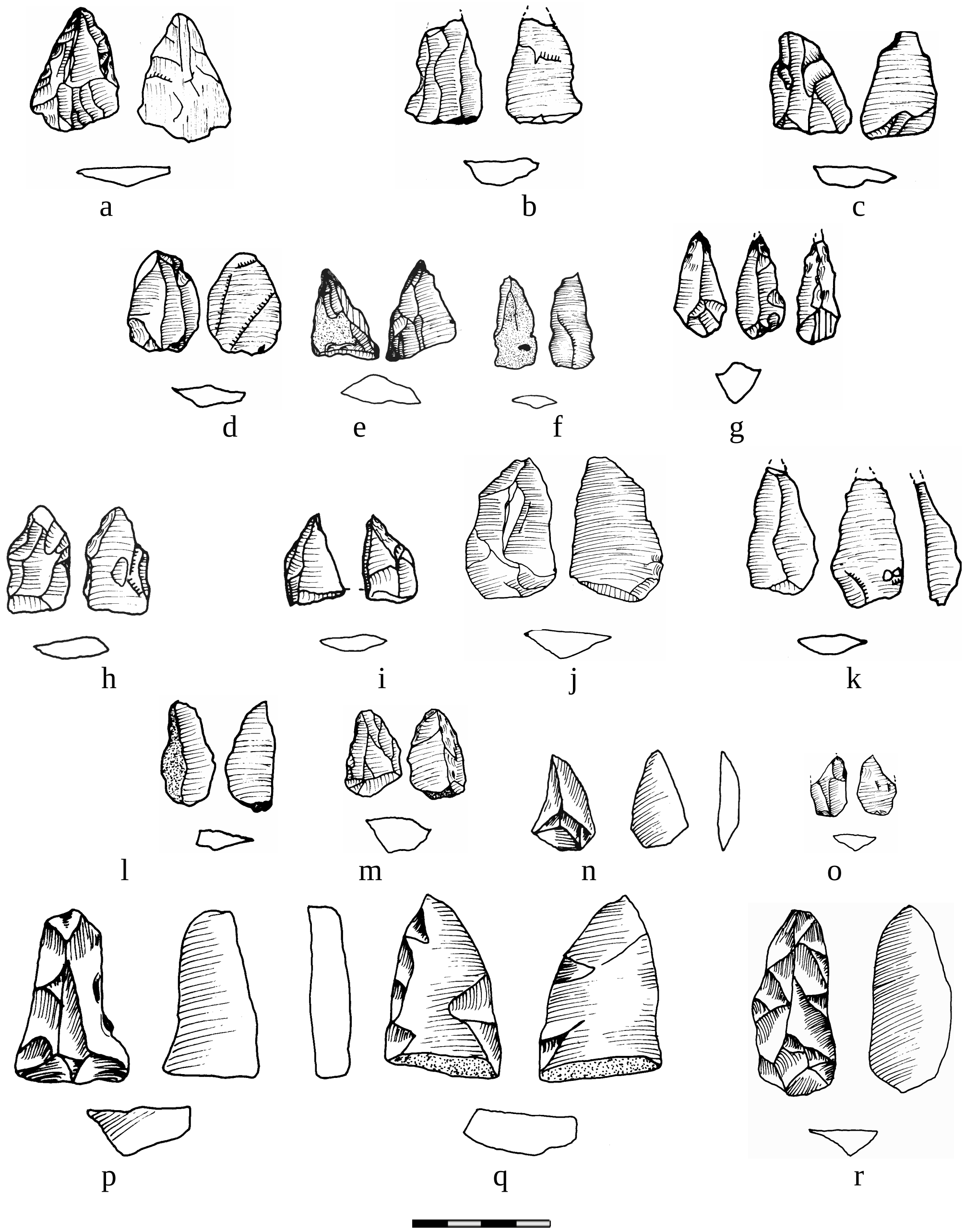



**Fig. 38. Atamora characteristic points**

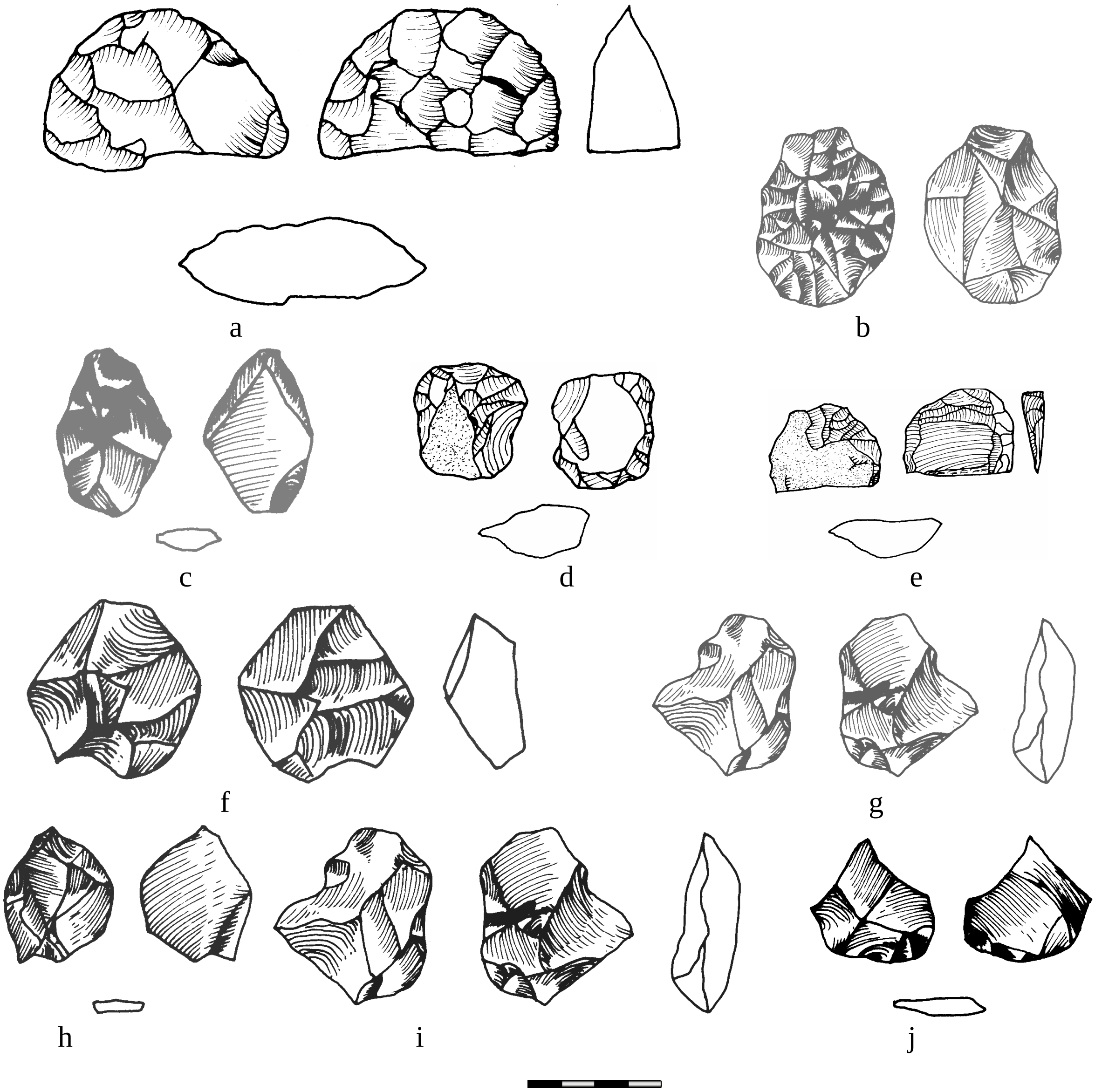



**Fig. 39. Atamora, scrapers recovered from the site**

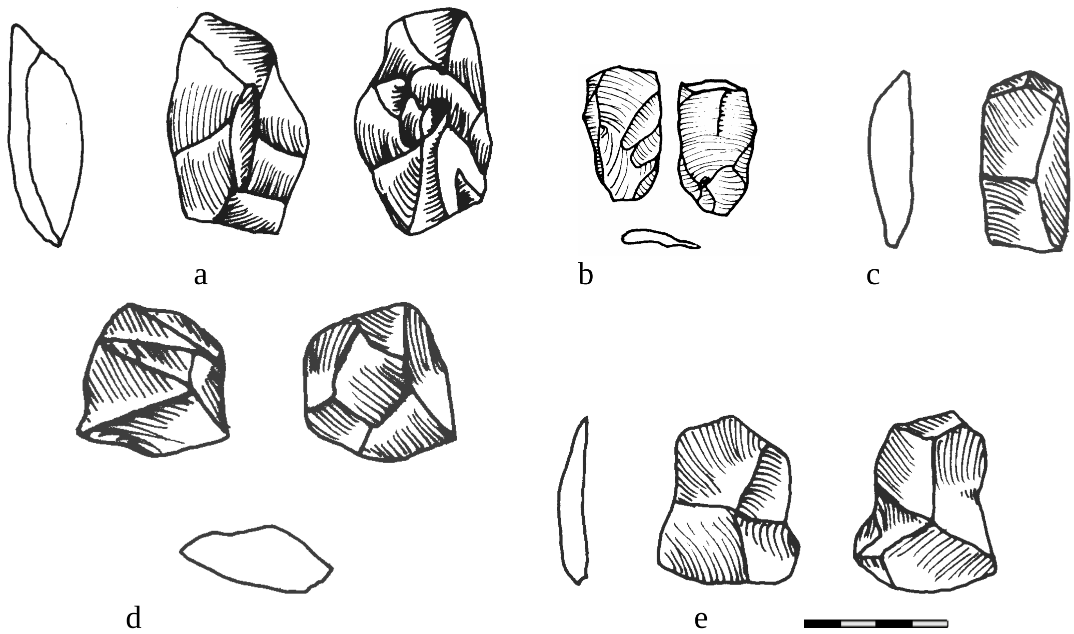



**Fig. 40.Atamora, Chisels**

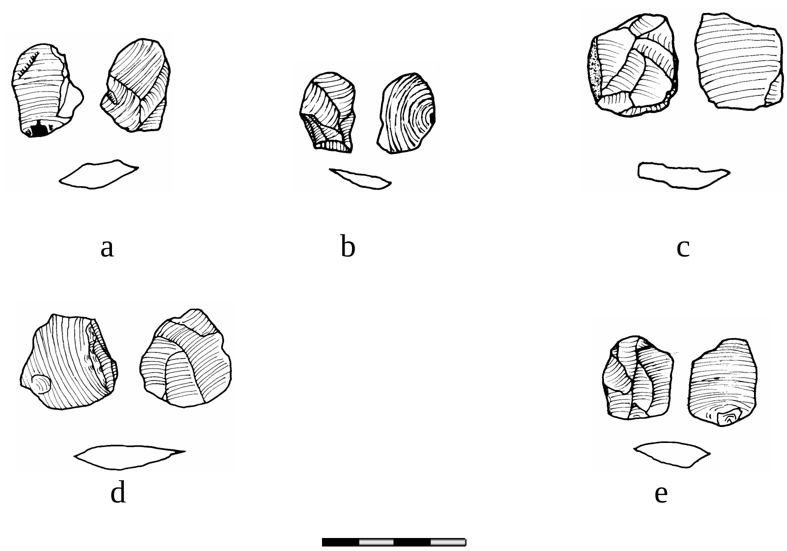



**Fig. 41.Atamora, Backed Blades**

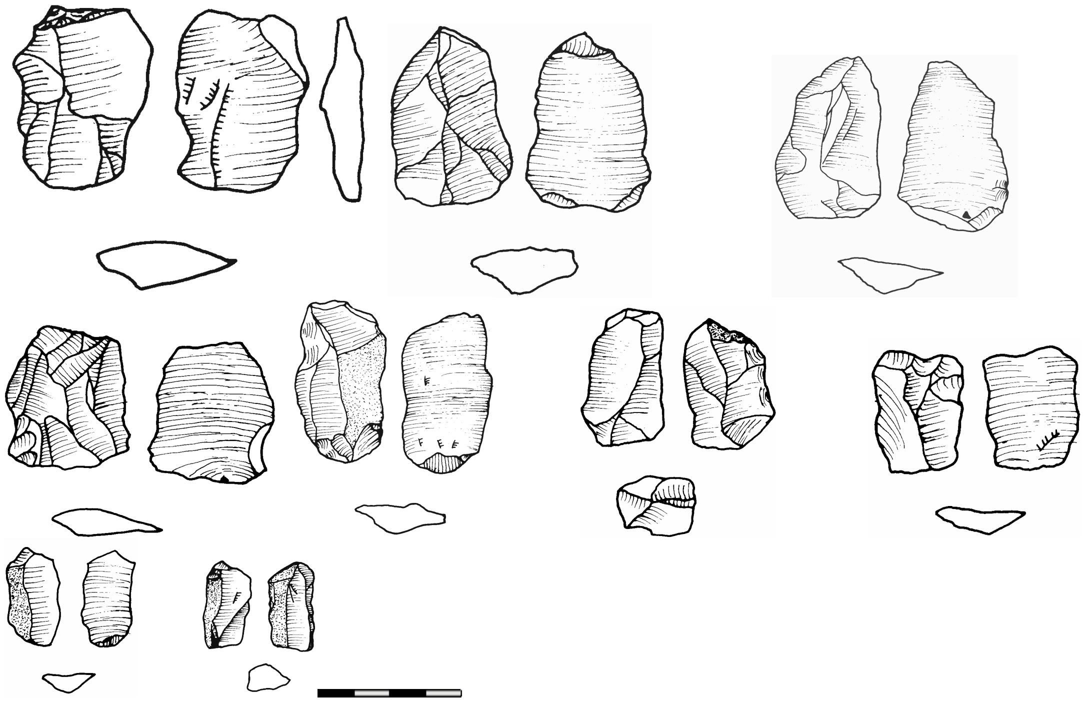


**Fig. 42. Atamora, Blades**

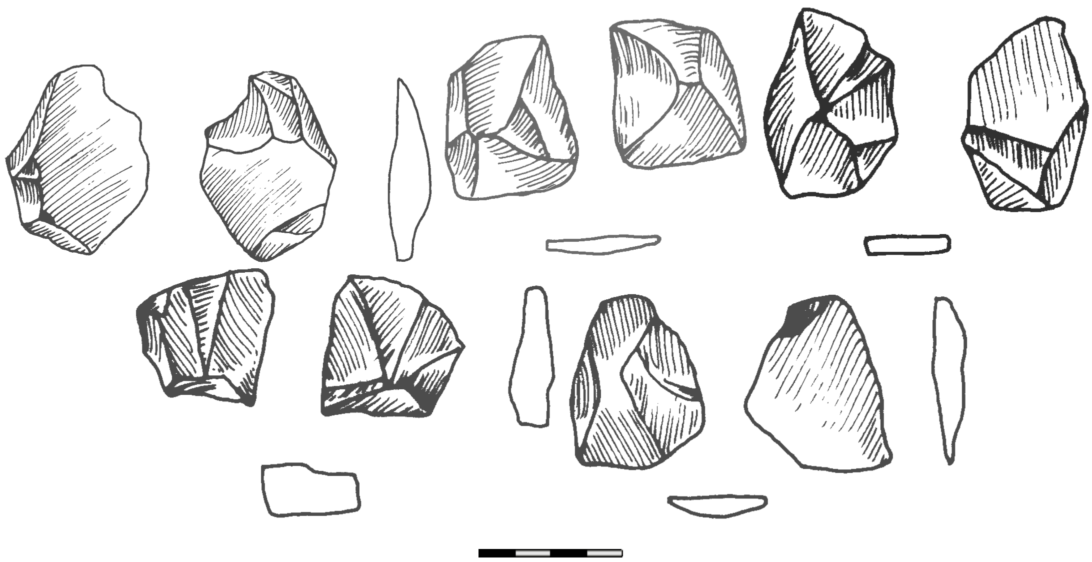


**Fig. 43. Atamora, Sectors**

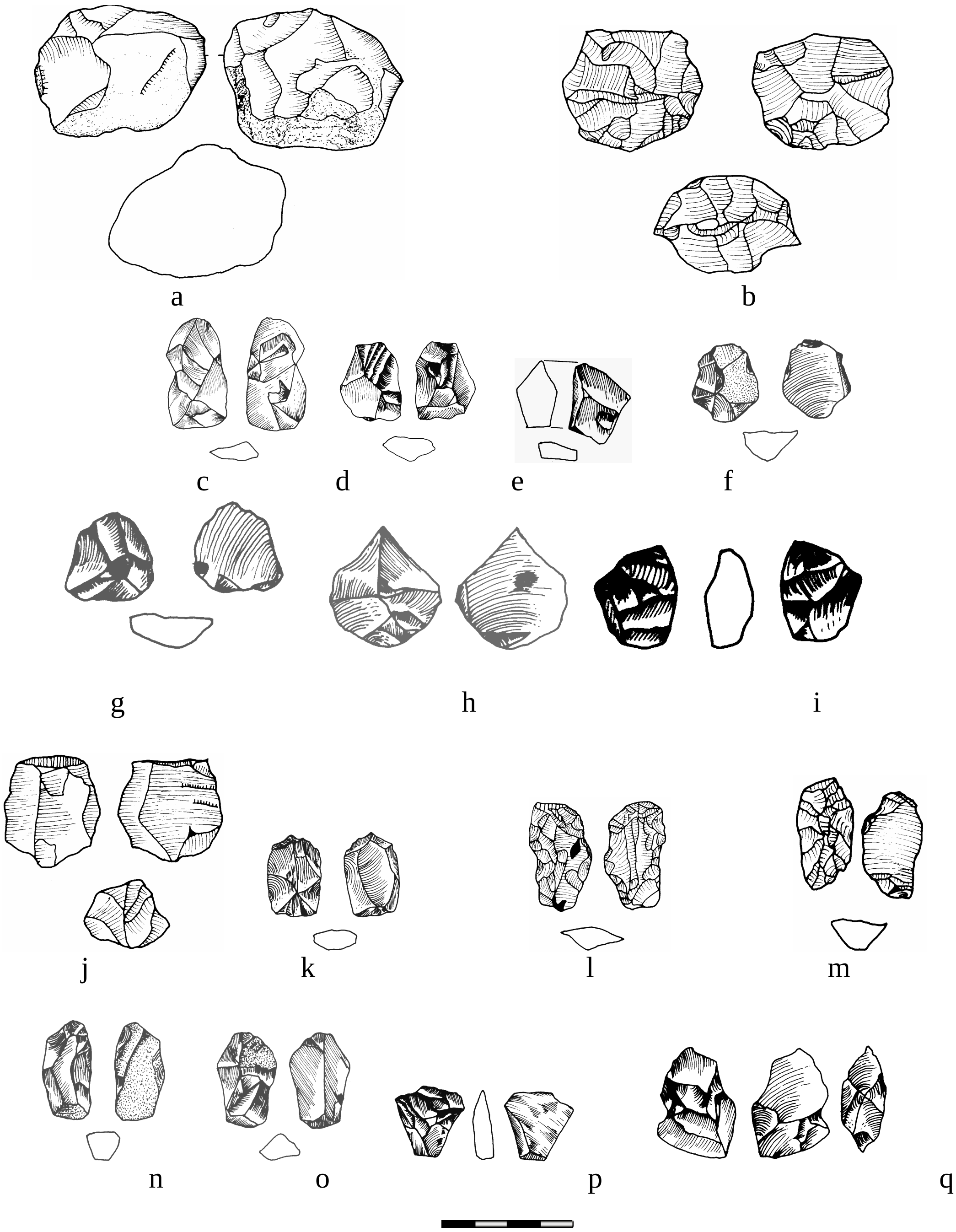



**Fig. 44. Atamora, Varied cores**

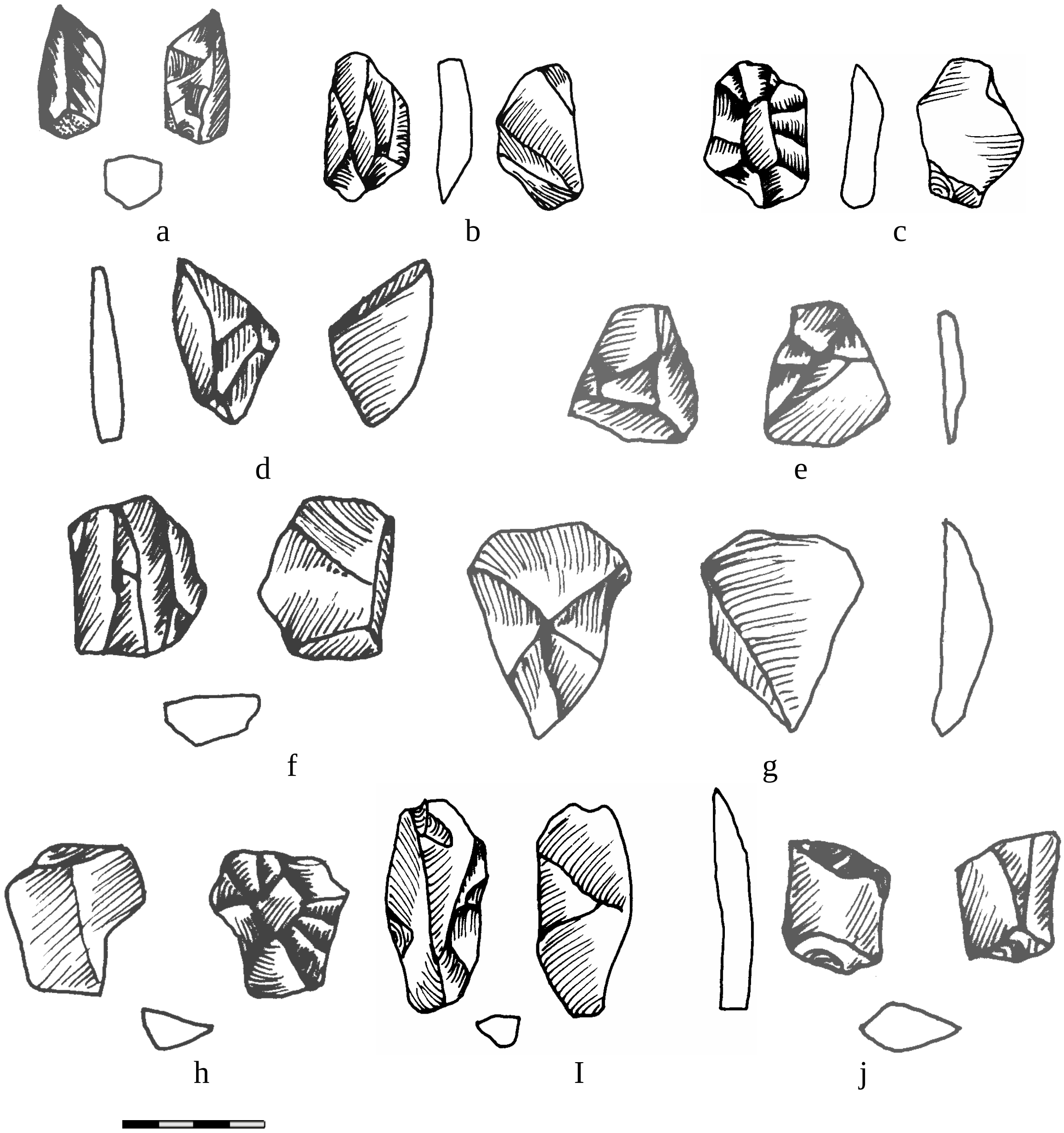



**Fig. 45. Atamora, Varied cores**

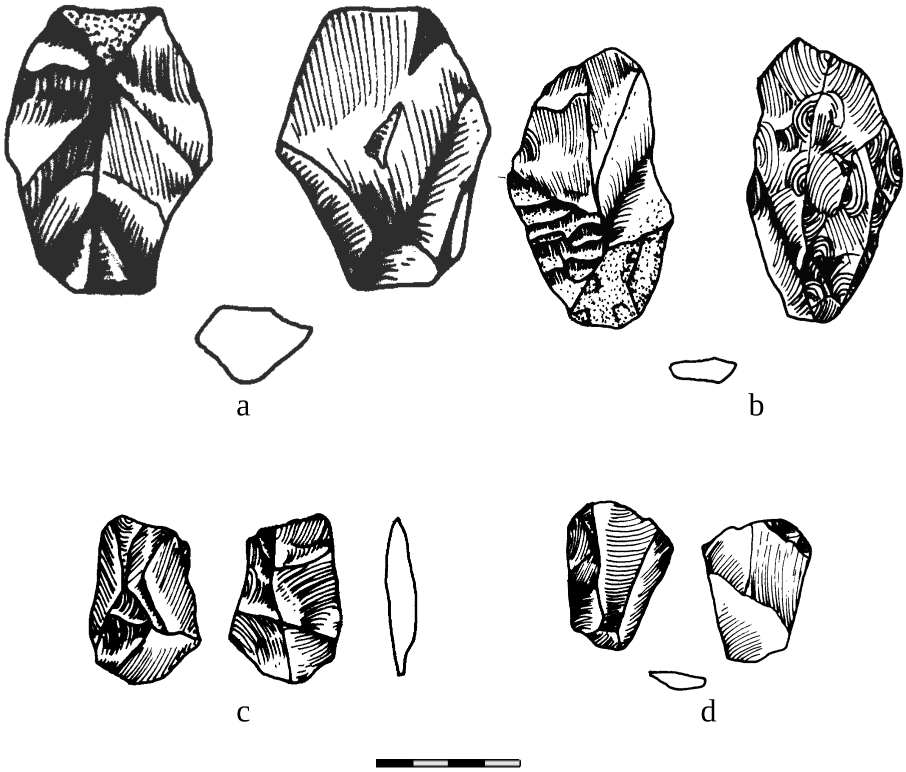



**Fig. 46. Atamora, Scrapers**

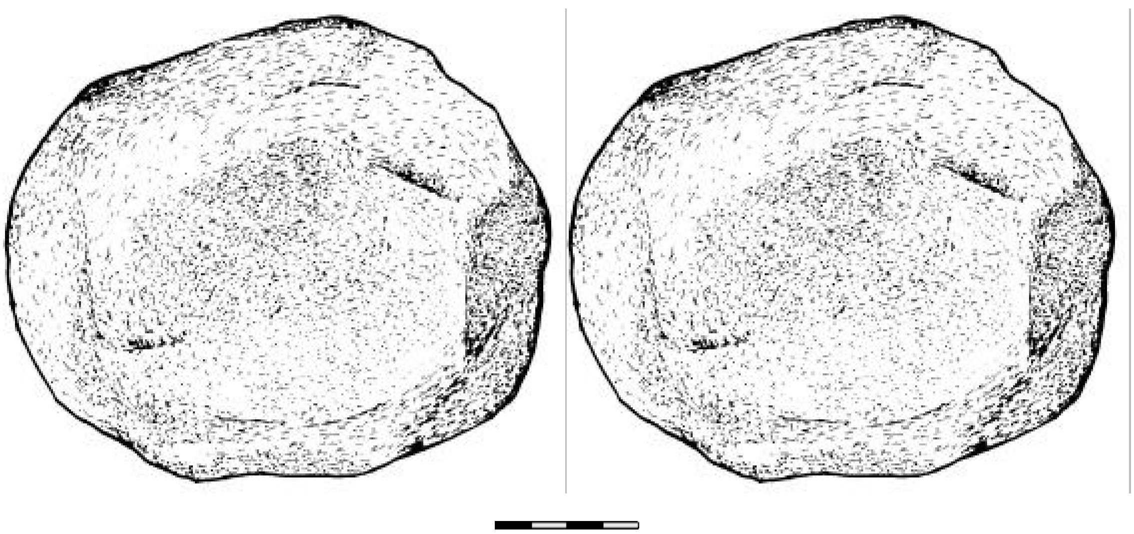


**Fig. 47. Atamora, Mullers (quartz)**

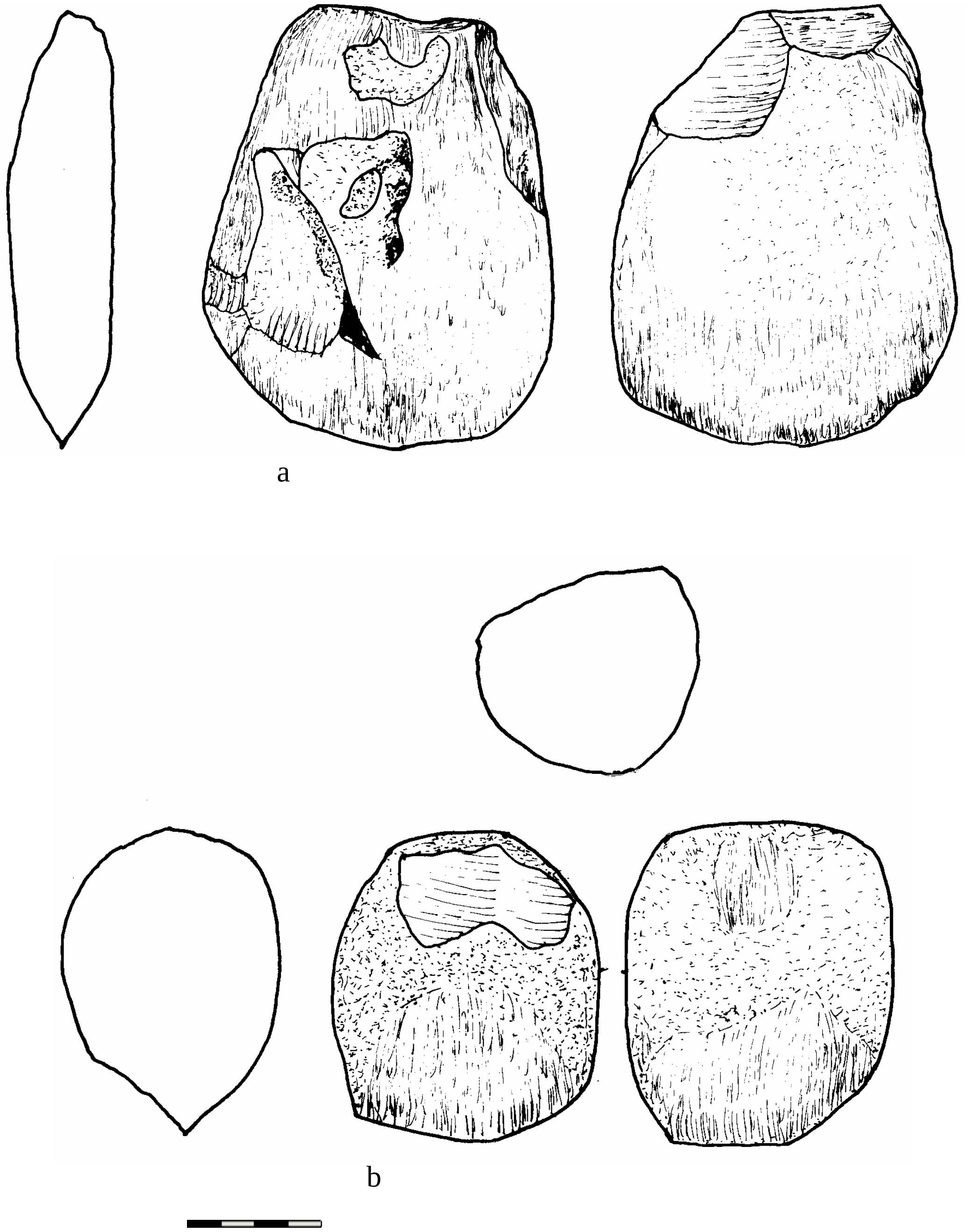



**Fig. 48. Atamora, Ground stone axes from Atamora (silimanite)**

**Plate 1: Ajibode, occupational level embedded on silt deposit at UMF Unit C**

**Plate 2. Atamora, general shot of the Atamora showing characteristic vegetation (derived forest)**

**Plate 3: Atamora, panoramic view of Atamora rock shelter from the west**

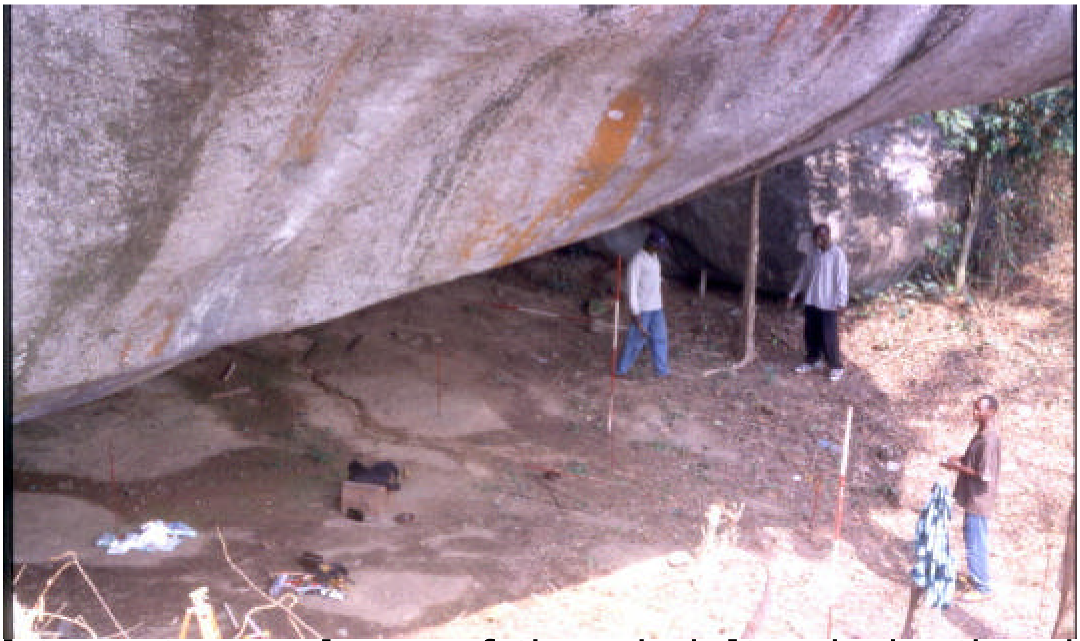


**Plate 4: Atamora, close up of the rock shelter showing the main pavilion from the south**

**Plate 5: Atamora, weathering activities in the landscape**

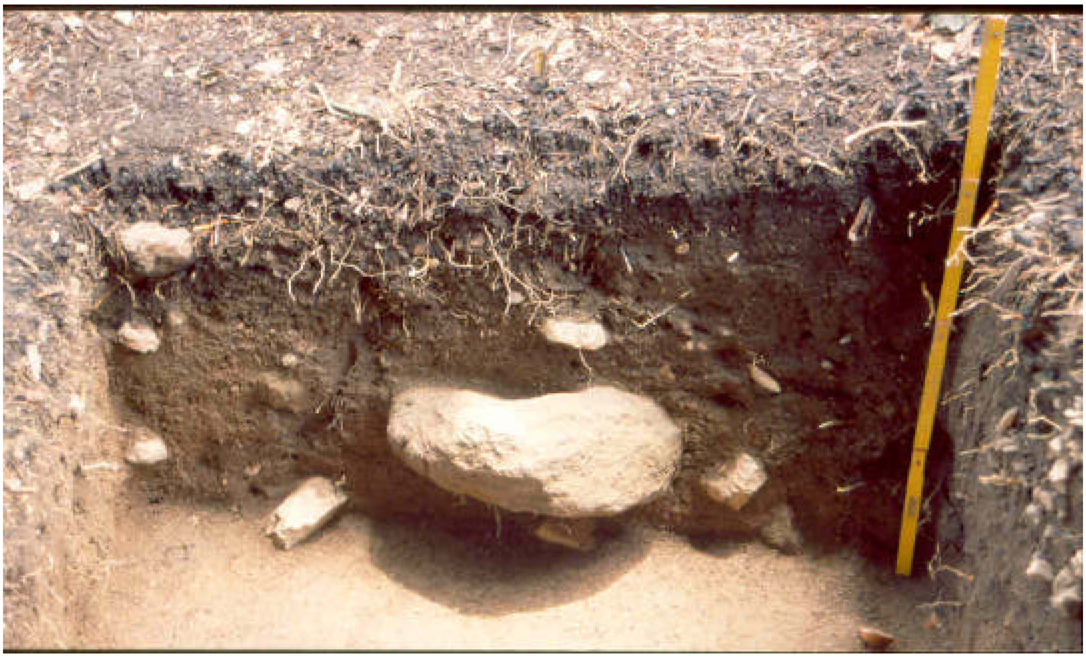


**Plate 6. Atamora, stratigraphic section showing embedded materials in Unit 3-66 (south wall)**


Plate 7. Atamora, west Section units: unit 3-66

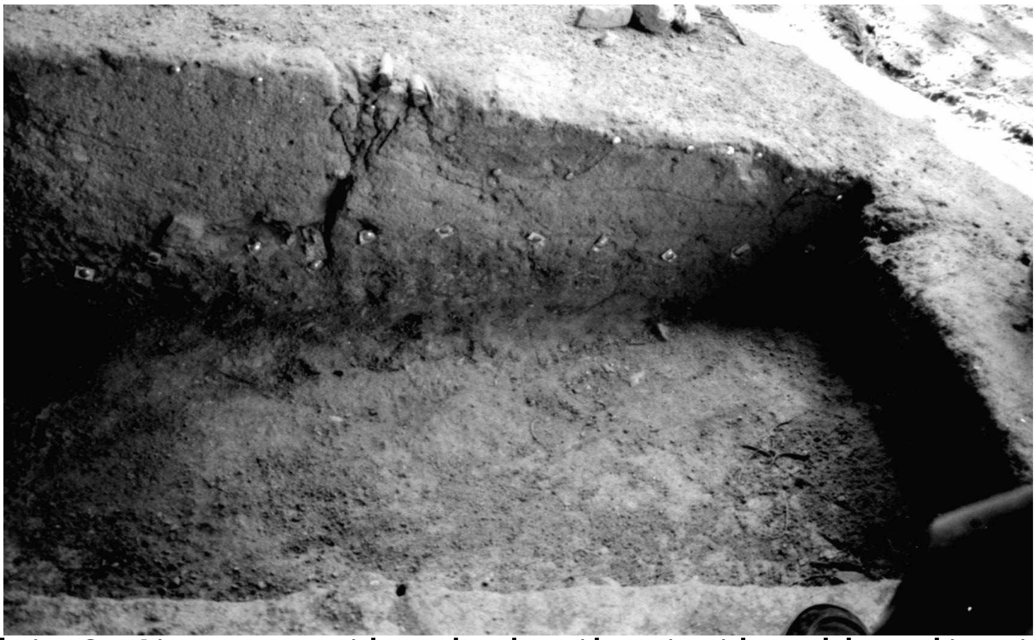


Plate 8. Atamora, section showing the stratigraphic units at Atamora: unit 1

**Plate 9. Atamora, exposed occupation floor at Atamora unit 3-66**

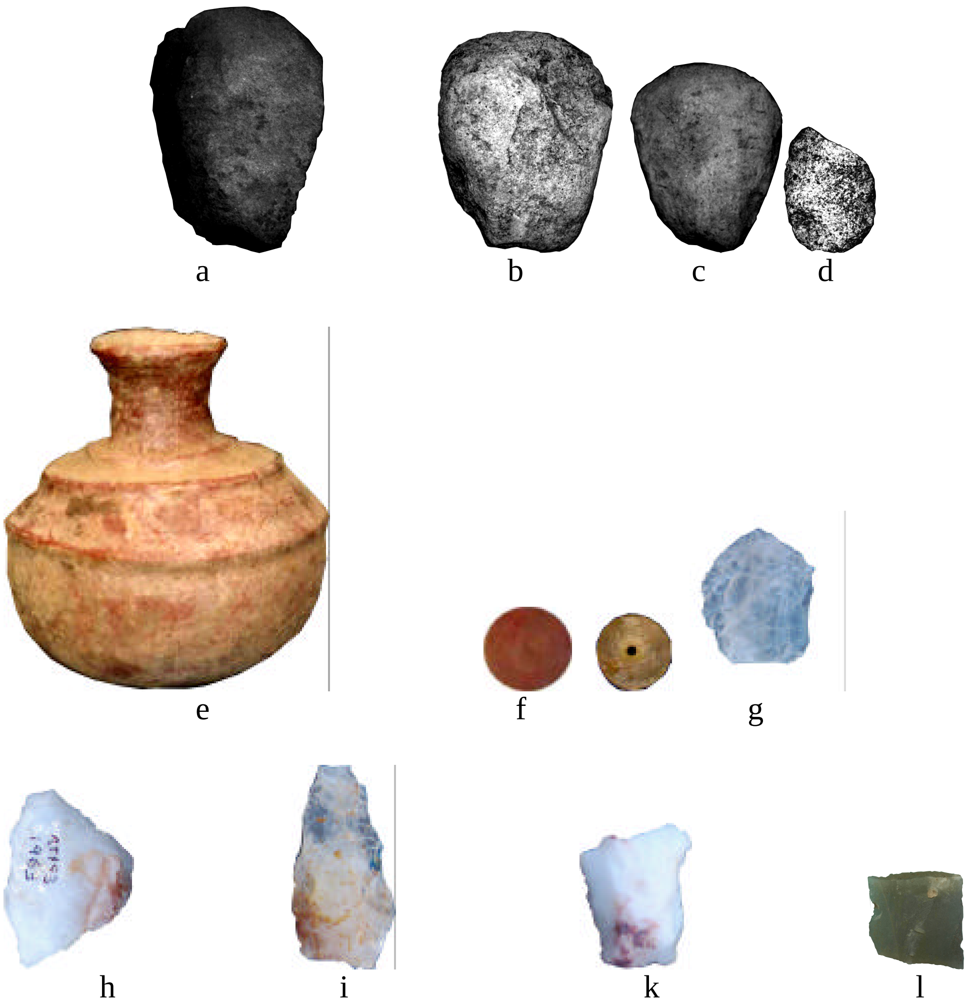



**Plate 10. Atamora, characteristic artefacts from Atamora: a.Preform; b-d.Ground stone artefacts; e. Jug; f. beads Flake; g-l. Lithic artefacts.**

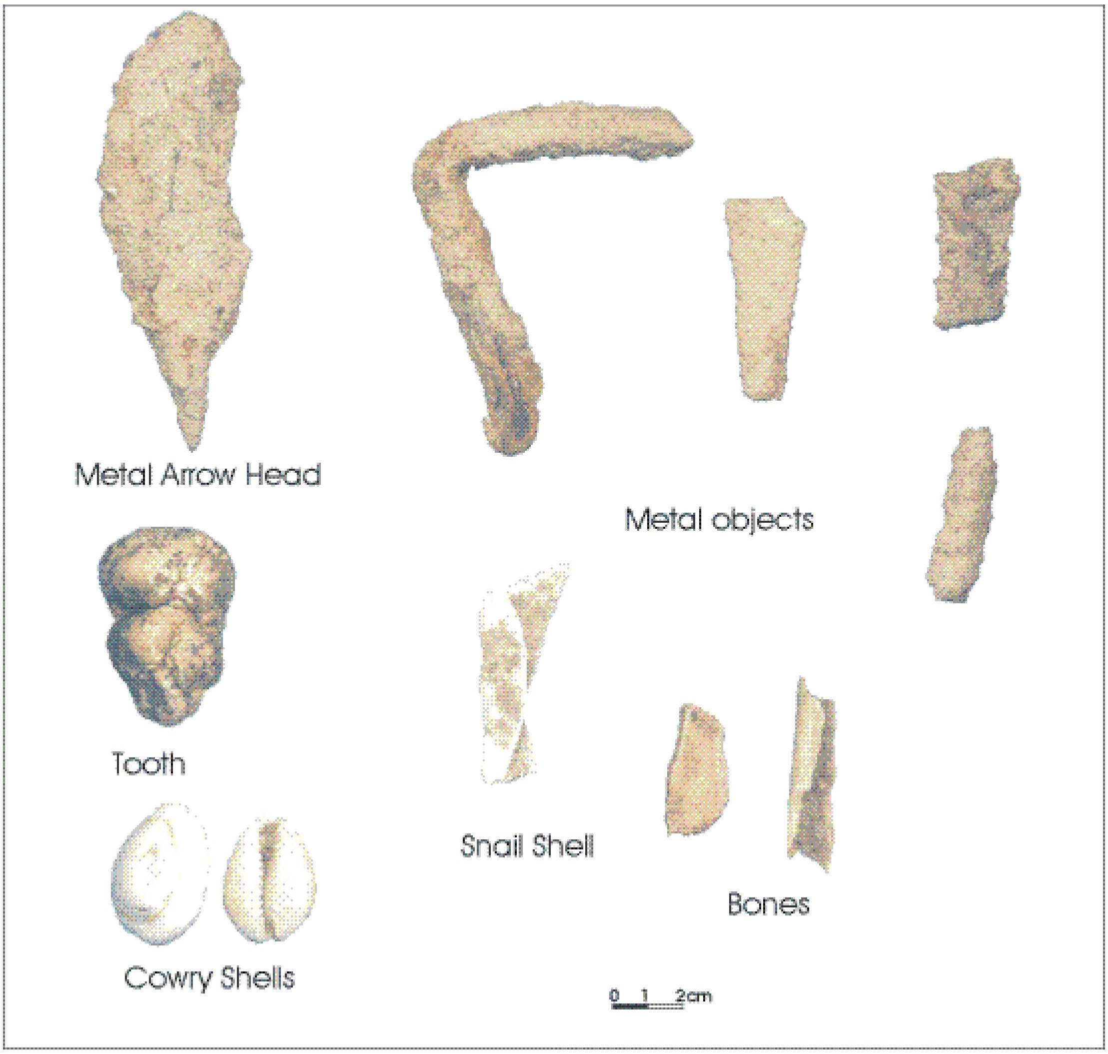



Plate 11. Ajibode, some non-lithic recovered from the excavations

Plate 12. Atamora:Potsherds recovered from the excavation

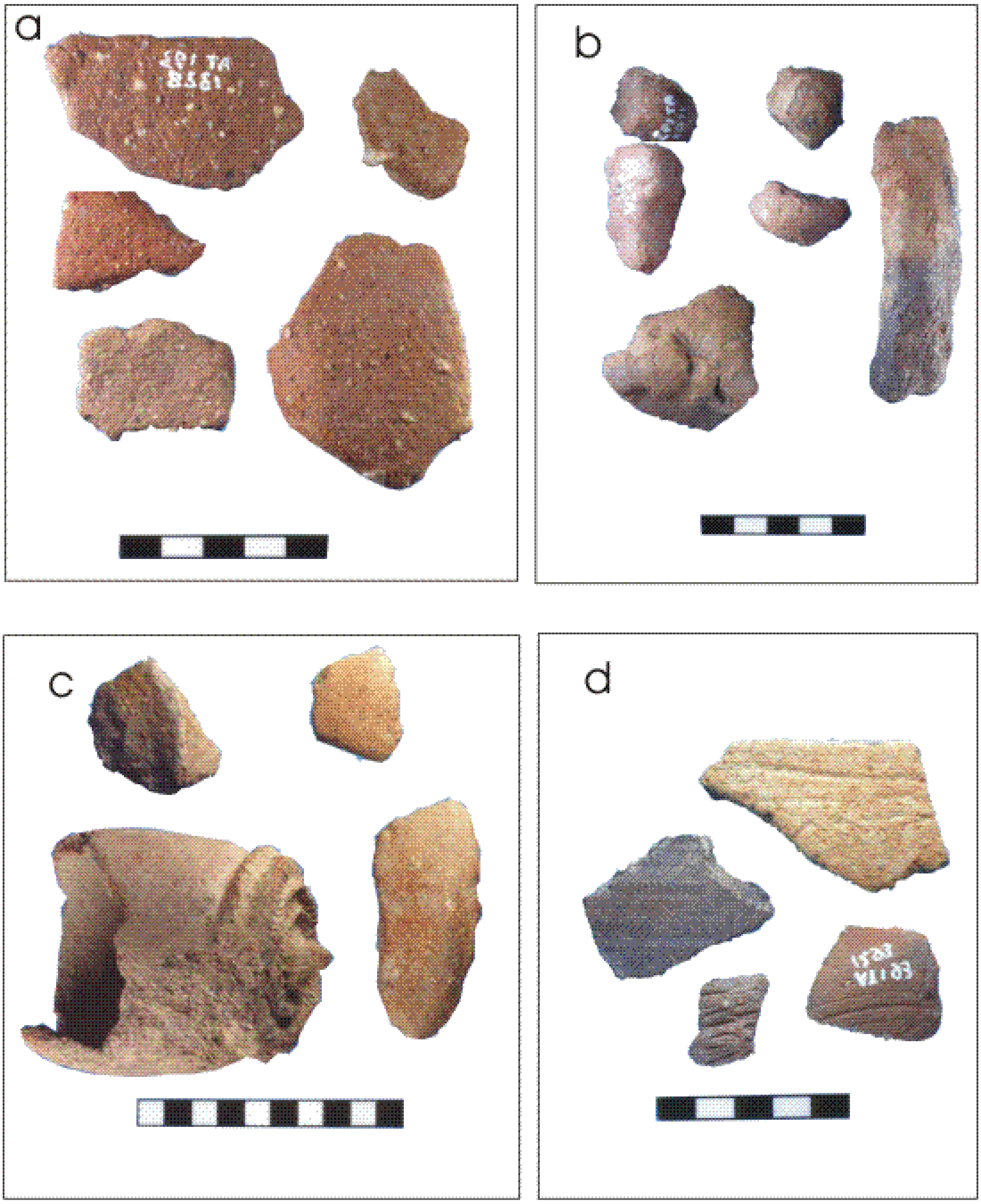



Plate 13. Atamora: modern potterie and terracotta recovered from the site

Plate 14.Atamora: Potsherds recovered during the excavation

# Appendix I

## Mechanical particle size analysis

Analytical Results

COARSE-GRAINED ANALYSIS DATA SHEET

Sample Name/No: 66/01 Depth -1.00m

Original Sample weight 40g

Dry Weight before sieving 22.41g

Weight of silt & clay 4.5g

| Microns | Phi (f) | Weight g. | Cumm. Weight | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 2.3 | 2.3 | 13.61 | 13.61 | |
| 2000 | -1.0 | 0.4 | 2.7 | 2.37 | 15.98 | |
| 1400 | -0.5 | 1.4 | 4.1 | 8.28 | 24.26 | Coarse Sand |
| 1000 | 0 | 2.3 | 6.4 | 13.61 | 37.87 | |
| 710 | +0.5 | 1.6 | 8.0 | 9.47 | 47.34 | |
| 500 | +1.0 | 2.5 | 10.5 | 14.79 | 62.13 | Medium Sand |
| 355 | +1.5 | 2.4 | 12.9 | 14.20 | 76.33 | |
| 250 | +2.0 | 1.7 | 15.6 | 10.06 | 86.39 | |
| 180 | +2.5 | 1.0 | 16.6 | 5.92 | 92.31 | |
| 125 | +3.0 | 0.4 | 17.0 | 2.37 | 94.68 | Fine Sand |
| 90 | +3.5 | 0.4 | 17.4 | 2.37 | 97.05 | |
| 63 | +4.0 | 0.4 | 17.8 | 2.37 | 99.42 | |
| <63 | Pan | 0.1 | 17.9 | 0.60 | 100.01 | |
| Total Weight | 16.9g | | | | | |
| % loss or gain | .04% | | | | | |

| | |
|---|---|
| Gravel | 12.05% |
| Sand | 67.82% |
| Silt & Clay | 20.08% |

7.5YR2/N/2
BLACK

Sample Name/No: 66/76 Depth -1.14m

Original Sample weight 40g

| | |
|---|---|
| Dry Weight before sieving | 35.59g |
| Weight of silt & clay | 4.9g |

| Microns | Phi (f) | Weight. g. | Cumm. Weight | Weight % | Cumm. Weight % | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | |
| 4000 | -2.0 | | | | | Gravel |
| 2800 | -1.5 | 4.6 | 4.6 | 14.88 | 14.88 | |
| 2000 | -1.0 | 3.7 | 8.3 | 11.97 | 26.85 | |
| 1400 | -0.5 | 3.7 | 12.0 | 11.97 | 38.82 | Coarse |
| 1000 | 0 | 3.7 | 15.7 | 11.97 | 50.79 | Sand |
| 710 | +0.5 | 3.7 | 19.4 | 11.97 | 62.76 | |
| 500 | +1.0 | 4.0 | 23.4 | 12.95 | 75.71 | Medium |
| 355 | +1.5 | 2.3 | 25.7 | 7.44 | 83.15 | Sand |
| 250 | +2.0 | 2.3 | 28.0 | 7.44 | 90.58 | |
| 180 | +2.5 | 1.6 | 29.6 | 5.18 | 95.77 | |
| 125 | +3.0 | 0.6 | 30.2 | 1.94 | 97.71 | Fine |
| 90 | +3.5 | 0.3 | 30.6 | .97 | 98.68 | Sand |
| 63 | +4.0 | 0.3 | 30.9 | .97 | 99.65 | |
| <63 | Pan | | | | | |
| Total Weight | 30.90g | | | | | |
| % loss or gain | 14.94% | | | | | |

| | |
|---|---|
| Gravel | 23.32% |
| Sand | 63.50% |
| Silt & Clay | 13.77% |

2.5YR5/5/4
LIGHT
OLIVE
BROWN

Sample Name/No: 173/30 Depth:1.49m

Original Sample weight _40g

Dry Weight before sieving 39.7g

Weight of silt & clay 15.4g

| Microns | Phi (f) | Weight. g. | Cumm. Weight g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | .3 | .3 | 1.24 | 1.24 | |
| 2000 | -1.0 | .4 | .7 | 1.65 | 2.89 | |
| 1400 | -0.5 | 1.2 | 1.9 | 4.96 | 7.85 | Coarse Sand |
| 1000 | 0 | 2.3 | 4.2 | 9.51 | 17.35 | |
| 710 | +0.5 | 3.3 | 7.5 | 13.64 | 30.99 | |
| 500 | +1.0 | 3.3 | 10.8 | 13.64 | 44.63 | Medium Sand |
| 355 | +1.5 | 3.2 | 14.0 | 13.22 | 57.85 | |
| 250 | +2.0 | 3.6 | 17.6 | 14.88 | 72.73 | |
| 180 | +2.5 | 2.4 | 20.0 | 9.92 | 82.65 | |
| 125 | +3.0 | 2.7 | 22.7 | 11.16 | 93.81 | Fine Sand |
| 90 | +3.5 | 1.0 | 23.7 | 4.13 | 97.94 | |
| 63 | +4.0 | .4 | 24.1 | 1.65 | 99.59 | |
| <63 | Pan | .1 | 24.2 | .41 | 100 | |
| Total Weight | 24.9g | | | | | |
| % loss or gain | .04% | | | | | |

Gravel 1.76%
Sand 59.19%
Silt & Clay 38.79%

10YR6/6/4
Light
Yellowish

Sample Name/No: 173/399 Depth: -1.63

Original Sample weight __40g

Dry Weight before sieving 39.32g

Weight of silt & clay 14g

| Microns | Phi (f) | Weight. g. | Cumm. Weight g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 1.5 | 1.5 | 5.93 | 5.93 | |
| 2000 | -1.0 | 1.3 | 2.8 | 5.14 | 11.07 | |
| 1400 | -0.5 | 1.8 | 4.6 | 7.12 | 18.19 | Coarse Sand |
| 1000 | 0 | 2.2 | 6.8 | 8.69 | 26.88 | |
| 710 | +0.5 | 3.2 | 10.0 | 12.65 | 39.53 | |
| 500 | +1.0 | 3.3 | 13.3 | 13.04 | 52.57 | Medium Sand |
| 355 | +1.5 | 3.3 | 16.6 | 13.04 | 65.61 | |
| 250 | +2.0 | 3.4 | 20.0 | 13.44 | 79.05 | |
| 180 | +2.5 | 2.2 | 22.2 | 8.69 | 87.74 | |
| 125 | +3.0 | 1.5 | 23.7 | 5.93 | 93.67 | Fine Sand |
| 90 | +3.5 | 1.0 | 24.7 | 3.95 | 97.62 | |
| 63 | +4.0 | .4 | 25.1 | 1.58 | 99.20 | |
| <63 | Pan | .2 | 25.3 | .79 | 100 | |
| Total Weight | 25.3g | | | | | |
| % loss or gain | .5% | | | | | |

| | |
|---|---|
| Gravel | .36% |
| Sand | 57.22% |
| Silt & Clay | 7.12% |

10YR5/5/3
Brown

Sample Name/No:173/533 Depth: -1.69m

Original Sample weight __40g

Dry Weight before sieving 39.42g

Weight of silt & clay 15.5g

| Microns | Phi (f) | Weight. G. | Cumm. Weight. G. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | |
| 4000 | -2.0 | | | | | Gravel |
| 2800 | -1.5 | 1.1 | 1.1 | 4.60 | 4.60 | |
| 2000 | -1.0 | 1.4 | 2.5 | 5.86 | 10.46 | |
| 1400 | -0.5 | 2.2 | 4.7 | 9.21 | 19.67 | Coarse |
| 1000 | 0 | 2.5 | 7.2 | 10.46 | 30.13 | Sand |
| 710 | +0.5 | 3.2 | 10.4 | 13.89 | 43.52 | |
| 500 | +1.0 | 3.5 | 13.9 | 14.64 | 68.14 | Medium |
| 355 | +1.5 | 3.2 | 17.1 | 13.89 | 71.55 | Sand |
| 250 | +2.0 | 2.9 | 20.00 | 12.13 | 83.68 | |
| 180 | +2.5 | 2.0 | 22.00 | 8.37 | 92.05 | |
| 125 | +3.0 | 1.0 | 23.00 | 4.18 | 96.23 | Fine |
| 90 | +3.5 | .6 | 23.60 | 2.51 | 98.74 | Sand |
| 63 | +4.0 | .2 | 23.80 | 12.13 | 99.58 | |
| <63 | Pan | .1 | 23.90 | .42 | 100 | |
| Total Weight | 23.90g | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 6.34% |
| Sand | 54.29% |
| Silt & Clay | 39.32% |

10YR6/6/4
Light Yellowish
Brown

Sample Name/No: 233/136 Depth:-1.26m

Original Sample weight 40g

Dry Weight before sieving 38.90g

Weight of silt & clay 7.50g

| Microns | Phi (f) | Weight g | Cumm. Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 2.7 | 2.7 | 8.63 | 8.63 | |
| 2000 | -1.0 | 3.5 | 6.2 | 11.18 | 19.81 | |
| 1400 | -0.5 | 2.7 | 8.9 | 8.65 | 28.44 | Coarse Sand |
| 1000 | 0 | 3.1 | 12.0 | 9.90 | 38.34 | |
| 710 | +0.5 | 3.8 | 15.8 | 12.14 | 50.48 | |
| 500 | +1.0 | 3.9 | 19.7 | 12.46 | 62.94 | Medium Sand |
| 355 | +1.5 | 3.6 | 23.3 | 11.50 | 74.44 | |
| 250 | +2.0 | 3.4 | 26.7 | 10.86 | 85.30 | |
| 180 | +2.5 | 2.1 | 28.8 | 6.71 | 92.01 | |
| 125 | +3.0 | 1.4 | 30.2 | 4.47 | 96.48 | Fine Sand |
| 90 | +3.5 | .7 | 30.9 | 2.24 | 98.72 | |
| 63 | +4.0 | .3 | 31.2 | .96 | 99.68 | |
| <63 | Pan | .1 | 31.3 | .32 | 100 | |
| Total Weight | 31.30g | | | | | |
| % loss or gain | .03% | | | | | |

| | |
|---|---|
| Gravel | 15.94% |
| Sand | 64.52% |
| Silt & Clay | 19.28% |

2.5YR/6/6/4
Light
Yellowish

Sample Name/No:233/320 Depth: -1.41m

Original Sample weight: 40g

| | | |
|---|---|---|
| Dry Weight before sieving | 39.92g | |
| Weight of silt & clay | | 14.2g |

| Microns | Phi (f) | Weight G. | Cumm. Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 1.2 | 1.3 | 4.67 | 4.67 | |
| 2000 | -1.0 | 1.8 | 3.0 | 7.00 | 11.67 | |
| 1400 | -0.5 | 3.2 | 6.2 | 12.45 | 24.12 | Coarse Sand |
| 1000 | 0 | 2.6 | 8.8 | 10.12 | 34.24 | |
| 710 | +0.5 | 2.8 | 11.6 | 10.89 | 45.13 | |
| 500 | +1.0 | 2.4 | 14.0 | 9.34 | 54.47 | Medium Sand |
| 355 | +1.5 | 2.7 | 16.7 | 10.50 | 64.98 | |
| 250 | +2.0 | 3.1 | 19.8 | 12.06 | 77.04 | |
| 180 | +2.5 | 2.1 | 21.9 | 8.17 | 85.21 | |
| 125 | +3.0 | 1.7 | 23.6 | 6.61 | 91.82 | Fine Sand |
| 90 | +3.5 | 1.1 | 24.7 | 4.28 | 96.10 | |
| 63 | +4.0 | .7 | 25.4 | 2.72 | 98.82 | |
| <63 | Pan | .3 | 25.7 | 1.17 | 100 | |
| Total Weight | 25.7g | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 7.52% |
| Sand | 56.86% |
| Silt & Clay | 35.57% |

5/5/4
Yellowish
Brown

Sample Name/No: 233/467 Sample location: -1.58m

Original Sample weight: 40g

Dry Weight before sieving 39.62g

Weight of silt & clay 15.4 g

| Microns | Phi (f) | | Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 3.3 | 3.3 | 13.64 | 13.64 | |
| 2000 | -1.0 | 1.8 | 5.1 | 7.44 | 21.08 | |
| 1400 | -0.5 | 2.3 | 7.4 | 9.50 | 30.58 | Coarse Sand |
| 1000 | 0 | 2.4 | 9.8 | 9.92 | 40.50 | |
| 710 | +0.5 | 2.8 | 12.6 | 11.57 | 52.07 | |
| 500 | +1.0 | 2.7 | 15.3 | 11.16 | 63.23 | Medium Sand |
| 355 | +1.5 | 2.4 | 17.7 | 9.92 | 73.15 | |
| 250 | +2.0 | 2.5 | 20.2 | 10.33 | 83.48 | |
| 180 | +2.5 | 1.7 | 21.9 | 7.02 | 90.51 | |
| 125 | +3.0 | 1.1 | 23.0 | 4.55 | 95.06 | Fine Sand |
| 90 | +3.5 | .7 | 23.7 | 2.89 | 97.95 | |
| 63 | +4.0 | .3 | 24.0 | 1.24 | 99.19 | |
| <63 | Pan | .2 | 24.2 | .83 | 100 | |
| Total Weight | 24.2g | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 12.87% |
| Sand | 48.21% |
| Silt & Clay | 38.87% |

2.YR7/7/6
Yellow

Sample Name/No 253/2 Depth -1,46m

Original Sample weight: 40g

| | |
|---|---|
| Dry Weight before sieving | 39.32g |
| Weight of silt & clay | 7.6g |

| Microns | Phi (f) | Weight G | Cumm. Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 3.8 | 3.8 | 11.98 | 11.98 | |
| 2000 | -1.0 | 2.4 | 6.2 | 7.57 | 19.55 | |
| 1400 | -0.5 | 2.4 | 8.7 | 7.89 | 27.44 | Coarse Sand |
| 1000 | 0 | 2.8 | 11.5 | 8.83 | 36.27 | |
| 710 | +0.5 | 3.7 | 15.2 | 11.67 | 47.94 | |
| 500 | +1.0 | 3.7 | 18.9 | 11.67 | 59.61 | Medium Sand |
| 355 | +1.5 | 3.7 | 22.6 | 11.67 | 71.28 | |
| 250 | +2.0 | 4.0 | 26.6 | 12.62 | 83.90 | |
| 180 | +2.5 | 2.3 | 28.9 | 7.26 | 91.16 | |
| 125 | +3.0 | 1.6 | 30.5 | 5.05 | 96.20 | Fine Sand |
| 90 | +3.5 | .8 | 31.3 | 2.52 | 98.72 | |
| 63 | +4.0 | .3 | 31.6 | .95 | 99.67 | |
| <63 | Pan | .1 | 31.7 | .32 | 100 | |
| Total Weight | 31.7g | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 15.77% |
| Sand | 64.85% |
| Silt & Clay | 19.33% |

2.5YR6/6/4
light
Yellowish

Sample Name/No: 253/655 Depth -1.25m
Original Sample weight 40g

Dry Weight before sieving 39.9 g

Weight of silt & clay 8.00 g

| Microns | Phi (f) | | Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | |
| 4000 | -2.0 | | | | | Gravel |
| 2800 | -1.5 | 1.4 | 1.4 | 4.3 | 4.39 | |
| 2000 | -1.0 | 1.6 | 3.0 | 5.02 | 9.41 | |
| 1400 | -0.5 | 2.4 | 5.4 | 7.52 | 16.93 | Coarse Sand |
| 1000 | 0 | 2.9 | 8.3 | 9.09 | 26.02 | |
| 710 | +0.5 | 4.0 | 12.3 | 12.54 | 38.56 | |
| 500 | +1.0 | 4.6 | 16.9 | 14.42 | 52.98 | Medium Sand |
| 355 | +1.5 | 4.6 | 21.5 | 14.42 | 67.40 | |
| 250 | +2.0 | 4.6 | 26.1 | 14.42 | 81.82 | |
| 180 | +2.5 | 2.5 | 28.6 | 7.84 | 89.66 | |
| 125 | +3.0 | 1.6 | 30.2 | 5.02 | 94.68 | Fine Sand |
| 90 | +3.5 | 1.0 | 31.2 | 3.31 | 97.82 | |
| 63 | +4.0 | .5 | 31.7 | 1.57 | 99.39 | |
| <63 | Pan | .2 | 31.9 | .63 | 100 | |
| Total Weight | 31.9g | | | | | |
| % loss or gain | .01% | | | | | |

Gravel 13.53%
Sand 66.38%
Silt & Clay 20.04%

10YR5/5/3
Brown

Sample Name/No: 253/566 Depth -1,42m
Original Sample weight 40g

Dry Weight before sieving 39.22 g
Weight of silt & clay 15.8g

| Microns | Phi (f) | Weight. g. | Cumm.g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | .2 | .2 | .86 | .86 | |
| 2000 | -1.0 | .4 | .6 | 1.71 | 2.57 | |
| 1400 | -0.5 | 1.3 | 2.1 | 5.56 | 8.13 | Coarse Sand |
| 1000 | 0 | 2.1 | 4.2 | 8.97 | 17.10 | |
| 710 | +0.5 | 3.0 | 7.2 | 12.82 | 29.92 | |
| 500 | +1.0 | 3.1 | 10.3 | 13.25 | 43.17 | Medium Sand |
| 355 | +1.5 | 3.4 | 13.7 | 14.53 | 57.70 | |
| 250 | +2.0 | 4 | 17.7 | 17.09 | 74.80 | |
| 180 | +2.5 | 2.4 | 21.1 | 10.26 | 85.07 | |
| 125 | +3.0 | 1.5 | 21.6 | 6.42 | 91.48 | Fine Sand |
| 90 | +3.5 | 1.0 | 22.6 | 4.27 | 95.75 | |
| 63 | +4.0 | .6 | 23.2 | 2.56 | 98.31 | |
| <63 | Pan | .2 | 23.4 | .86 | 100 | |
| Total Weight | 23.4 | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 1.53% |
| Sand | 58.13% |
| Silt & Clay | 40.29% |

10YR7/7/4
Very Pale
Brown

Sample Name/No: 253/893 Depth -1,58m
Original Sample weight 40g

Dry Weight before sieving 37.8g
Weight of silt & clay 12.4g

| Microns | Phi (f) | | Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 1.2 | 1.2 | 4.76 | 4.76 | |
| 2000 | -1.0 | 1.3 | 2.5 | 5.16 | 9.92 | |
| 1400 | -0.5 | 1.7 | 4.2 | 6.75 | 16.67 | Coarse Sand |
| 1000 | 0 | 2.4 | 6.6 | 9.52 | 26.19 | |
| 710 | +0.5 | 2.4 | 9.0 | 9.52 | 35.71 | |
| 500 | +1.0 | 2.4 | 11.4 | 9.52 | 45.23 | Medium Sand |
| 355 | +1.5 | 2.4 | 13.8 | 9.52 | 54.75 | |
| 250 | +2.0 | 5.4 | 19.2 | 21.43 | 76.18 | |
| 180 | +2.5 | 2.4 | 21.6 | 9.52 | 85.70 | |
| 125 | +3.0 | 1.4 | 23.0 | 5.56 | 91.26 | Fine Sand |
| 90 | +3.5 | 1.4 | 24.4 | 5.56 | 96.82 | |
| 63 | +4.0 | .4 | 24.8 | 1.59 | 98.41 | |
| <63 | Pan | .4 | 25.2 | 1.59 | 100 | |
| Total Weight | 25.2g | | | | | |
| % loss or gain | .53% | | | | | |

| | |
|---|---|
| Gravel | 6.61% |
| Sand | 60.05% |
| Silt & Clay | 32.80% |

2.5YR6/6/6
Olive
Yellow

Sample Name/No: 227/2 Depth -1,06m

Original Sample weight: 40g

Dry Weight before sieving 39.12 g

Weight of silt & clay 10g

| Microns | Phi (f) | Weight g | Cumm. Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | .8 | .8 | 2.75 | 2.75 | |
| 2000 | -1.0 | .6 | 1.4 | 2.06 | 4.81 | |
| 1400 | -0.5 | 1.4 | 2.8 | 4.81 | 9.62 | Coarse Sand |
| 1000 | 0 | 2.7 | 5.5 | 9.28 | 18.90 | |
| 710 | +0.5 | 3.8 | 9.3 | 13.06 | 31.96 | |
| 500 | +1.0 | 3.7 | 13.0 | 12.71 | 44.67 | Medium Sand |
| 355 | +1.5 | 3.8 | 16.8 | 13.06 | 57.73 | |
| 250 | +2.0 | 5.8 | 22.6 | 19.93 | 77.66 | |
| 180 | +2.5 | 2.2 | 22.6 | 7.56 | 85.22 | |
| 125 | +3.0 | 2.2 | 24.8 | 7.56 | 92.78 | Fine Sand |
| 90 | +3.5 | 1.3 | 28.1 | 4.47 | 97.25 | |
| 63 | +4.0 | .6 | 28.7 | 2.06 | 99.31 | |
| <63 | Pan | .2 | 28.9 | .69 | 100 | |
| Total Weight | 29.1g | | | | | |
| % loss or gain | .05% | | | | | |

Gravel 3.57%
Sand 70.81%
Silt & Clay 25.56%

**2.5 YR 7/4**
**Pale yellow**

Sample Name/No: 233/44 Depth: -1.15m

Original Sample weight: 40g

Dry Weight before sieving 36.8g

Weight of silt & clay 16g

| Microns | Phi (f) | | Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | .9 | .9 | 4.37 | 4.37 | |
| 2000 | -1.0 | .4 | 1.3 | 1.94 | 6.31 | |
| 1400 | -0.5 | .9 | 2.2 | 4.37 | 10.68 | Coarse Sand |
| 1000 | 0 | 1.3 | 3.5 | 6.31 | 16.99 | |
| 710 | +0.5 | 2.1 | 5.6 | 10.19 | 27.18 | |
| 500 | +1.0 | 2.7 | 8.3 | 13.11 | 40.29 | Medium Sand |
| 355 | +1.5 | 3.3 | 11.6 | 16.02 | 56.31 | |
| 250 | +2.0 | 4.0 | 15.6 | 19.42 | 75.73 | |
| 180 | +2.5 | 2.7 | 18.3 | 13.12 | 88.84 | |
| 125 | +3.0 | 1.4 | 19.7 | 6.80 | 95.64 | Fine Sand |
| 90 | +3.5 | .6 | 20.3 | 2.91 | 98.55 | |
| 63 | +4.0 | .2 | 20.5 | .97 | 99.52 | |
| <63 | Pan | .1 | 20.6 | .49 | 100 | |
| Total Weight | 20.6g | | | | | |
| % loss or gain | .54% | | | | | |

| | |
|---|---|
| Gravel | 3.53% |
| Sand | 54.45% |
| Silt & Clay | 43.48% |

2.5 YR 5/4
Light Olive

Sample Name/No 227/153 Depth: -1.38m

Original Sample weight 40g

Dry Weight before sieving 38.81 g
Weight of silt & clay 13.9g

| Microns | Phi (f) | Weight. g. | | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | Gravel |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | .4 | .4 | 1.61 | 1.61 | |
| 2000 | -1.0 | .7 | 1.1 | 2.81 | 4.42 | |
| 1400 | -0.5 | 1.3 | 2.4 | 5.22 | 9.64 | Coarse Sand |
| 1000 | 0 | 2.7 | 5.1 | 10.84 | 20.48 | |
| 710 | +0.5 | 3.2 | 8.3 | 12.85 | 33.33 | |
| 500 | +1.0 | 3.0 | 11.3 | 12.05 | 45.38 | Medium Sand |
| 355 | +1.5 | 3.1 | 14.4 | 12.44 | 57.83 | |
| 250 | +2.0 | 4.9 | 19.3 | 19.68 | 77.51 | |
| 180 | +2.5 | 2.0 | 21.3 | 8.03 | 85.54 | |
| 125 | +3.0 | 1.5 | 22.8 | 6.15 | 91.69 | Fine Sand |
| 90 | +3.5 | 1.3 | 24.1 | 5.22 | 96.91 | |
| 63 | +4.0 | .4 | 24.5 | 1.61 | 98.52 | |
| <63 | Pan | .4 | 24.9 | 1.61 | 100 | |
| Total Weight | 24.9g | | | | | |
| % loss or gain | .03% | | | | | |

| | |
|---|---|
| Gravel | 2.83% |
| Sand | 61.32% |
| Silt & Clay | 35.82% |

10 YR 6/4
Light Yellowish Brown

Sample Name/No 227/196 Depth: -1.57m

Original Sample weight 40g

Dry Weight before sieving 39.02g
Weight of silt & clay 13g

| Microns | Phi (f) | | Weight. g. | Weight % | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | |
| 4000 | -2.0 | | | | | Gravel |
| 2800 | -1.5 | .4 | .4 | 1.54 | 1.54 | |
| 2000 | -1.0 | .7 | 1.1 | 2.69 | 4.23 | |
| 1400 | -0.5 | 1.3 | 2.4 | 5.00 | 9.23 | Coarse |
| 1000 | 0 | 2.5 | 4.9 | 9.62 | 18.85 | Sand |
| 710 | +0.5 | 3.2 | 8.1 | 12.31 | 31.16 | |
| 500 | +1.0 | 3.3 | 11.4 | 12.69 | 43.85 | Medium |
| 355 | +1.5 | 3.5 | 14.9 | 13.46 | 57.31 | Sand |
| 250 | +2.0 | 5.0 | 19.9 | 19.46 | 76.55 | |
| 180 | +2.5 | 2.3 | 22.2 | 8.85 | 85.4 | |
| 125 | +3.0 | 1.7 | 23.9 | 6.54 | 91.94 | Fine Sand |
| 90 | +3.5 | 1.3 | 25.2 | 5.00 | 96.94 | |
| 63 | +4.0 | .6 | 25.8 | 2.31 | 99.25 | |
| <63 | Pan | .2 | 26.0 | .77 | 100 | |
| Total Weight | 26g | | | | | |
| % loss or gain | .05% | | | | | |

| | |
|---|---|
| Gravel | 2.82% |
| Sand | 63.81% |
| Silt & Clay | 33.32% |

2.5YR 6/4
Light
Yellowish

Sample Name/No: 280/01 Depth: .55m
Original Sample weight 40g

| | |
|---|---|
| Dry Weight before sieving | 34.47g |
| Weight of silt & clay | 5.5g |

| Microns | Phi (f) | Weight. g. | Weight % | | Cumm. Weight% | |
|---|---|---|---|---|---|---|
| 16000 | -4.0 | | | | | Gravel |
| 11200 | -3.5 | | | | | |
| 8000 | -3.0 | | | | | |
| 5600 | -2.5 | | | | | |
| 4000 | -2.0 | | | | | |
| 2800 | -1.5 | 1.4 | 1.4 | 4.83 | 4.83 | |
| 2000 | -1.0 | 1.6 | 3.0 | 5.52 | 10.35 | |
| 1400 | -0.5 | 2.4 | 5.4 | 8.28 | 18.63 | Coarse Sand |
| 1000 | 0 | 3.3 | 8.7 | 11.38 | 30.01 | |
| 710 | +0.5 | 3.3 | 12.08 | 11.38 | 41.39 | |
| 500 | +1.0 | 3.3 | 15.3 | 11.38 | 52.77 | Medium Sand |
| 355 | +1.5 | 3.3 | 18.6 | 11.38 | 64.15 | |
| 250 | +2.0 | 4.6 | 23.2 | 15.86 | 80.01 | |
| 180 | +2.5 | 2.5 | 25.7 | 8.62 | 88.63 | Fine Sand |
| 125 | +3.0 | 1.4 | 27.1 | 4.83 | 97.46 | |
| 90 | +3.5 | 1.4 | 28.5 | 4.83 | 98.29 | |
| 63 | +4.0 | .5 | 29 | 1.72 | 100 | |
| <63 | Pan | - | - | | - | |
| Total Weight | 29 | | | | | |
| % loss or gain | .06% | | | | | |

2.5YR5/5/4
LIGHT
OLIVE

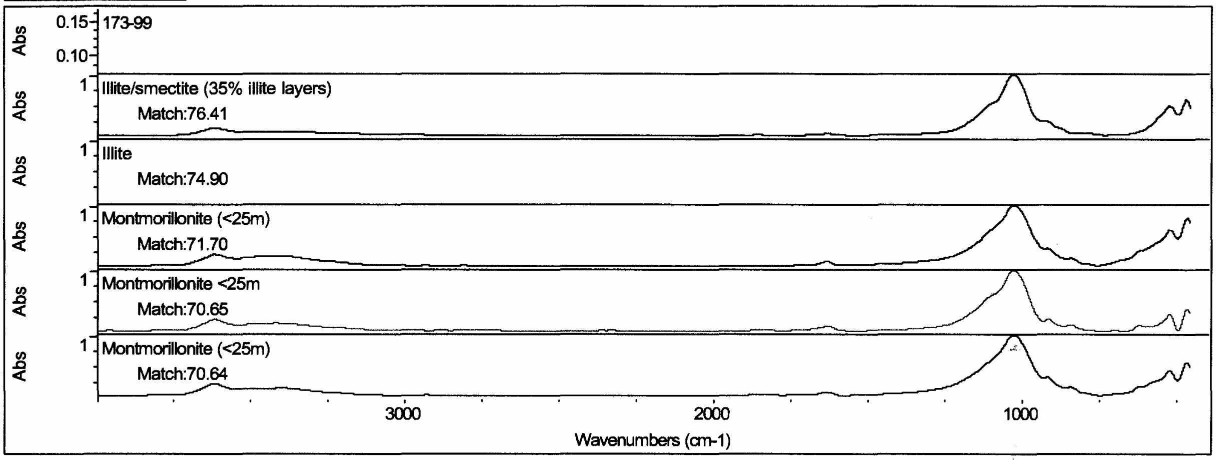
| | |
|---|---|
| Gravel | 8.70% |
| Sand | 75.43% |
| Silt & Clay | 16.96% |

# Appendix II

## Results of mineralogical analysis

Nicolet

Title: 173-99 Tue Jul 08 22:58:41 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

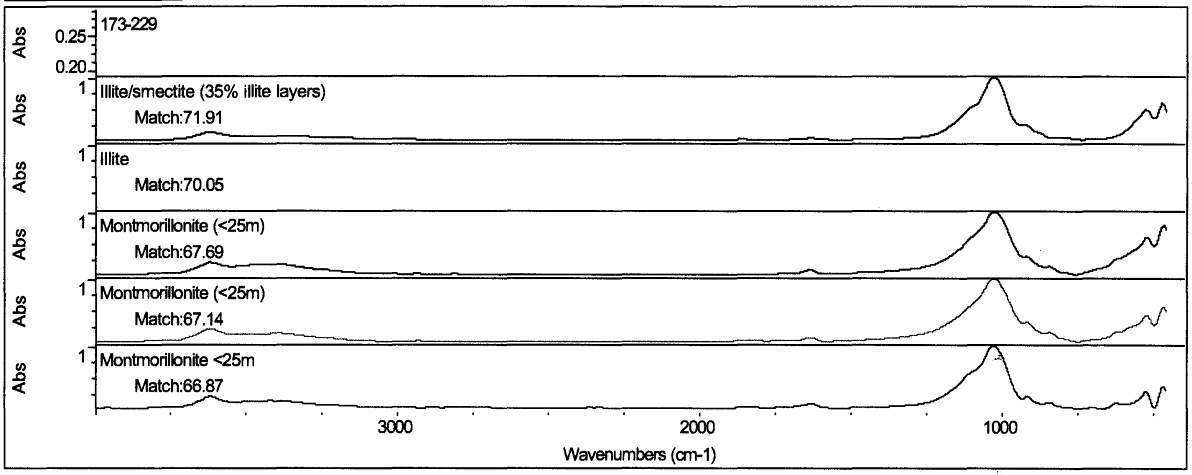
Spectrum: 173-99
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 76.41 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 74.90 | Illite | U.S. Geological Survey Minerals |
| 40 | 71.70 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 70.65 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 41 | 70.64 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 35 | 68.78 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 36 | 66.20 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 66 | 62.62 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 62.44 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 61.74 | Microcline | U.S. Geological Survey Minerals |

Nicolet

Title: 173-229

Tue Jul 08 23:01:35 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

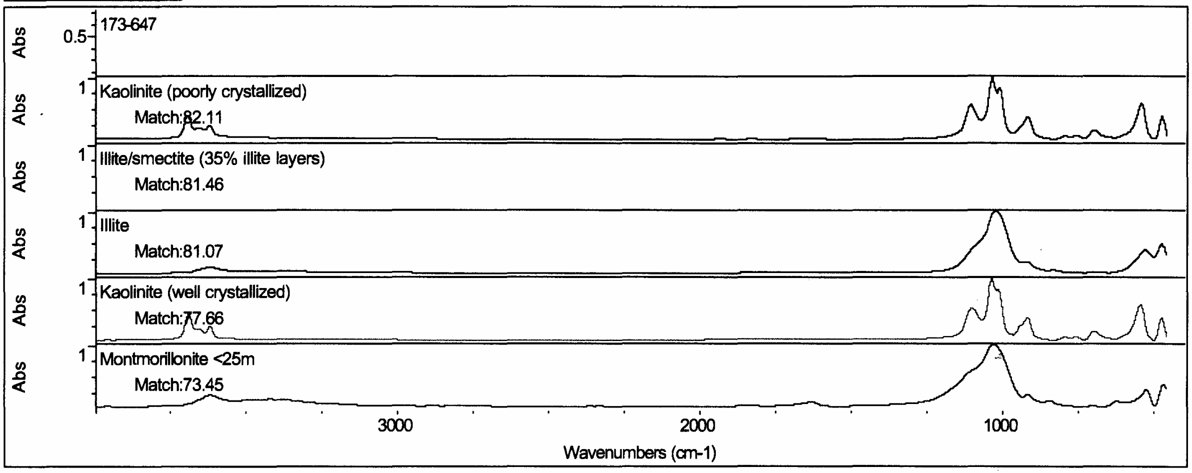
Spectrum: 173-229
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 71.91 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 70.05 | Illite | U.S. Geological Survey Minerals |
| 40 | 67.69 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 67.14 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 66.87 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 56 | 63.83 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 66 | 63.82 | Sanidine | U.S. Geological Survey Minerals |
| 39 | 62.29 | Microcline | U.S. Geological Survey Minerals |
| 65 | 62.26 | Sanidine | U.S. Geological Survey Minerals |
| 35 | 58.22 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |

Nicolet

Title: 173-647

Tue Jul 08 23:03:26 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

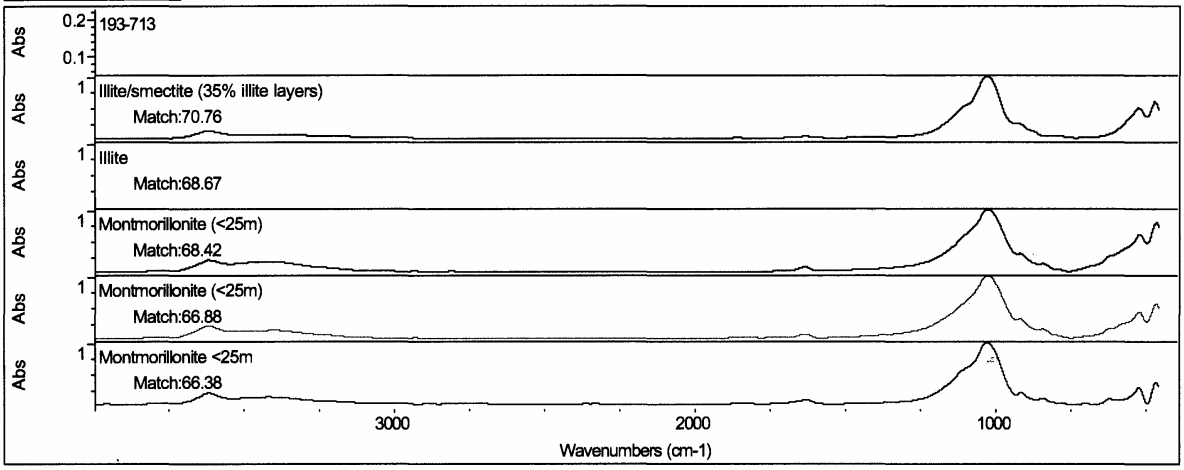
Spectrum: 173-647
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 35 | 82.11 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 34 | 81.46 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 81.07 | Illite | U.S. Geological Survey Minerals |
| 36 | 77.66 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 42 | 73.45 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 40 | 73.19 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 72.83 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 66 | 65.90 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 65.62 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 64.94 | Microcline | U.S. Geological Survey Minerals |

Nicolet

Title: 193-713

Tue Jul 08 23:10:47 2003

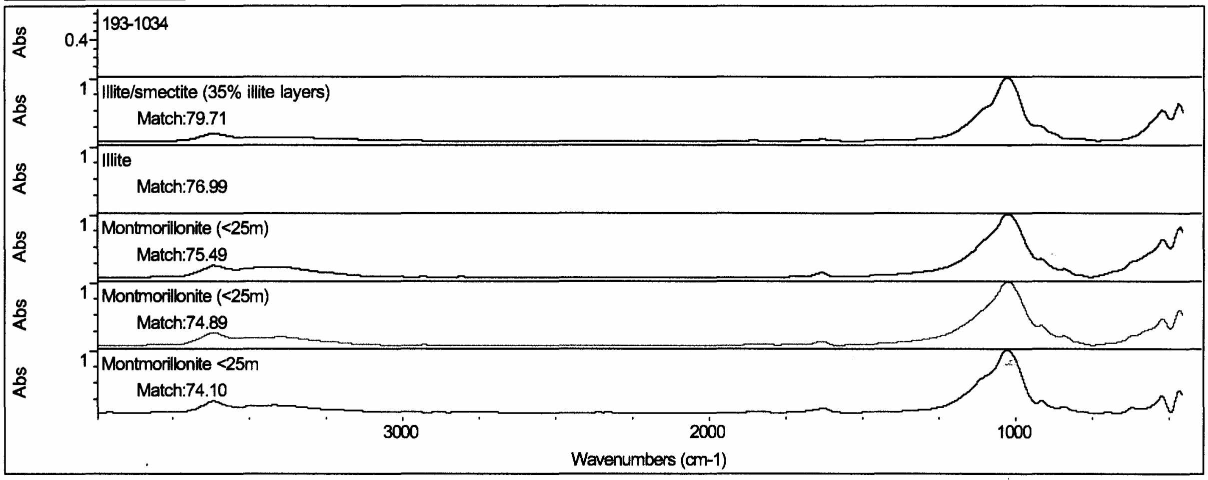



User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

Spectrum: 193-713
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 70.76 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 68.67 | Illite | U.S. Geological Survey Minerals |
| 40 | 68.42 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 66.88 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 66.38 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 56 | 64.81 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 64.72 | Microcline | U.S. Geological Survey Minerals |
| 66 | 64.15 | Sanidine | U.S. Geological Survey Minerals |
| 65 | 62.86 | Sanidine | U.S. Geological Survey Minerals |
| 35 | 59.00 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |

Nicolet Title: 193-1034 Tue Jul 08 23:11:32 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

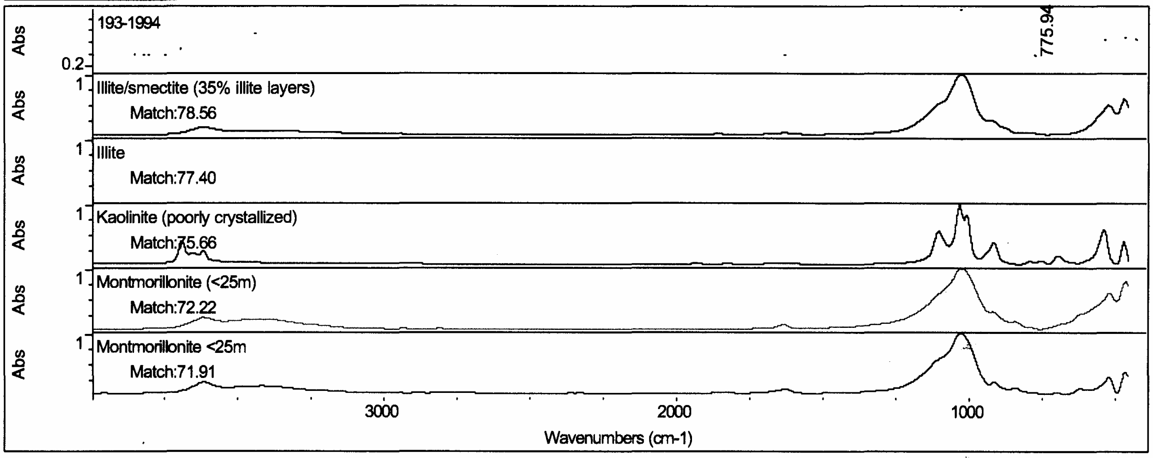
Spectrum: 193-1034
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 79.71 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 76.99 | Illite | U.S. Geological Survey Minerals |
| 40 | 75.49 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 74.89 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 74.10 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 66 | 70.41 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 70.19 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 69.68 | Microcline | U.S. Geological Survey Minerals |
| 35 | 69.13 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 65 | 67.54 | Sanidine | U.S. Geological Survey Minerals |

Nicolet

Title: 193-1994

Tue Jul 08 23:12:28 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

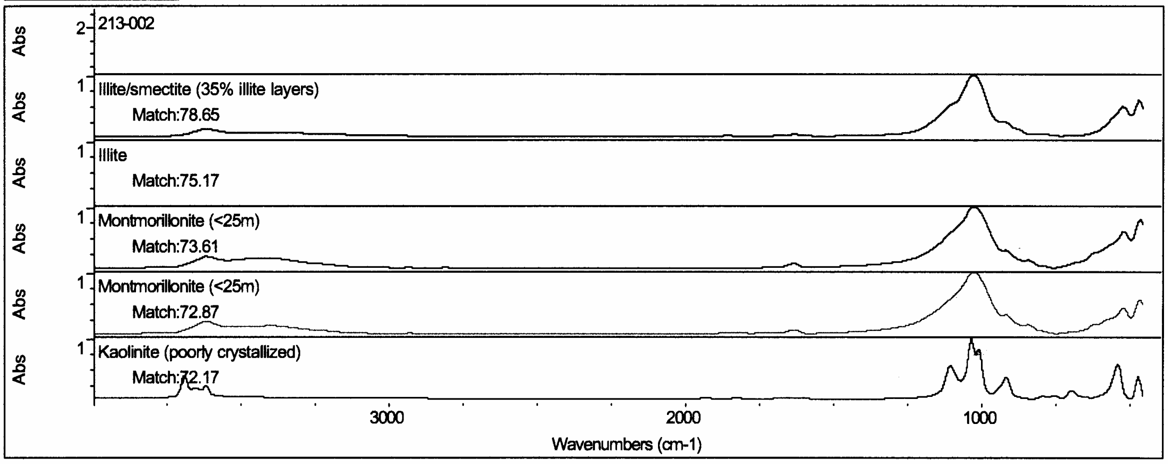
Spectrum: 193-1994
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 78.56 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 77.40 | Illite | U.S. Geological Survey Minerals |
| 35 | 75.66 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 40 | 72.22 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 71.91 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 41 | 71.68 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 36 | 70.64 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 56 | 64.80 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 66 | 64.59 | Sanidine | U.S. Geological Survey Minerals |
| 39 | 63.72 | Microcline | U.S. Geological Survey Minerals |

Nicolet

Title: 213-002

Tue Jul 08 23:16:38 2003



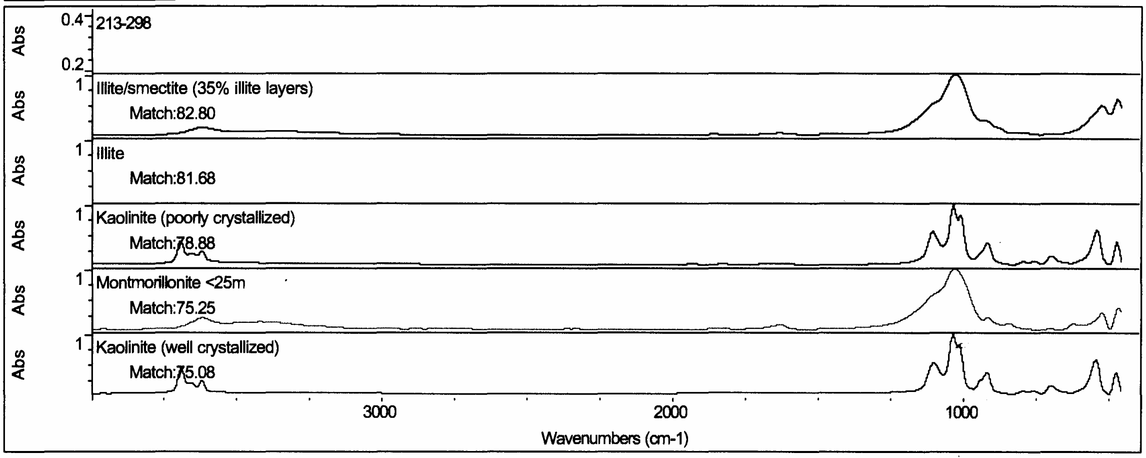

User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

Spectrum: 213-002
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 78.65 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 75.17 | Illite | U.S. Geological Survey Minerals |
| 40 | 73.61 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 72.87 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 35 | 72.17 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 42 | 72.15 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 39 | 68.70 | Microcline | U.S. Geological Survey Minerals |
| 56 | 68.42 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 66 | 68.23 | Sanidine | U.S. Geological Survey Minerals |
| 36 | 67.63 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |

Nicolet

Title: 213-298 Tue Jul 08 23:18:49 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

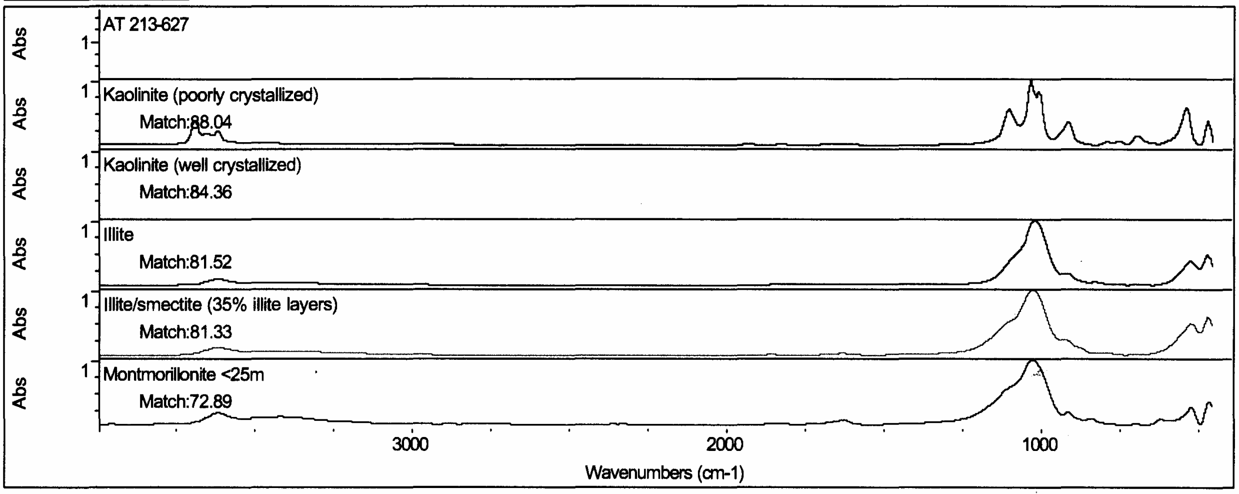
Spectrum: 213-298
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 82.80 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 81.68 | Illite | U.S. Geological Survey Minerals |
| 35 | 78.88 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 42 | 75.25 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 36 | 75.08 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 40 | 74.97 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 74.87 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 66 | 65.19 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 64.90 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 63.33 | Microcline | U.S. Geological Survey Minerals |

Nicolet

Title: AT 213-627

Tue Jul 08 22:43:20 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

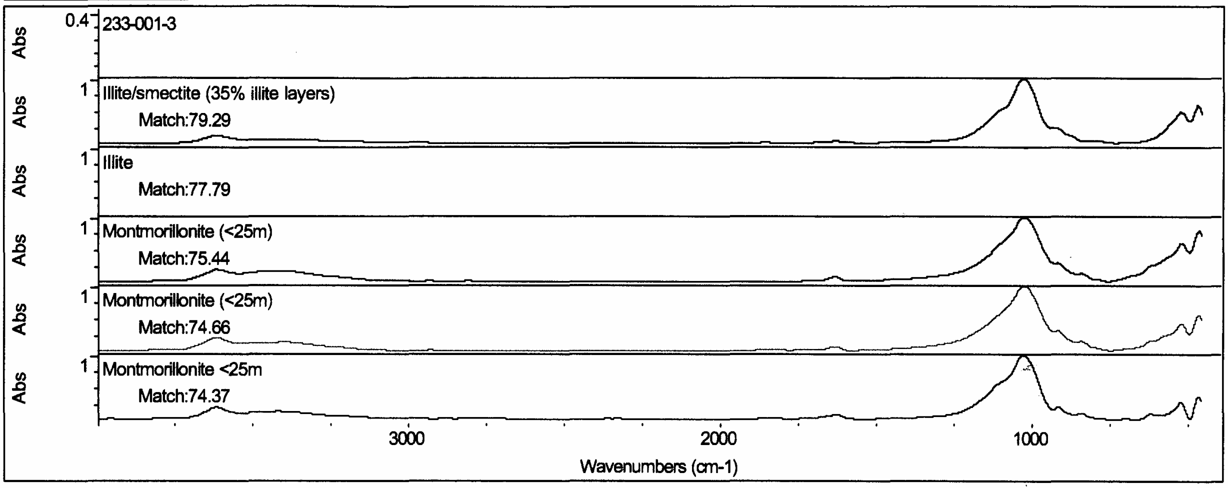
Spectrum: AT 213-627
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 35 | 88.04 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 36 | 84.36 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 33 | 81.52 | Illite | U.S. Geological Survey Minerals |
| 34 | 81.33 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 42 | 72.89 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 40 | 72.51 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 71.99 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 72 | 62.60 | Talc | U.S. Geological Survey Minerals |
| 43 | 61.51 | Muscovite | U.S. Geological Survey Minerals |
| 66 | 58.54 | Sanidine | U.S. Geological Survey Minerals |

Nicolet

Title: 233-001-3

Tue Jul 08 23:24:49 2003

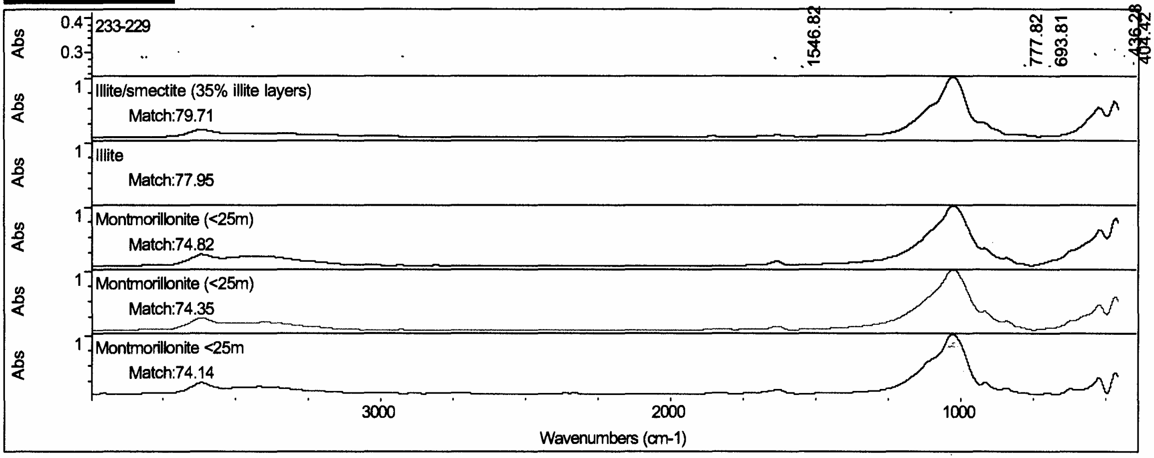



User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

Spectrum: 233-001-3
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 79.29 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 77.79 | Illite | U.S. Geological Survey Minerals |
| 40 | 75.44 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 74.66 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 74.37 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 39 | 71.13 | Microcline | U.S. Geological Survey Minerals |
| 56 | 70.44 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 66 | 70.44 | Sanidine | U.S. Geological Survey Minerals |
| 65 | 67.19 | Sanidine | U.S. Geological Survey Minerals |
| 35 | 64.89 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |

Nicolet Title: 233-229 Tue Jul 08 23:26:04 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

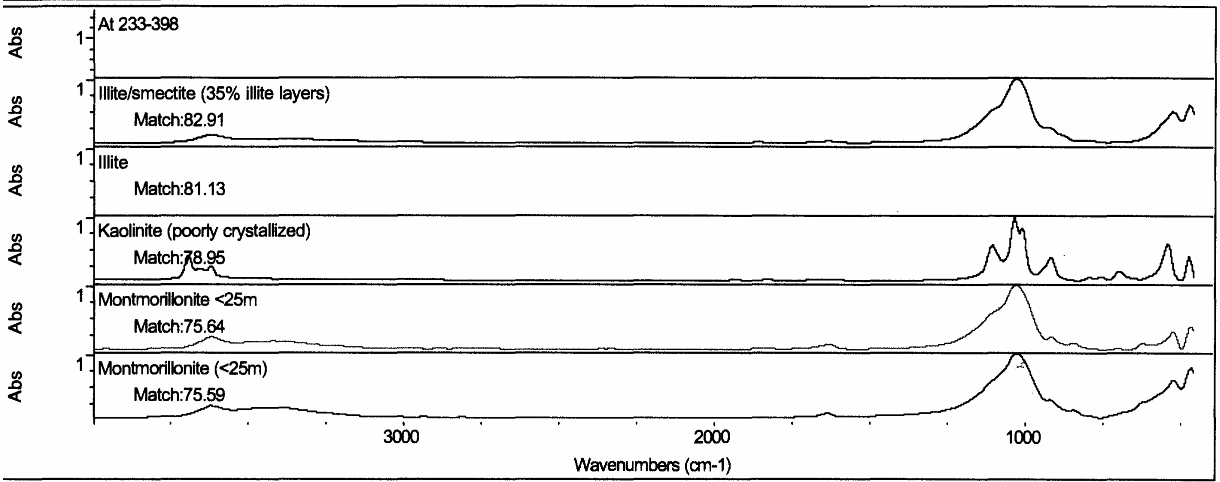
Spectrum: 233-229
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 79.71 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 77.95 | Illite | U.S. Geological Survey Minerals |
| 40 | 74.82 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 74.35 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 74.14 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 35 | 66.21 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 66 | 65.81 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 65.57 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 39 | 64.12 | Microcline | U.S. Geological Survey Minerals |
| 36 | 63.70 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |

Nicolet

Title: At 233-398

Tue Jul 08 22:48:06 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

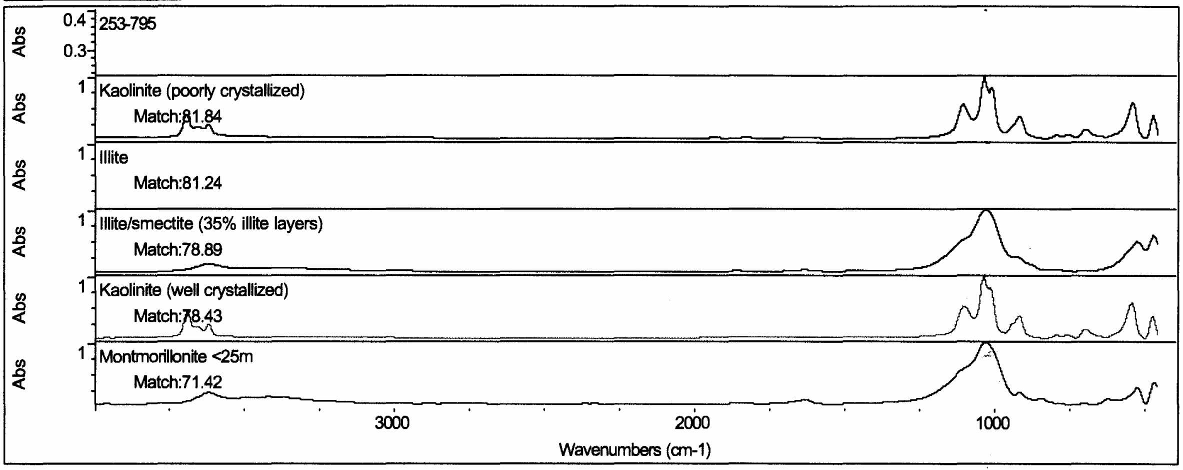
Spectrum: At 233-398
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 82.91 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 81.13 | Illite | U.S. Geological Survey Minerals |
| 35 | 78.95 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 42 | 75.64 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 40 | 75.59 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 75.46 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 36 | 74.54 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 56 | 70.73 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 66 | 70.46 | Sanidine | U.S. Geological Survey Minerals |
| 39 | 69.92 | Microcline | U.S. Geological Survey Minerals |

Nicolet

Title: 253-795

Tue Jul 08 23:29:13 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

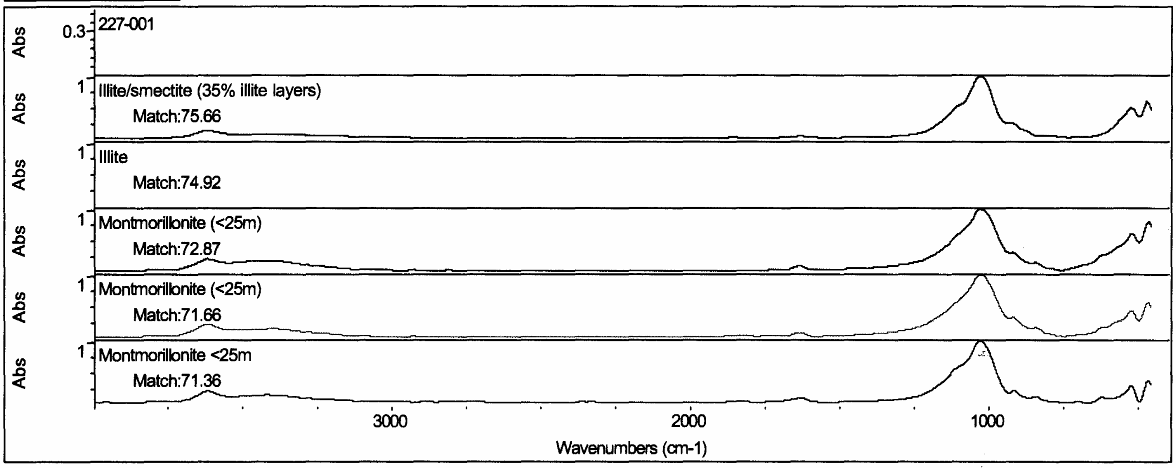
Spectrum: 253-795
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 35 | 81.84 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 33 | 81.24 | Illite | U.S. Geological Survey Minerals |
| 34 | 78.89 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 36 | 78.43 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 42 | 71.42 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 40 | 70.51 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 70.06 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 72 | 64.12 | Talc | U.S. Geological Survey Minerals |
| 43 | 59.79 | Muscovite | U.S. Geological Survey Minerals |
| 69 | 56.44 | Smectite | U.S. Geological Survey Minerals |

Nicolet

Title: 227-001

Tue Jul 08 23:19:28 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

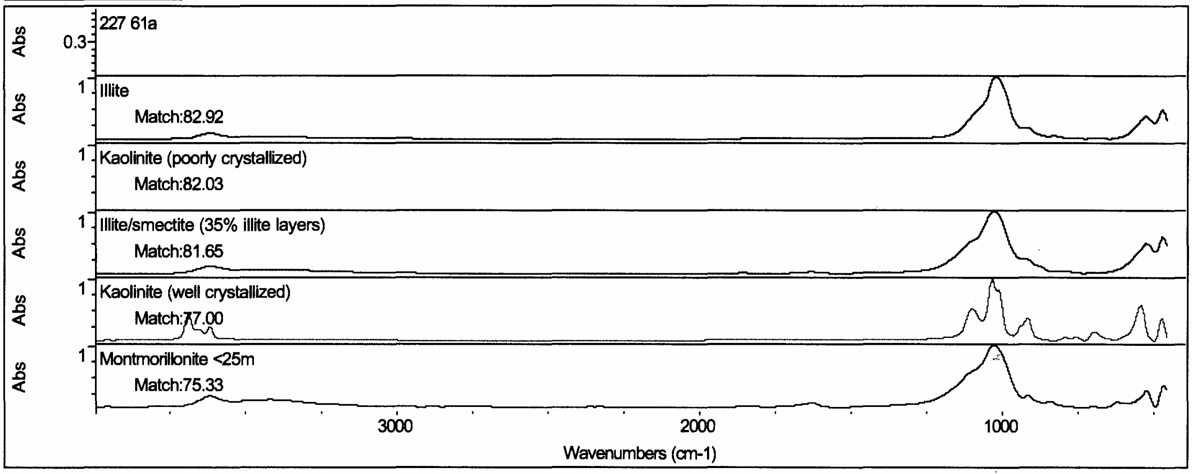
Spectrum: 227-001
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 34 | 75.66 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 33 | 74.92 | Illite | U.S. Geological Survey Minerals |
| 40 | 72.87 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 71.66 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 42 | 71.36 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 35 | 66.37 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 66 | 64.16 | Sanidine | U.S. Geological Survey Minerals |
| 56 | 63.32 | Orthoclase; Moonstone | U.S. Geological Survey Minerals |
| 65 | 62.80 | Sanidine | U.S. Geological Survey Minerals |
| 36 | 62.38 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |

Nicolet

Title: 227 61a

Tue Jul 08 23:23:29 2003




User name: Jere J Akpobasa
Number of sample scans: 32
Number of background scans: 32
Resolution: 4.000
Sample gain: 1.0
Mirror velocity: 0.6329
Aperture: 100.00

Spectrum: 227 61a
Region: 3995.85-455.13
Search type: Correlation
Hit List:

| Index | Match | Compound name | Library |
|---|---|---|---|
| 33 | 82.92 | Illite | U.S. Geological Survey Minerals |
| 35 | 82.03 | Kaolinite (poorly crystallized) | U.S. Geological Survey Minerals |
| 34 | 81.65 | Illite/smectite (35% illite layers) | U.S. Geological Survey Minerals |
| 36 | 77.00 | Kaolinite (well crystallized) | U.S. Geological Survey Minerals |
| 42 | 75.33 | Montmorillonite <25m | U.S. Geological Survey Minerals |
| 40 | 74.90 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 41 | 74.35 | Montmorillonite (<25m) | U.S. Geological Survey Minerals |
| 72 | 63.92 | Talc | U.S. Geological Survey Minerals |
| 43 | 62.77 | Muscovite | U.S. Geological Survey Minerals |
| 66 | 59.98 | Sanidine | U.S. Geological Survey Minerals |