

**HUMAN ADAPTIVE STRATEGIES IN EASTERN LAKE
TURKANA REGION DURING THE HOLOCENE PERIOD:
A MICROWEAR WEAR AND FUNCTIONAL ANALYSIS.**

BY

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**A PROJECT PAPER SUBMITTED IN PARTIAL
FULFILMENT FOR THE DEGREE OF MASTER OF ARTS
IN ARCHAEOLOGY UNIVERSITY OF NAIROBI.**

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DECLARATION

This is my original work and has not been presented for any degree at any other university.

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DEDICATION

This work is dedicated to my mother Grace Chepkesis Ndiema and all mothers throughout the world this millennium and beyond.

ACKNOWLEDGEMENTS

I am very grateful to all those people and institutions that in one-way or the other made this study a success. While I recognize my indebtedness to their contributions, it is not possible to mention all of them here. However, a few people and institutions deserve a mention.

First and foremost, I would like to express my gratitude to the University of Nairobi for awarding me a scholarship that made it possible to undertake the MA in archaeology. Indeed special thanks to Prof. M Achola (Chair, Department of History) for her support and encouragement. My supervisors, Dr. E Wahome and Mr. M. D. Kyule, tireless efforts to ensure that I got all the necessary literature for my work cannot be gainsaid. I also acknowledge the assistance of lecturers Gilbert Wafula, M. Amolo, Mulu Muia and George Odeny not forgetting the entire staff at the department.

No words can express my gratitude to Mr. and Mrs. John Wilson for all their support, love and kindness. They not only gave me fish but also taught me how to fish. I don't think I will ever be able to repay this debt in a lifetime I hope a **THANK YOU** will suffice in the meantime.

I am also indebted to Prof. Jack Harris (Head, Department of Anthropology Rutgers University) who offered me valuable advice in the field. He did not mind discussing with an ignorant student all the nuances of research and even offer a meal. I just want to say **Asante Sana mzee!**

I am also grateful to Dr. Karega Munene of Archaeology division at the National Museum of Kenya (NMK), who kindly allowed me to use materials from the Holocene sites of Koobi Fora. To all the staff at the division of archaeology NMK I say thank you.

I also take this opportunity to thank my colleagues especially Sinali Anthony for his ever encouraging phrase “pwana hiyo ni fit” it was the midnight oil that kept the study going. I salute Kirui, Wenani, Mwambu, Masinde, Purity,

Eunice, Nancy and many others that I cannot name. Ruth Mwihaki and Purity Kiura deserve special mention for their valuable advice and encouragement that helped to overcome the many hurdles that were on the way.

I am indebted to my mother, brothers, sisters and all relatives for the freedom of inquiry, tolerance, love and encouragement that helped me choose my own direction in life. To them all I am humbly grateful.

Finally I extend my gratitude to my fiancée Lillian Chepkwemoi for her understanding and putting up with my absence that forced us to delay tying the knot. Thank you for your patience and undying love.

TABLE OF CONTENTS

DECLARATION	I
DEDICATION.....	II
ACKNOWLEDGEMENTS	III
LIST OF TABLES	VII
LIST OF FIGURES.....	VII
ABSTRACT	VIII
CHAPTER ONE	I
INTRODUCTION.....	I
1.0: INTRODUCTION	1
1.2 PROBLEM STATEMENT	2
1.3 BACKGROUND TO RESEARCH	5
1.3.1 LSA comparisons	5
1.3.2 Micro-wear studies	6
1.4 CONTRIBUTIONS OF LITHIC ANALYSIS.....	8
1.5 CONCEPTUAL FRAMEWORK	10
1.5.1 Cultural Ecology	10
1.6: RESEARCH OBJECTIVES.....	12
1.7 HYPOTHESES	12
1.8 SITE DESCRIPTIONS.....	13
1.8.1 GaJj4 (Dangodien)	13
1.8.2 FwJj 5	15
1.8.3 GaJj12.....	16
1.8.4 FxJj 12N.....	17
1.9 EAST AFRICAN CLIMATE DURING THE HOLOCENE	17
1.10 SUMMARY	25
CHAPTER TWO	26
METHODOLOGY	26
2.0 EXPERIMENTAL REPLICATION AND EDGE WEAR STUDIES	26
2.1 FUNCTIONAL SIGNIFICANCE OF VARIABLES.....	26
2.2 EDGE MORPHOLOGY	27
2.3 REDUCTION EXPERIMENTS	28
2.4 UTILIZATION.....	32
2.5.1 Butchery and Dis-articulation.....	33
2.5.2 Wood cutting and shaping	35
2.6 LITHIC ANALYSIS	37
2.7 SUMMARY.....	39
CHAPTER THREE.....	40
DESCRIPTIVE ANALYSIS	40
3.0 TOOL FUNCTION AT SITE GAJj4, GAJj12, FWJj5 AND FXJj12N	48
3.1 SUMMARY.....	49
CHAPTER FOUR	50

DISCUSSION 50

4.1 CRAFTSMANSHIP AND ENERGY LEVELS..... 52

4.2 ABILITY AND INTELLIGENCE..... 53

CHAPTER FIVE..... 55

CONCLUSION 55

APPENDIX..... 59

6.0 DEFINITION OF TERMS 59

BIBLIOGRAPHY 60

List of Tables

1	Sites under study and their C14 dates.....	15
2	Percentage distribution of chert and Obsidian tools at GaJj4.....	41
3	Percentage distribution of chert and obsidian tools at FwJj5.....	42
4	Percentage distribution of chert and obsidian tools at GaJj12.....	43
5	Percentage distribution of chert and obsidian tools at FxJj12N.....	43
6	Occurrence of frequency within the sites under discussion	44
7	Inter-site variation in types and percentages.....	45
8	Tool edge angle and its degree of efficiency.....	45
9	Tool length in relation to edge angle efficiency ranking and the amount of micro edge wear among obsidian tools.....	46
10	Tool edge angle and its relative efficiency.....	47
11	Tool length in relation to edge angle efficiency ranking and the amount of micro edge wear among chert tools.....	49

9

List of figures

1	Lake Turkana Basin.	20
2	Location of sites under study.....	21
3	Correlated of stratigraphic sections.....	22
4	FxJj12N principal geological section.....	23
5	Stone artifacts from FxJj12N.....	24
6	Measurement of edge angle and edge length.....	31
7	Bipolar technique.....	32
8	Levallois technique.....	32

ABSTRACT

The reconstruction of past human behavioral patterns from material remains recovered from archaeological record is one of the major goals of archaeology. It is recognized that these patterns of human behavior are the result of a complex set of interplay between cultural and environmental factors. In order to achieve this goal, it is argued that the archaeologist must have a well-founded knowledge on how the recovered materials were used. In this study, I explore human adaptive strategies in resource exploitation using microlithics at the Galana Boi deposits (Holocene) within the Koobi Fora formation.

The sites that are examined in the eastern shores of Lake Turkana are, **GaJi4** at Dangodien, **FwJj5** at Ileret, **GaJi12** at Alia Bay and **FxJj12N** at Karari. This work is different from previous Barthelme (1983), Nelson (1973) done in the study area because of its approach, organization and treatment of data. Previous research for example Batherlme (1983) seemed to have paid attention to regional site comparisons with emphasis on land use patterns.

. Replicated tools are used to perform some tasks to find the micro edge damage which is compared with those formed on tools recovered from the archaeological record using a low power microscope at x40 magnification. This is important in shaping our understanding of the complex nature of the derived behavior patterns among the Holocene toolmakers.

Indeed functional and experimental studies provide an insight into the tasks that these tools might have performed. Based on the analysis of edge wear on

different tools from Levallois technology it appears quite well to accommodate the notion of highly skilled toolmakers.

Experimental and functional analysis of tools recovered from the Holocene deposits has brought up several issues relating to adaptive strategies. The data presented here is in line with more generalized subsistence strategy based on locally available resources. The idea of Levallois technique is found to be consistent with the specialized approach to subsistence but what can be inferred from stone manufacture and usage in the centralized location of the settlements. The level of artistic coordination is also found to be amazingly high.

CHAPTER ONE

INTRODUCTION

1.0: Introduction

This study attempts to understand human adaptive strategies East of Lake Turkana during the Holocene using comparative and replicate technological studies within sites at Allia Bay, Koobi Fora, Ileret and Karari respectively GaJj12, GaJj4, FwJj5 and FxJj12N (all of which lie between 3.9°N and 36°E). These sites have been classified as hunter-gatherer, fishing settlements and pastoral Neolithic sites (Barthelme 1983).

The Late Stone Age (LSA) in East Africa is characterized by standardization and specialized way of flaking artifacts (mainly microliths) from cores (Klein 1999). I have used this term (LSA) in this study because of it is a useful contribution to the cultural historical nomenclature of East Africa. As it helps to identify widespread and distinctive set of similar cultural traditions.

The most prominent artifacts of this time are small pointed backed bladelets and various types of scrappers that are at times accompanied by crescent shaped microliths (Clark 1977).

Unlike in the Early Pleistocene when hominids used raw materials indiscriminately (Toth 1982), during the Holocene there seems to have been a deliberate attempt to procure specific raw materials especially the cryptocrystalline silica. The ability to produce microliths from cores takes more

skills, strength and foresight than that of the Middle Stone Age (MSA) toolmakers (Toth 1982). This is because humans are not very good carnivores and thus it is important to use stone tools as a catalyst to gain access to food (meat and marrow) acquired through hunting or scavenging.

1.2 PROBLEM STATEMENT

Past research in the eastern shores of Lake Turkana (Leakey 1978, Isaac 1978, Bunn 1982, 1983, Toth 1982, Barthelme 1983, Rogers 1998) has demonstrated that there were unprecedented shifts in the distribution of sites, subsistence, economy, technology and social organizations of human populations. The complex behavioral patterns that are visible during the Holocene had therefore begun to manifest themselves way back in the Early Pleistocene (Keeley and Toth 1981:52.) through the kind of technologies that were used in the exploitation of different resources.

For efficient use of tools, there was need for the Holocene populations to select raw materials and produce tools that could carry out the tasks at hand. After making the tool, the toolmakers had to select the suitable edge for the tool. The limited understanding on the way(s) on which stone artifacts were used remains a major obstacle to full understanding of ancient human adaptive behavior. The archaeological material recovered is of little use in the study of human behavior unless used in tandem with other functions e.g. ecology and environment. This is because they only partially reflect human behavior.

Typological classification of artifacts is defined on morphological grounds with their functions being purely speculative. Lynch and Robbins (1975:175) acknowledge that stone artifact typologies are arbitrary classifications that are debatable. For example, which is the most important when describing a scrapper - the position of the working edge or the shape of the tool? Functional variability within a single morphological type is the norm within the various settlement groups of the Holocene. The mainly retouched and un-retouched pieces have microscopic edge damage or wear polishes (Keeley 1980) that may result during use.

Conventional tool typologies only give an approximate indication of function. Analysis is restricted to intentionally retouched pieces that cover a small portion of the tool used. Such analysis can give a very incomplete picture of the total site activity. It is generally accepted that most of the backed microlith artifacts were hafted or composite tools. Unfortunately, none of these has been found in the study area. Faunal evidence recovered from the Holocene sites includes bovids, warthogs (FxJj 14N), domesticated animals such as caprins and cattle (GaJj4 and FwJj5) fish bones (FxJj12N) and other animals (Barthelme 1983).

Studies by Toth and Schick (1980) in the early Pleistocene at the Karari Escarpment in the Koobi Fora region yielded faunal remains of wild animals almost the same taxa as those recovered by Barthelme. In their analysis, Toth *et al.* (1980), argued that the tools used to exploit these resources were larger than

those found in the Holocene deposits. Studies by Barthelme (1983), on the various Holocene sites do not indicate the presence of such large tools.

Hominids traveled for several kilometers in search of suitable raw materials for making tools (Bower 1984 as quoted in Ioth 1982). Can the efficiency of certain tools made from specific raw material be the reason that hominids had to travel long distances in search of specific raw materials for tool production? Does it also mean that the consumption pattern had changed drastically during the period (10,000-3,500 BP) that humans did not break bones for marrow? The outcome of this research will therefore help to answer these questions and clear or reinforce the arguments that currently engulf the use of these tools. Evidence of these and other studies will enhance our understanding of the interplay between climatic changes and human adaptation in the East Lake Turkana Basin during the late Pleistocene and Holocene epochs.

A critical look into Barthelme's (1983) comparative analysis shows a breakdown of artifactual materials from the various groups of sites. Due to John Barthelme's research objectives earlier mentioned in this document, Barthelme does not go a step further to look into inter-site variation especially in terms of types and percentages. This, in my opinion is crucial in the sense that by eliminating a host of other shaped tools such as *outicles ecailles*, cores and geometricals and instead focusing only on a narrow group of shaped stone tools it becomes possible to achieve inter site comparison in types and percentages.

1.3 BACKGROUND TO RESEARCH.

Paleo-anthropological research in Koobi Fora and indeed the entire Lake Turkana basin has a long history stretching back to the late 1960s when archaeological sites were discovered by Richard Leakey during an expedition to the Omo Delta in Ethiopia (Leakey 1978). Subsequent research has continued to take place unto the present (Isaac 1978, Harris 1978, Bunn 1982 Barthelme 1983, 1981 Feibel 1991, Rogers 1998, Harris, *et. al.* 2001).

1.3.1 LSA comparisons

It is interesting to note that only a few of the aforementioned scholars have based their research on Holocene deposits in the study area. Even those who have attempted to do so (Nelson 1973, Phillipson 1977, and Barthelme 1983) have focused their research on land use patterns, lithics technology and regional comparative studies as opposed to micro edge damage.

Charles Nelson (1973) documented patterns of artifact variability from twenty nine different LSA sites from Eastern and Southern Africa. However, Barthelme (1983) gives an account of all the Holocene sites in the Koobi Fora area. In his study, he reconstructed land use patterns and established a comparison of these Holocene sites with those at Ishango, Khartoum and in central and western Kenya.

1.3.2 Micro-wear studies

Micro-wear studies are said to be the brainchild of, Sergei Semenov (1964) who established this trend in the Soviet Union. From his work, it became clear that there existed a method of inferring tool use from microscopic traces on the used edge of a tool.

Tringham *et. al.* (1974), demonstrated that striations sometimes appeared slowly during use and at times did not appear at all. Instead of focusing on striations, they argued that attention should be paid to micro-flaking, which is the edge damage caused on tools depending on the material that it was worked on (Grace 1989). Tringham *et. al.* (1974) also based their studies on low power microscopy.

Basing on the findings from his research on the lower Paleolithic assemblages from Britain, Keeley (1980) advocated for high-power microscopy (over 400x), arguing that this would enable micro polishes that are distinctive to different materials to be studied. There have been other investigations on the Magdalen end scrapers (Hall 1993) but none came up with conclusive evidence on the use of microlithic tools.

Nicholas Toth (1981) used different tools from Koobi Fora to carry out experiments such as breaking bones for marrow, dis-articulation and de-fleshing using different artifacts. His research was however confined to the Early Pleistocene. Barut (1994) examined the changes in lithic raw materials procurement and use across the MSA/LSA transition and the relationship of

technological change to changing patterns of settlement and mobility. Amollo (2001) addressed the issue of flaking properties of different raw materials from two Middle Stone Age sites namely, Prospect Farm (GsJi7) in Rift Valley province and Muguruk (GqCi1) in Nyanza province (Kenya). The methods that the above scholars used were experimentation and were by large extend successful basing on the comments made at the end of their research (for Example Amolo 2001:166)

The most intensive microscopic examination on microliths done on sub Saharan Africa was that of mode 5 tools (Clark 1977) done at Chiwe Mupula in the Zambian Copper Belt (Phillipson 1977). However, the study was aimed at showing that the so-called “waste flakes” had actually been utilized.

From the above, we can conclude that the examination of wear patterns on suitable artifacts can give a great deal of information about tool functions. Despite the rich Holocene deposits in East Turkana, no study has been carried out on Holocene tools and how they relate to the human adaptive strategies. What forms the basis of this research is the veracity that we do not have enough information from site GaJj4, GaJj12, FxJj12N and FwJj5 to make a definitive statement concerning the subsistence strategy and the real use of these tools.

1.4 Contributions of lithic analysis

Lithics have a place in the study of present and extinct communities in the world (Toth 1980). This is because environmental conditions of preservation rarely control their presence. Lithics have been used as spatial and temporal indicators of the distribution and conduct of prehistoric groups Toth (1980).

Researchers have come to grapple with the grim reality that behavior is not preserved like bones in the archaeological chronicle but is only manifested on the tools that are recovered. Lithic analysis has also helped in reconstructing the distribution of prehistoric groups as well as their dietary and defense systems Toth (1980) Similarity and dissimilarity in stone tools have been used in the classification of what one might term as the major phases of human evolution (The Early Stone Age, Middle Stone Age and the Late stone Age). Stone artifacts are often found intact unlike ceramics that breaks easily into several pieces thus compromising analysis. Stone tools are easily available and are therefore likely to give a complete picture of the society under study. Such an advantageous use of stone tools has enabled archaeologist to formulate theories that form the basis for archaeological interpretations.

It should however be noted that experimental archaeology is not an isolated scholarly fad (Coles 1981) but genuine concern that has provided information on local and regional cultures. It is therefore hoped that this research teamed up with that of other researchers, has gathered data that has enhanced our understanding of the interplay between climatic change and human adaptations at East Turkana

during the Holocene (9700-3200 BP). With such knowledge, we can reconstruct a holistic picture of the hominin adaptive strategies in the region during the Holocene.

Experiments conducted to replicate artifacts can be of great value in understanding the usefulness of different tools, technologies and strategies used by hominin. The purpose of replicate experiments is to provide an interpretive framework about the archaeological materials and function for the Holocene humans in the region.

I believe that this research has made significant contributions to the growing bodies of knowledge on middle-range theory in archaeology (Binford 1968, Thomas 1989) and in the process provide direction on functional analysis of microlith tools used during the Holocene. This research has demonstrated the necessity of basing functional inferences on experimental data.

This project has provided useful information that has helped to dispute the conventional tool typology as an approximate indication of function. This research has also provided data that can be used with that of others and the productivity of using a framework of experiments specially constructed for application to a particular period and areas.

The findings of this study when used in collaboration with that of other scholars such as (Keeley 1981,1980 Ioth 1982 Barthelme 1981 and Amollo 2001) has therefore given a holistic picture of hominid adaptive strategies during this critical prehistoric period.

1.5 CONCEPTUAL FRAMEWORK

1.5.1 Cultural Ecology

In view of the questions observed above, this study adopts cultural ecology to help explain human adaptive strategies in Eastern Lake Turkana during the Holocene period. Cultural ecology as propounded by Julian Steward (1955) considers environmental resources (flora and fauna), weather patterns, topography and geography in order to understand human adaptive strategies. The concept of cultural ecology has since evolved into a sub- field that looks at the relationship between settlement, environment, geomorphology, subsistence strategy and social organizations. It is believed that humankind has not freed himself from the shackles placed upon him by the environment (Phillipson 1977:252). Steward (1955) argued that even present-day traditional economies are based on precise adaptations to particular environmental conditions.

Behavioral patterns involving subsistence and their effect on the social structure of a group is given emphasis on the organization, timing, recycling and management of human work in pursuit for subsistence.

This study therefore sought to find a definite relationship between environmental conditions and cultural adaptations and places them in a technological perspective. The distribution of Holocene sites and subsequent domestication of animals could have encouraged the use of lightweight and long life tools. Raw materials might have been procured from distant sources. Cultural ecology is not only concerned with the interaction between social institutions and the environment but also with cultural means of adaptability to the environment.

Ultimately cultural ecology has helped this research place natural habitat and technological innovations in proper perspective and help the data analysis gain higher-level of sophistication as we seek answers to questions that are being addressed by this study.

In order to close the gaps in the archaeological record archaeologist must observe first hand working of the implements in systematic context (Binford 1968).

Archaeologists require an external input to fill the gap between contemporary observations and past human behaviors. It is the duty of archaeologist to provide firm bridging arguments so as to breath behavioral life into the objects of the past (Thomas 1998).

Where as ethno-archaeologist work with functional behavioral systems, experimental archaeologists on the other hand attempt to define behavioral patterns through controlled and direct replication (Schiffer 1985). This study therefore uses wear patterns observed on tools from the archaeological record and

those formed on replicated tools, to demonstrate that middle-range theory does not defy reality but shows that a given technique or resource could have been exploited in the past.

1.6: RESEARCH OBJECTIVES

An integrated part of the multi-dimensional approach to use wear interpretation is the testing of function through experimental replication. One of the primary objectives of this study therefore is to carry out experimental test in order to understand the processes involved in artifact manufacture and their perceived use.

- (1) This research attempts to study the relationship between tool morphology and function to determine if typological classification has functional significance.
- (2) The research also attempts to replicate microlithic tools and then use them to perform various tasks to see if tools made of specific raw materials performed some tasks better than others.
- (3) Finally this research compares and contrast artifacts from a hunter-gatherer site (GaJj12); fishing settlement (FwJj12N, and GaJj12) and the pastoral Neolithic sites (GaJj4 and FwJj5). With a view of finding out how the tool assemblages vary in types and percentages.

1.7 HYPOTHESES

The following hypotheses were tested;

- A tool made of specific raw material develops distinctive patterns of edge damage.
- There is a relationship between edge angle, the amount and nature of edge wear and the hardness of the worked material.

1.8 SITE DESCRIPTIONS

The Holocene sequence of East Turkana lies within what has come to be known as the Galana Boi deposits with sediments overlying the Plio-Pleistocene deposits of the Koobi Fora Formation (Harris 1978). The Galana Boi deposits stick out as gray sequence of sediments dominated by lacustrine and marginal lacustrine, poorly consolidated diatomaceous silt stones, sand and mollusk materials (Feibel 1991). The deposits are about 10 meters thick although in some areas it is 32 meters.

All the materials used in this research were recovered from the sites listed below. The reason for picking on these sites is because they lie within the Holocene and are spatially distributed over the study area, which in my opinion can give a holistic picture of the human adaptive strategies over the period under study.

1.8.1 GaJj4 (*Dangodien*)

The GaJj4 site complex is one of the archaeological occurrences that have been discovered within the Holocene deposits in East of Lake Turkana. The Dangodien site is classified as Pastoral-Neolithic site. Pastoral-Neolithic is a term that has

been proposed to imply prehistoric cultures of Eastern Africa that relied substantially on domesticated stock for their livelihood, used pottery and employed typical LSA technologies for the manufacture of edged tools (Ambrose 1982:123; Barthelme 1983:135)

Gajj4 is located along the margins of a major inland river drainage in area 102. Altimeter readings I took in June 2003 indicate that the site lies 49 Meters above the present-day shoreline. A series of radiocarbon dates provided by Geo-Chron Labs as quoted by Barthelme (1983) supports the notion that human occupation at the site must have been around 4000 BP. Faunal materials recovered from the site include *ovi-caprines* and domesticated cattle. . The site is arguably the first in east Africa to show evidence of domestication Barthelme (1983). Microlothic tools made of obsidian account for over 70% of the shaped tools.

Stratigraphically, Dangodien has a thickness of 32-33 m, and lies unconformably on the upper member of the Koobi Fora formation. It has a SW depositional dip of about 4° . The succession consists of, dark brown silt clays, fine silt sands, coarse beach sands and gravels.

This litho facies have been interpreted to mean that the site was located along the margins of a major inland river drainage (Barthelme 1983).

SITE	C14 DATES
GaJj4	4000 BP
FxJj12N	3200 BP
GaJj 12	9300-9700 BP
FwJj5	3200 BP

Table 1: Sites under study and their c14 dates (Barthelme 1983)

1.8.2 FwJj 5

This site is also known as the stone bowl site (Barthelme 1983). It is located $\frac{1}{2}$ km south of Ileret River in area 110. Radio metric dates places the site at about 4000 BP ± 140 (Geochron labs as quoted by Barthelme 1983). The Galana Boi deposits in the area lay upon exposed upper member of the Koobi Fora formation and had accumulative thickness of about 32m (Barthelme 1983).

Barthelme (1983) says that the stratigraphy of the site is composed of clean gravely sands. Several horizons have rich accumulation of unbroken mollusk shell. The associations of mollusk, fish bone, bone harpoons and clean coarse sands indicate that the lower Galana Boi units were former beach sediments. In the upper Holocene, we get coarse dirty sands broken mollusks whereby the shell in the upper level is pale-gray, poorly consolidated coarse sand, mixed with angular rock fragments. The top sediments consist of light gray consolidated coarse sand.

A thick sequence characteristic of the Galana Boi deposits overlies the erosion surface. This could be interpreted to mean that human groups must have occupied the area during periods of fluvial drifting. Microlithic were the most common type of shaped tools followed by scrapers, the raw materials used include Chert, Obsidian and Lava with Chert accounting for the highest percentage. Faunal evidence recovered from the site includes domesticated caprines.

1.8.3 GaJi12.

The site is located on the Holocene exposures that are about 500m in length .It consists mainly of discontinuous outcrops. Barthelme (1983) holds that according to his altimeter readings the site must have stood at 47-48 M above the 1983-lake levels.

The sediments consist of diatomaceous silt coarse sand, fine coarse sand and finally coarse sand with broken mollusks. The upper most coarse sand which are listed as level A and B (see figure 4) are thought to represent beach deposits. Microlithic tools comprise the highest number of shaped tools shaped bone harpoons have also been recovered. Faunal materials recovered include hippo and Bovids. Site GaJi12 is important in this research in that it represents the fisher settlement sites, which is one of the settlement sites that were the subject of this research.

1.8.4 FxJj 12N

The site is located in the Holocene deposits in the outcrops of Koobi Fora formation along the Karari Escarpment in the eastern shores of Lake Turkana. The site complex is located in area 117.

Altimeters reading indicate that there is a probability of a localized tectonic activity. The readings I took in June 2003 point out that the site must have stood 80-85m above the present day Lake Turkana.

The Galana Boi sediments at FxJj 12N consist of silty clay, fine silty sands and coarse sands with gravel. Principle archaeological horizons interfingers with that of dark brown silty clay small collection of fragmentary water abraded reptile mammal remains were recovered. Well-presented fragmentary human skeleton has been recovered *in-situ*.

1.9 EAST AFRICAN CLIMATE DURING THE HOLOCENE

Previous archaeological work by in the aforementioned sites sheds light on this project. In order to give a better perspective of the paleo-economy and in essence, the pre-historic population structure, I include a small section on the general paleo-environment of the Holocene in East Africa.

Climate influences every component of the environment hydrological and biological cycles, plant cover, animal life and human activity (Grove 1993). Evidence attest that the low levels of moraines on the high mountains of East Africa and Ethiopia indicate that snow lines were about 100M lower than present at around 30,000-14,000 BP

(Shaw *et. al.* 1993) Temperatures stood at 5⁰C lower than the present. Between the tropics and particularly towards the end of the Pleistocene the climate experienced changed from an arid state to wet state (Maley 1992 as quoted in Shaw *et. al.* 1993). In the Rift Valley in southern Ethiopia Lakes Shala, Abayata and Langene merged and combined with Lake Ziway. Further South Lake Turkana was fed by Lake Stephanie in the Chew Bahir basin. In an attempt to determine the magnitude of change in rainfall, the amount would have been about five times greater than now. This was responsible for the greater size of Lakes Nakuru, Elementaita Naivasha, Victoria and Turkana basins. Throughout the inter-tropical Africa, there are signs of Lake Regression at around 7200 BP and at 8000-7200 BP (Maley 1992 as quoted by Shaw *et. al.* 1993). In the Afar Depression lake levels fell after 4000BP as they did in Lake Turkana and the Western Rift (Owen *et. al.* 1982). A final amelioration of aridity took place after 3500 BP in several areas. There is evidence that Lake Turkana rose briefly to +70M above the present level during the late Holocene but after 3000 BP its oscillations were about +50M (Barthelme 1983)

Lake Naivasha, which had dried completely, formed again and has persisted through the last two millennia into the present. A rather minor rise among the Ethiopian Lake levels came a thousand years later. Since 1800 BP, levels seem to have been low generally compared to those of the present day (Maley 1992).

Superimposed on an overall downward trend and long-term variations in Lake Levels and rainfall are centennial and decadal fluctuations of the kind experienced in recent times. In general there seems to be good ground to suggest

that East Africa and the entire Lake Turkana basin in particular is a drier place today in the north of Capricorn than it ever was in the Holocene.

It is against this background of environmental change that Holocene populations dwelling on the Eastern shores of lake Turkana exploited both terrestrial and aquatic resources as they were provided by the changing climatic conditions. The decision by the populations to settle at different places was influenced by such climatic conditions.

Figures 1-5 provides some background information on the general location of the study area, sites distribution, its geological setup and the various tools recovered from one of the sites under study.

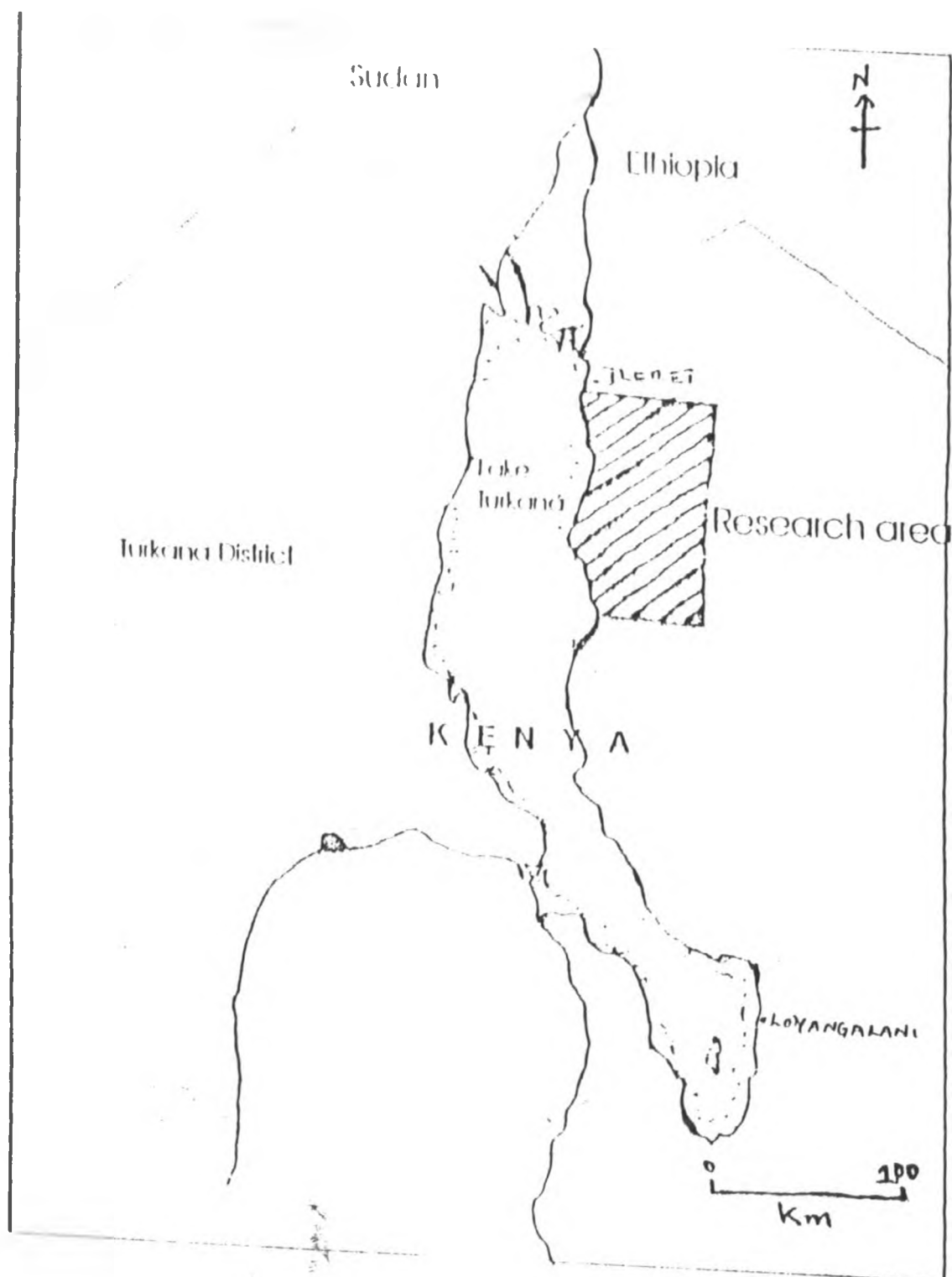


Figure 1: Lake Turkana Basin (adapted from Bartholme (1983))

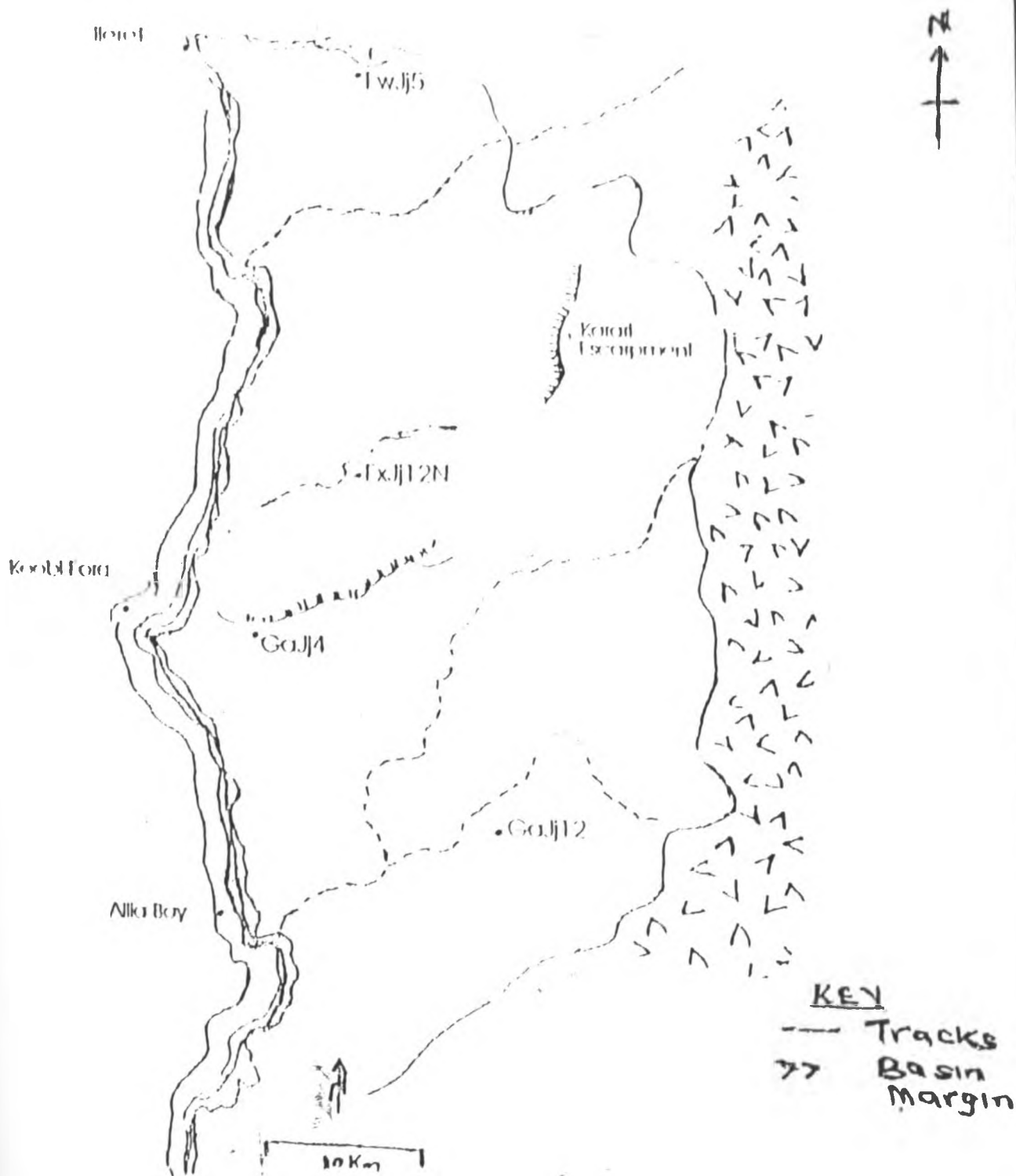


Figure 2: Location of Holocene sites under discussion (Adopted from Barthelme 1983)

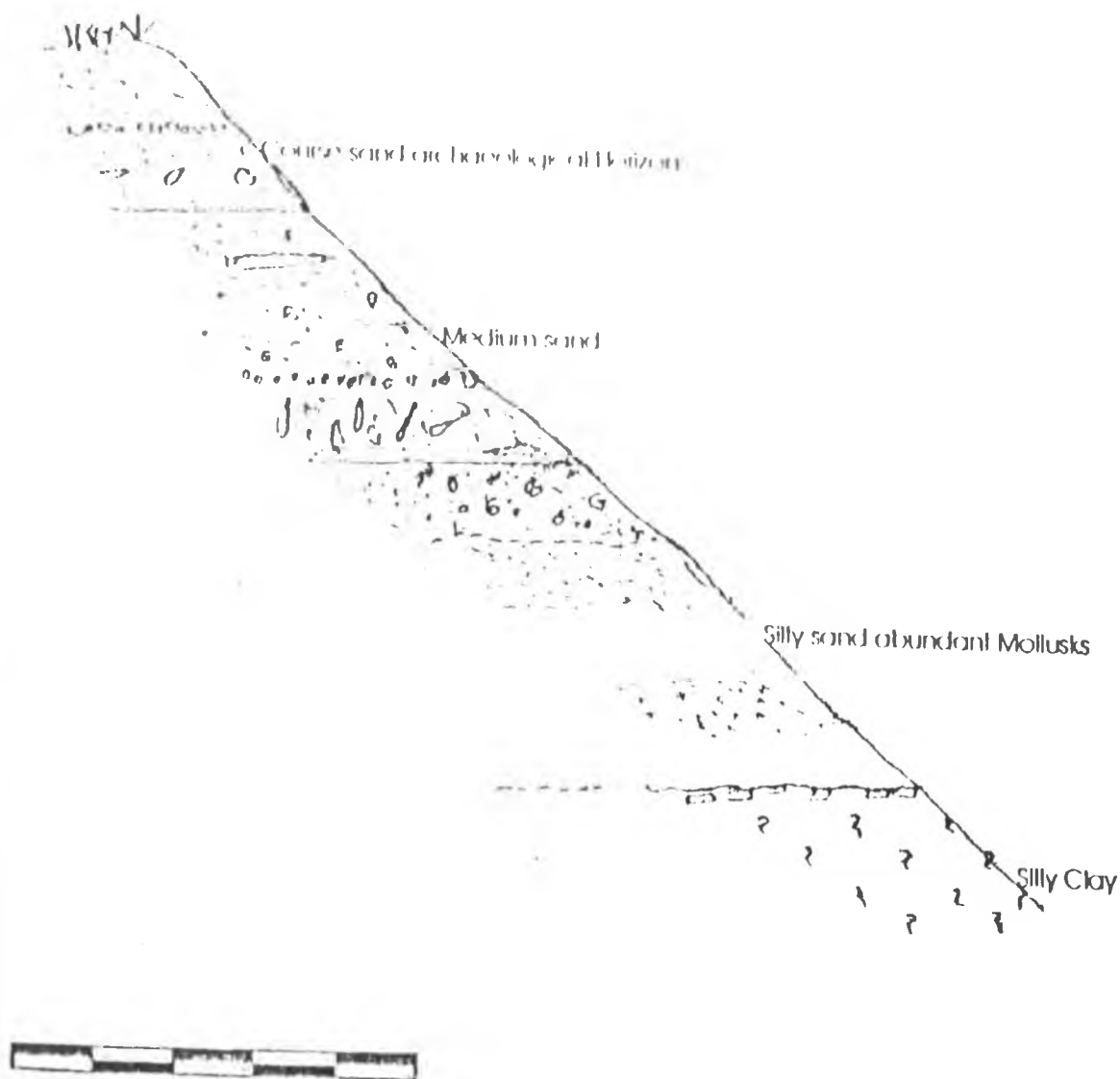


Figure 3: Stone Bowl site (FWJ5) profile geological trench. (Adopted from Barthelme 1983)

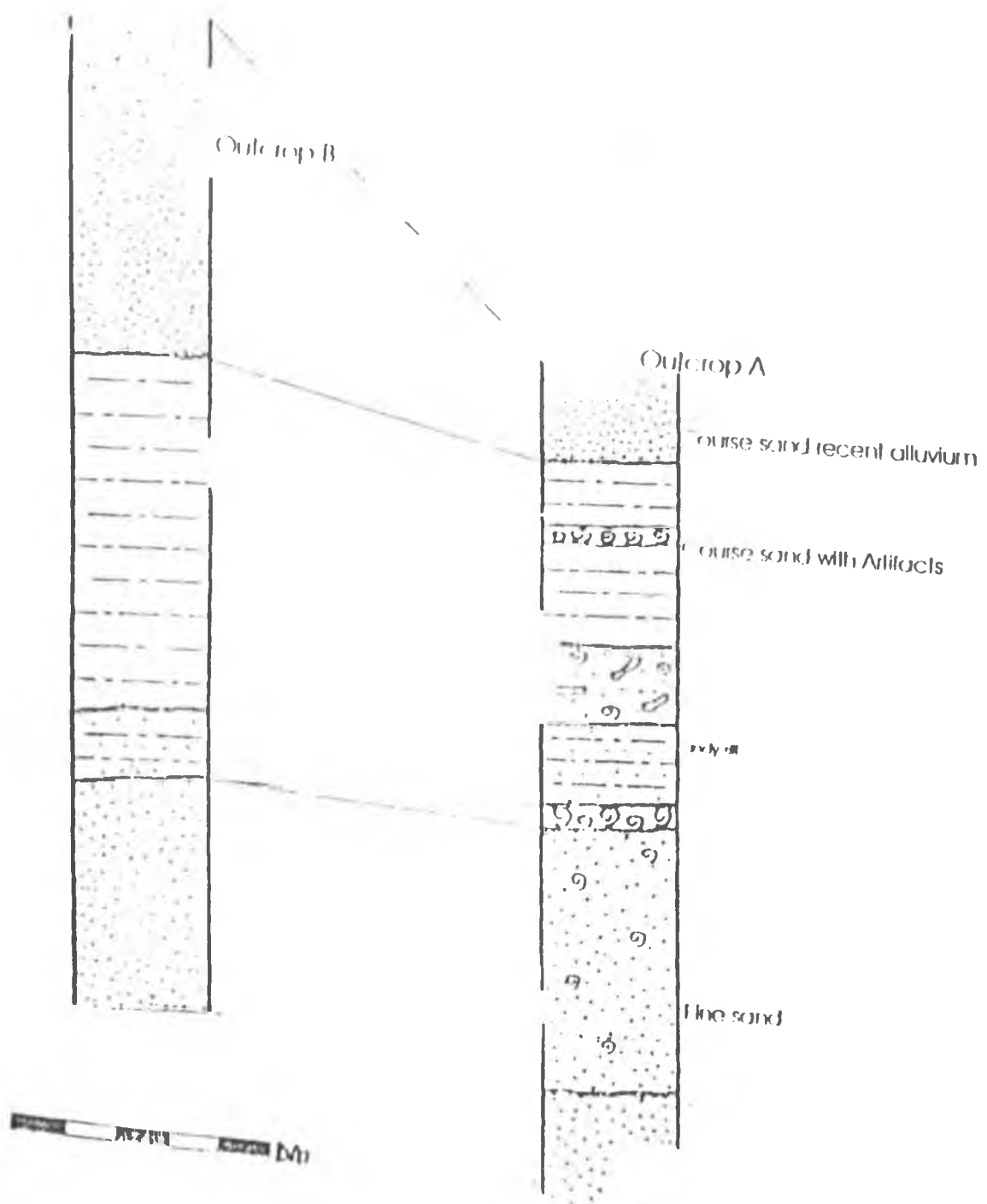


Figure 4: Correlated stratigraphic section Gail 12 (adapted from Barthelme)

Figure 5: Stone artifacts from Lxk 124 (Adapted from Ballentine 1983)



1.10 Summary

This chapter has defined the research problem and a background of the study highlighting at length previous related studies and presented the major questions investigated.

The theoretical framework on which the study is based has equally been discussed giving cultural ecology as the relevant theory that will guide all the interpretations to be made latter.

CHAPTER TWO

METHODOLOGY

2.0 Experimental Replication and Edge Wear Studies

This section deals with the methods of data acquisition from the sites under study. It also presents functional experiments to gauge the relative efficiency of various artifacts for specific tasks.

Experimental tools were made using two types of raw materials (Chert and Obsidian) recovered from the sites under study. These were samples that had earlier been collected and kept at the NMK laboratory.

The observed wear traces on tools from the archaeological sites were then checked and analyzed against similar experimental tool types. Use of a tool on a bone created more edge damage than was present on the tool when used for fish processing. Quite often attempts to experimentally replicate the wear traces suggested unknown materials. This could be attributed to other factors like chemical and biological effects on the tool before recovery.

2.1 Functional significance of variables

This research used a number of variables namely:

- ◆ Tool length,
- ◆ Edge angle
- ◆ Raw materials

Edge angle. This was measured as the angle created by the convergence of the two edges. Edge angle was taken with a goniometre.

Tool length -The curvature of some tools (crescents) was measured by fitting a line using a piece of thread that was straightened and measured against a ruler.

Tools from the four sites ranged from between 40mm-20mm.

Raw materials: This was restricted to chert and obsidian, which was easily, available and identified due to their fine silica crystalline. The reason as to why Chert and Obsidian were chosen was due to their abundance in the study area and the ability of these rocks to show micro edge damage at relatively low magnification (x40).

2.2 Edge Morphology

This was taken because it is functionally diagnostic when correlated with a variable such as edge wear. The amount and nature of edge wear, edge angle and hardness of the worked materials have some relationship (Grace 1989). For example, a tool with acute edge angle used for cutting meat gives insignificant edge wear. The combinations of acute angle and absence of edge wear on tool rules out the use of a tool on a hard material even if it was used for a short period, as edge wear occurs almost immediately (8-10 minutes according to Keeley 1980).

The relationship between edge angle and the hardness of worked material allows for probability projections on the possible use of a tool. Morphological

attributes such as tool length and edge angle allows us to give a possible explanation of the functional capability of a tool. For instance, during experimental studies it was found out that a tool with acute angle working edge could not scrape a bone effectively as the resulting edge wear makes the tool ineffective after a short period of use. Since the level of use-wear varies on different tools, interpretation can therefore only be made to the point that evidence allows.

All the above-mentioned variables had meaning attached to them. Though some variables such as raw materials had no functional significance they were however recorded because of their potential effect on variables that are functionally diagnostic for example edge angle.

2.3 Reduction Experiments

Experimental replication of stone artifact forms can help us gain sound understanding of the technological way of tool manufacture and then speculates on what was going on in the heads of the toolmakers. (Toth 1980:23)

Toth (1980) pointed out some of the valuable information that such studies can reveal, which included,

- Understanding which production strategies were used.
- Finding out the technique employed
- Understanding the “paths of least resistance” in lithic production.

Replicate studies that were used here followed those used by Nicholas Toth (1982). The experiments were carried out at different levels.

Level 1

This level involved general experiments in flaking raw materials from **GaJj4**, **GaJj12**, **FwJj5** and **FxJj12N**. It was basically aimed at gaining creative knowledge of suitable techniques or reduction strategies needed to arrive at certain forms. A number of tools were reproduced at this stage.

Level 2

This level involved detailed experiments in replicating cores in all aforementioned sites. Experimental flake populations were then compared with those excavated (230 experiments).

Materials recovered by Barthelme (1983), which were analyzed in the study, were mainly LSA microlithics. The materials, which were randomly sampled, could be attributed to Levallois technique. The methods that were tried for tool replication were. The reason as to why this methods were chosen is that during level one of replicate experiments it was found out that the techniques mentioned below were found to be suitable for raw materials (Chert and Obsidian) from the sites under discussion.

- (i) Hard Hammer percussion
- (ii) Bipolar technique and
- (iii) Levallois technique
- (I) **Hard Hammer Percussion**

This method involved stone flaking using a hammer by a series of blows directed at it (Toth1982). Both hammer and the core are held in the hand. But for

heavier cores it was found to be practical to set them down for flaking. The technique worked well for all flakable raw materials and it proved especially useful for Obsidian. The pronounced bulb of percussion is left behind as a fracture.

(II) Bipolar Technique

This technique involved resting of a potential core on a stationary stone (anvil) and striking it from the top with a hammer stone. The stone to be flaked is oriented along its axis vertically to produce longer spalls. This technique suited the materials made from Chert because of its hardness compared with that of obsidian.

(III) Levallois

During this research it was found that Levallois was an ingenious method of producing good serviceable flakes of predetermined shape devoid of cortex and with clean cutting edges (Amollo 200:122).

The form of original core and its pattern of preparation remove a single flake whose shape and size is predetermined. Both Levallois and core flakes can be retouched, flaked and shaped for some hand held use.

Continuous retouch was carried out to acquire the desired shape of tools such as crescents. During replication, studies it was noted that the production of crescents took a lot more compared to flakes.

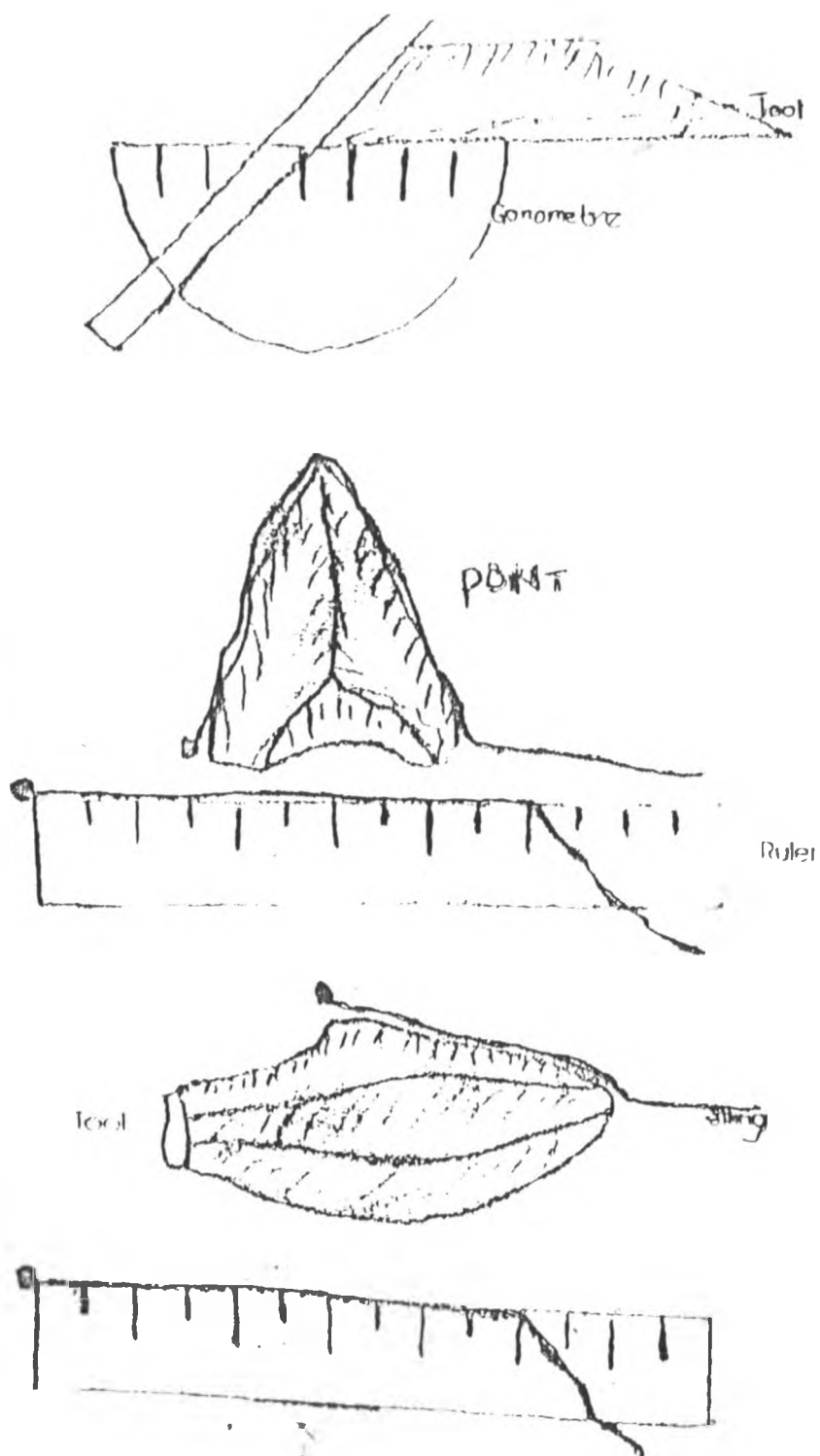


Figure 3: Measurement of Edge angle and tool length

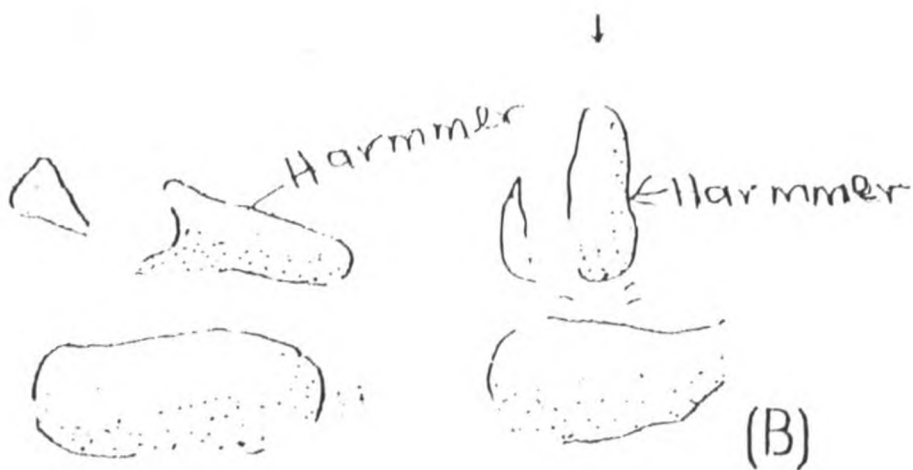
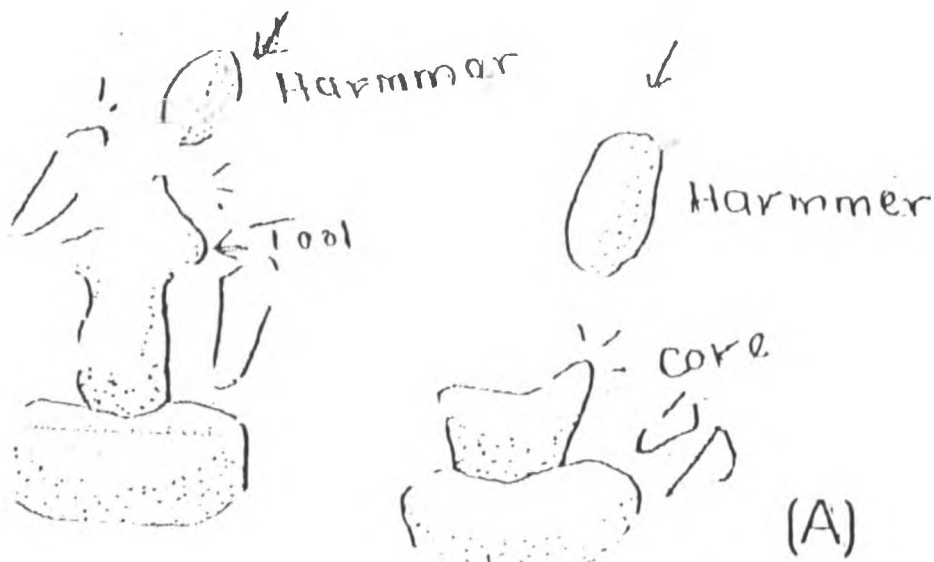


Figure 7: Bipolar (a) and Levallois (b) techniques. (Adopted from Amato 2001;

2.4 Utilization

Based on experimental replication some inferences about resource utilization and usage can be made

Some of the artifacts 44.4% in the case of GAJ12, recovered from the sites under study were made from non-local materials (obsidian) according to Barthelme (1983) the nearest source was at the basin margins, a distance of about 150km, showing some evidence of exchange or at least some movement of Holocene populations over long distances.

The pattern and mode of usage illustrated in this study may not have direct bearing on the state of materials at the time of their recovery. However, it offers an explanatory hypothesis that favours functional imagination and reflects positively on the aspects of strategic planning during the Holocene. Considering that the economies during the Holocene were simple (Barthelme 1983) the experiments first relied on the possibility of dealing with a self-sufficient economy.

2.5.1 Butchery and Dis-articulation

Toth (1982) argues that animal butchery was the major catalyst in the origin of lithic technology in aiding humans gain access to animal foodstuff acquired by hunting or scavenging.

In order to improve the accuracy of my studies it would have been better to try the tools from the sites under discussion on animals such as waterbuck, warthog or a hippo. But killing an animal such as a hippo or waterbuck is tantamount to poaching in Kenya besides this could also be termed unethical in the

professional circles. The cost of a cow in Kenya is exorbitant while that of a goat is equally prohibitive. This research was therefore restricted to buying a morsel of goat meat and fish that were experimented on. The time and financial resources allocated to this study were equally limited.

No experiments were done before the goat or the fish died. A look at the composition of assemblages recorded from the site under study draws a lot of suspicion on whether those tools were used to perform some tasks such as severing the neck of an animal to terminate its life as it is done today. In my opinion therefore animals might not have been killed using these tools. It is most likely that traps and snares were employed rather than direct confrontation. A sizeable piece of meat was bought and the tools used to cut it into small portions for specified period of time (between 8-10 minutes).

Disarticulation involved the division of the meat into smaller portions with emphasis being on removing meat from the bones. Obsidian flakes dulled very quickly and needed constant re-sharpening. Micro-wear studies discussed in this chapter show that flakes and crescents appear to have had the same function. Crescents refined quite well in fish processing, which might explain their dominance in the fish settlements.

No hafting was done to test the notion that the tools might have been used for defensive purposes of the said materials, as this was outside the scope of my study.

After a detailed study of bone fracture patterns, Bonnicksen (1979), managed to differentiate between fracture patterns caused by stone wielding hominids and those by forces like carnivore. Where flake scars and bone flakes were listed as indicators of hominid impact on bones. Bonnicksen (1979) however, fails to determine the difference between fracture patterns caused by flakes and carnivores as both have been observed in hyena dens at FxJj50 (Koobi Fora) Bunn *et. al.* (1980).

The tools (scrappers, microliths and crescents) were used to try and attempt the extraction of bone marrow. The only implements that proved useful were the hammer stones. However, flakes and crescents were unusually efficient in putting decorations on bones, which looked like those recovered by Barthelme from site Galj4 (Barthelme 1983: 188).

Where as the tools served multiple purposes, it is not easy to know whether at the time of their manufacture this was a pre-conceived purpose or it only happened by chance. However, it seems clear that there was deliberate planning before and during tool manufacture as evidence from the archaeological record indicate that the subsistence base was fairly broad.

2.5.2 Wood cutting and shaping

This research embarked on sharpening wood into some form of arrowhead or spear. This slow and painstaking activity led to a lot of micro flaking on the tool. There was no attempt at controlling the conduct angle, amount of pressure exerted on the tool or stroke length.

The tests gave valuable comparable insights into the effect of variables on efficiency and functions. Whereas acute angled (less than 30°) tools with short edges achieved higher efficiency in wood cutting, the convex edged tools were less effective than the concave. Transverse scrapper with an edge angle of 88° proved to be ineffective which in my opinion was due to its denticulation though the increase in edge angle reduced its efficiency. This means that the edge profile has a direct correlation with efficiency. Tools that served effectively in cutting fresh medium sized wood could serve just as effectively in different but related activities. Scholars such as Keeley (1983) with relatively high level of success have used similar experiments.

Edge analysis was done to determine the amount and nature of wear on tool edges using a lower power microscope at a magnification of X40. Use wear analysis provided a unique opportunity of reconstructing activities at the sites under discussion.

If the Holocene conditions were unpredictable as we have seen in section 2.6 that required rapid adaptive strategies then rapid mobility as pointed out by Barthelme (1983 Pp137) on the possible occupation of site Galj11 and 12 is worth being given some serious thought. Short time site occupation and amount of non-local material is reflected in the lithic assemblage. Different adaptive strategies may be employed to manipulate the utility of artifacts and therefore bridge the spatial and temporal discontinuities between need and opportunities (Binford 1968).

In determining how long materials will last tactics for producing flakes from cores, re-sharpening or renewal of stone tools and the transport of tools and raw materials all play a central role. A closer look at these variables helped the study acquire information about contingencies faced by the population during the Holocene period in making tools needed.

Cleaning

The tools both excavated and replicated were wiped using white spirit washed with warm water and kitchen detergent. They were then immersed in warm hydrochloric acid HCl (10% and NaOH 20%) solution for 20 minutes. The necessity of this procedure was to remove organic residues on tools. Other scholars such as Grace (1989) Keeley (1982) and Mike Becker (Per. Comm.) have successfully used this procedure. The tools were then observed under a low power microscope using low power microscope at X40 magnification.

2. 6 Lithic Analysis

To understand inter-site assemblage variation in tool types, different characteristics such as length, edge angle and edge morphology were examined. In looking at adaptive strategies, Binford (1968) discussed how certain lithic assemblage patterns were indicative of either expedient or reactive tool manufacture. In my view the issue of planning was a function of balancing the technological provisioning with provisions of places. One inference from the lithic

patterns is that humans in this area, during the early Holocene might have been extremely mobile. But as they progressed they began to stay in one place for longer period of time or reused the same place over many times.

Though such inference has no direct relationship to adaptive strategies being investigated in this study it reveals that the temporal (9700- 3200 BP) shift coincides with a shift from mainly hunting, gathering and scavenging to fishing and domestication based on faunal evidence recovered from the study area. The way in which humans went about maximizing the benefits from the habitat while minimizing the drawbacks, like shifting from hunting and gathering to fishing and domestication is part of the adaptive strategies that informs this study.

In view of lithic assemblage as a set of tools designed to perform specific tasks the differences between assemblage on the same broad cultural level can be interpreted as reflecting,

- (i) Different settlement type
- (ii) Stylistic variability

The aim of typological analysis is to use a well-defined framework to assess the similarities and differences between tool occurrence, types and the percentages. Using this approach, it has been possible to study the reduction sequence based on typology.

The typology used in the analysis is the one developed for East Africa by Nelson (1973). This type of classification puts artifacts into three broad categories namely cores, tools and waste. This study was however restricted to tools and again confined to limited groups of shaped tools namely scrapers, flakes and crescents.

2.7 Summary

This chapter has outlined the approaches used in the analysis of the materials from the four sites under study. It fronts a holistic approach as the most appropriate methodological option for the study. The approach examined the nature of artifact manufacture, tool use and eventual discard by the inhabitants of Eastern shores of Lake Turkana basin during the Holocene. Though one can make many of these aspects independent topics of study, I believe this holistic approach will give a better picture of the behavioral patterns in the four sites.

CHAPTER THREE

DESCRIPTIVE ANALYSIS

The following is a statistical breakdown of the type of artifacts available in each of the sites under discussion.

GaJj 4

Tools	Raw materials	No. of Tools	Percentage (%)
Whole flake	Obsidian	47	30.7
Scrappers	Obsidian	10	6.5
Crescents	Obsidian	27	17.6
Whole flake	Chert	14	9.2
Scrappers	Chert	4	2.7
Crescents	Chert	51	33.4
TOTALS	2	153	100

Table 2:Percentage distribution of obsidian and chert tools from site GaJj4

Site FwJj5

Tools	Raw materials	No. Of tools	Percentage (%)
Whole flakes	Obsidian	20	31.7
Crescents	Obsidian	6	9.5
Scrappers	Obsidian	2	3.2
Whole Flake	Chert	12	19.1
Crescents	Chert	5	7.9
Scrappers	Chert	18	28.6
Totals	2	63	100

Table 3: Percentage distribution of obsidian and chert tools from site FwJj5

However, it should be noted that the above figures might slightly differ from those presented by Barthelme. This is because of difference in the typological frameworks used in this study i.e. that developed for East Africa by Charles Nelson (1973)

GaJj12

Tools	Raw materials	No of artifacts	Percentage (%)
Whole Flakes	Obsidian	5	4.7
Crescents	Obsidian	4	3.7
Scrappers	Obsidian	1	0.9
Whole Flakes	Chert	47	43.9
Crescents	Chert	37	34.6
Scrappers	Chert	13	12.2
Total	2	107	100

Table 4: Percentage distribution of chert and obsidian tools from site GaJj12

FxJj12N

Tools	Raw materials	No. of tools	Percentage (%)
Whole Flake	Obsidian	0	0
Crescents	Obsidian	6	8.8
Scrappers	Obsidian	3	4.4
Whole Flakes	Chert	10	14.7
Crescents	Chert	6	8.8
Scrappers	Chert	43	63.3
Total	2	68	100

Table 5: Percentage distribution of chert and obsidian tools from site FxJj12N

Having seen the tabular breakdown on how the sites vary in types and percentages, let us now very briefly look at the inter site variation in terms of raw

materials. This is important in the sense that the sites under study have been designated by Barthelme for a specific purpose or activity and from experimental results or tests as we shall see shortly, there tends to be a relationship between raw materials and type of activity. Chert for example performed relatively well in fish processing unlike obsidian. The following table indicates variation among sites in terms of raw materials

Site	Raw materials	%
GaJj 4	Obsidian	54.9
	Chert	45.1
FwJj 5	Obsidian	44.4
	Chert	55.5
GaJj 12	Obsidian	9.3
	Chert	90.7
FxJj 12N	Obsidian	13.2
	Chert	86.8

Table 6: Occurrence of frequency within the sites under discussion

The foregoing data is crucial in realizing the second objective, whether tools made of specific raw materials perform better in some tasks than others. It is worth to note that analysis in inter site variation will still be confined to the two types of raw materials (Chert and Obsidian).

Site Tool Types	GaJj 4		FwJj5		GaJj 12		FxJj 12N	
	Nos.	%	Nos.	%	Nos.	%	Nos.	%
Whole flakes*	61	39.9	32	58.8	52	48.6	6	9.4
Scrappers	14	9.2	20	31.7	14	13.1	12	18.7
Crescents	78	50.9	11	17.5	41	38.3	46	71.9
Totals	153	100	63	100	107	100	64	100

* Whole flakes here is used to mean a tool if it has evidence of having been utilized.

Table 7: Inter-site variation in tool types and percentages

It is worthy noting that during the analysis a functional view rather than lithic mutations or evolution of artifactual materials was adapted. This was important as it offered the mode of analysis, which was not based on a single variable as being representative of function.

A count of tool types divided by the number of tools in an assemblage and variety in edge angles indicated diversity in activities. This can be correlated with assemblages from site where resources were brought in as a strategy for ensuring self-sufficiency

Certain aspects were important in this study. First was the determination of a used edge .In this study a used edge had to visually show evidence of use wear and to be functionally suited to some tasks which had to be performed with regard to tool design.

Let us now have brief tabular breakdown of how the various tools performed in the light of edge angular and the efficiency in which they performed a number of tasks.

<i>Edge Angle in degrees</i>	<i>Efficiency Ranking</i>
80	3
60	3
45	2
30	1
20-29	1

Key

- 1- Very effective
- 2- Effective
- 3- Not effective

Table 8: Tool edge angle and its degree of efficiency

Having looked at the edge angle in the light of efficiency let us now look at the relationship between edge angle, tool length and the time spent in performing a given task and the amount of micro flaking per 10mm using tools made from two different raw materials that is chert and obsidian. Both table 9 and 10 provides data that is based on the experimental replication of microlithic tools. This data is crucial in determining the relationships between edge angle and tool efficiency.

Tool length in mm	Tool Type with edge angle 20-30°	Time in minutes to perform a task	Average Efficiency Ranking per Tool Type	Number of fractures per 10mm
15-25	Flakes	4	1	10-15
	Crescents	4	2	7- 9
	Scrappers	5	1	9-11
25.1- 45	Flakes	5	2	10-15
	Crescents	4	1	10-13
	Scrappers	3	3	10-13

Total number of tools (n) =100

Flakes =45%

Crescents=25%

Scrappers=30%

Table 9: Tool length in relation to edge angle efficiency ranking and the amount of micro edge wear among obsidian tools

Tool length in mm	Tool Type with edge angle 20-30°	Time in minutes to perform a task	Average Efficiency Ranking per Tool Type	Number of fractures per 10mm
15-25	Flake	6	1	6-8
	Crescents	7	2	7-9
	Scrappers	5	1	9-10
25.1-45	Flakes	7	2	10-15
	Crescents	6	1	11-14
	Scrappers	8	2	11-13

Total number of tools (n) = 153

Flakes = 35%

Crescents = 30%

Scrappers = 35%

Table 10: Tool length in relation to edge angle efficiency ranking and the amount of micro edge wear among chert tools

Both table 9 and 10 shows relationship between tool length edge angle and the averaged performance ranking. The average amount of edge wear based on the above variables has also been addressed. The most pronounced form of micro edge damage on the tools can be grouped into two:

(a) Fractures there were two types of fractures namely snapped and stepped, which tallied relatively well with those presented by Keeley (1981:132). Obsidian tools had more than 5 fractures per 10mm especially on those tools from the fisher

settlement sites where as those from the Pastoral Neolithic sites the pattern changed to over 10 fractures per 10 mm. Very little rounding was observed among the obsidian tools.

(a) **Rounding** this occurred at two levels that is light or Heavy. Light rounding was however confined to the fisher settlement sites (GaJj12 and FxJj12N). Heavy rounding which is macroscopic and can be felt by fingers as significant smoothing or blunting was more pronounced on chert artifacts recovered from the Pastoral-Neolithic site (GaJj4 and FwJj5) replicated tools that had been used in de-fleshing and cutting wood exhibited heavy rounding.

3.0 Tool function at site GaJj4, GaJj12, FwJj5 and FxJj12N

For the purpose of determining the use of tools from the four sites several clusters of variables that are functionally diagnostic were formed. These included tool length and edge angle Tools that were less than 30° proved effective for a variety of closely related functions mainly;

- ◆ Wood grooving
- ◆ Meat cutting
- ◆ Shaping bones
- ◆ Fish processing

The efficient tools had acute angle lying between 20°-29° and were also thin though the actual thickness was not measured for it was not one of the variables to be tested in this study.

In general up to 90% (n=153) were suited for the task. It is however interesting to note that the relative standardized length of the tools lay between 15-45mm. Most of the tools made of chert from the four sites had a tendency of rounding whereas those made of obsidian had minimal rounding.

3.1 Summary

This chapter has highlighted data analyzed using typological classification propounded by Charles Nelson (1973). The data from micro wear studies and morphological classification has equally been presented; the next chapter discusses the implications of this data in the light of what other scholars have done

CHAPTER FOUR

DISCUSSION

This study followed the same principle as that used by Barthelme (1983) but differs in the parameters of analysis in the treatment of data and organization. This research therefore sought to compare individual sites (GaJj4, FwJj5, GaJl12 and FxJj12N) which lie within the Holocene exposures and are spatially distribution over the study area and then attempted to use the emerging results to answer the questions stated out in the objectives.

The parameters for comparisons that were used in this research were typological and restricted to specific tool category namely;

(b) Flakes

(c) Crescents

(d) Scrappers

The study was also limited to specific raw materials namely chert and obsidian. The major reason for confining the study to limited typologies and raw materials was due to time and financial constraints. Having done that let us now take time to reflect what this research has brought to the table in the light of what other scholars have done.

Charles Nelson (1973) suggested that traditional approach to typological classification stress the construction of regional sculptural stratigraphic succession as a framework for interpreting culture history, evolution of technology and economic change in a broad ecological perspective.

I find it difficult to agree with such an approach especially when applied in the context of Holocene deposits. Explanations that rely on diffusion and migrations should be viewed with a lot of caution to negate bias especially when attempting to construct the processes of change. In view of lithic assemblages as a set of tools designed to perform specific tasks, the differences between assemblages on the same broad cultural level can be interpreted as reflecting

(a) Differences in the tasks being performed

(b) Different site utilization *viz a viz* resource utilization that is presented by different ecological settings within the larger environment. A multi -dimensional approach to functional and Cultural ecology analysis as advised by Roger (1989) can be seen from the data presented in chapter three based on the analysis of materials recovered from the site under study.

In his theory of cultural ecology Julian Steward (1955) emphasized the need to determine the behavior patterns involved in the use of a particular technology. This is the concept that was used during the course of this study with three factors being put forward.

- I. The floral and fauna materials exploited
- II. The technology at GaJj4, IwJj5, GaJj12 and FxJj12N
- III. How subsistence behavior might have affected other aspects of life.

At the level of functional trials the many names accorded to scrappers e.g. side, end scrappers among others had little relevance in this study. Most of them had similar edge angles and performed the same duties with very slight change in

efficiency (see table 9 and 10). Majority of the tools were acute angled, which have been discussed under edge analysis tests. It however occurs to me that there was somewhat deliberate planning before and during tool manufacture. This is seen from the standardization of tools.

The profile of a tool on the other hand equally limits its functional capability. I therefore beg to disagree that typological classifications do not have a positive correlation with function hence the need to base classification of tools on function rather than type.

4.1 Craftsmanship and Energy Levels

Based on experimentation, some inferences about physical and mental abilities as determinants of adaptive strategies in site GaJj4, GaJj12, FwJj5 and FxJj12N can be made.

Evidence from replicate experiments show that humans dwelling along the eastern shores of Lake Turkana during the Holocene period seem to have been very dexterous with the human technique of tool manufacture. The level of artistic co-ordination as highlighted earlier was amazingly high and produced the required tools with constant dimensions deemed convenient for the intended usage.

Fineness in flaking was particularly reflected in microlithic tools that required adequate time and training to master. It is therefore not possible to say that they were produced by chance. For example during the analysis of materials from the sites the tools had a length of 15-45mm.

In the course of experimentation, I noted that time taken to come up with one tool was relative to its eventual importance. I found all artifacts from the four sites to be different and challenging to replicate. The hardness of chert and sharpness of obsidian made the replication even more difficult. Renfrew and Bahn (1996) have raised this, where thermal treatment of lithic materials especially Chert was found to make flaking easier. Though testing if tools had been thermally altered would have helped shed light on the process of tool manufacture in East of Lake Turkana but that was outside the scope of this project as for now I hold that such a view could be a possibility.

4.2 Ability and Intelligence

Toth (1982) has argued that material culture can always give some insight into some minimum value when assessing skill. It is obvious that the inhabitants of site GaJj14 GaJj12, FwJj5, FxJj12N were capable of providing complex and more sophisticated tools. However, I must admit that it is not easy to predict and gauge the intelligence of humans without the obvious risk of creating scales. Tool making was in my opinion learnt through artistic mastery from the older members of society

While experimenting on the tools with the idea of self-sufficient economy, I operated from the assumption that communities living in the study area during this time framework gathered their requirements on their own from their ecological niche. In a more decentralized economy, everyone saw as an adaptive strategy, the potential of the other as a buyer (but not in monetary sense). It should however be

noted that the faunal evidence recovered from the sites under study indicate the possibility of combining several occupations such as hunting, fishing, gathering and domestication of wild animals. The hypothesis postulated by Amollo (2001: 118) that a hunter might have made several trips to trade his meat (animals for GalJ4?) with the specialized tool maker, fisherman, gatherers or the emerging farmer is too tempting not to be given a second thought.

Though the productions of various forms of tools are described in this study, it does not assume that the tools were the intended end products. The morphology, size of cobbles and flakes had a direct impact on the eventual piece produced during experimentation.

They influenced the fracture patterns and the eventual arrival at the particular retouched core forms. Angular cobbles with their almost spherical proportions provided easy flaking in many directions and produced unifacial circular scrappers and thinner scrapers that could be made into varied kind of scrappers and crescents. It was also noted that the type of flakes generated influenced the type of artifact made from them.

The possible function of stone tools related to other potent guiding notions concerning the environments, the dietary systems and the cognitive abilities of humans. The scientific thread in these human activities can easily be separated from such notions. In my opinion it would be wise to devote time and resources to functional classification than using all names to baptize tools that have no relevance to function it performed.

CHAPTER FIVE

Conclusion

Human ancestors especially during the Holocene period were weak animals who had to rely on brain rather than turmoil for survival. These dwellers probably relied on gathering plants, catching small animals and domesticating them. They had to come up with strategies to survive and procreate in an otherwise harsh environment.

Cultural evolution being an orderly sequence of change between the population and environment has not stopped (Stebbins 1971). Humankind had acquired the skills to manipulate the physical inanimate environment for their benefits.

They must have derived efficient tools using scarce or not easily accessible raw materials. The thrust of this study then was to find out how the Holocene humans adjusted their own technologies to make potential ways of achieving the ultimate goal become a reality.

Many archaeologists and palaeo-anthropologists have attempted to answer this question. Those who have taken lithic analysis as a possible route have found themselves entangled in pathological desire to classify everything into neat little pigeonholes and infer from the same.

Huge amounts of data are analyzed in an effort to create interpretation but knowledge is not data or quantity of data recovered and analyzed. Knowledge is the certainty that you know. Though the typological classification is important in

helping us condense the voluminous data that we recover so that we can talk of specifics and provide a vocabulary for communication, it all boils down to discussing mere data. There is need therefore, to do more and deduce adaptive strategies basing on functional analysis.

Problems may come due to;

- (a) Differential preservation and recovery of artifacts and fauna
- (b) Lack of reliable dates and
- (c) Nature of materials recovered from the sites under study

Despite the above shortcomings several factors emerged, notably:

- (i) Occupation sites were determined by water, the presence of ancient rivers in sites GaJj4, FwJj5, GaJj12 and FxJj12N provided attraction to humans leading to repeated occupation.
- (ii) Tool making technique was not centralized but carried from source to base.
- (iii) There was maximum utilization of raw materials
- (iv) Large production of lithic assemblage comprise of small tools

Most cores in the assemblage are Levallois based on their outline giving the impression of high-level of regularity and patterning. Most of the tools are flaked and crescents. The approach to tool manufacture represented in the four assemblages is similar.

It appears that when flakes were selected for tool production there must have been a target in mind. Flakes were mostly retouched along their axes and the distal ends. The tools do not vary significantly except in proportions and size at

the two sites. For example at GaJj4 tool percentage is 54.4% where as at GaJj12 it stood at 44.4%.

The hammer stones were included as stone tools in the subsistence economy rather than in the manufacturing sector. Names such as end , bifacial and side scrappers among others tools had little relevance. Most of them 50.9% had smaller edge angles and reinforced same duties with very slight change in efficiency.

Experimental and functional analysis of tools found in the Holocene deposits has brought up several issues. The data presented is in line with a more generalized subsistence strategy based on locally available resources

The debitage from the assemblages of the four sites indicate that some tools were not required for immediate use. Despite the experimental and functional studies carried out in this research the projected functions of these tools were derived from the author's own personal experiences, which have been shaped by modern environment. Knowledge of paleo- environments however, helped to shape and strengthen the experiments carried out.

Movement was thus used as a strategy in locating food, water and raw materials. Despite the disparities in raw materials and tool types at the four sites, technological developments seem to have followed roughly similar courses.

From the evidence given it is safe to deduce that during the Holocene the choice to produce microliths as the most preferred tool lay in its perceived advantage. It is thus not easy to attach the role technology played without an in-depth

understanding of the social circles. Such factors enhance the cohesion of a given society in hard times and in essence dictate the time and nature of change. At the level of lithic analysis, this research has demonstrated the necessity of basing functional inferences on experimental data rather than using productivity experiments especially constructed for use in a particular period or area. No generalized experiments can ever hope to solve all pre-historic micro-wear problems although this research has managed to draw the following conclusions;

- (a) There is a high correlation between the detailed appearance of micro-wear patterns and materials that caused them.
- (b) The findings demonstrate the direct application of experimental results to archaeological assemblages and uncover details like standardization of tools among the Holocene communities.
- (c) Finally, the study has also established some interesting relationship between morphology and function of tools among the assemblages of the sites that were studied.

I wish to recommend that a landscape approach to the study of Holocene sites, as has happened at Koobi Fora Rogers (1998). This is likely to yield better results than the trench system used by Barthelme (1983). The landscape approach will give future research an expansive outlook and appreciation of the unique characteristics of the human mind, which helped them to fit into different environments using efficient adaptive strategies.

APPENDIX

6.0 Definition of terms

- a) **Microliths** refers to any backed stone tools. They include crescents, truncated flakes and straight-backed flakes.
- b) **Crescents** refers to flakelets having biterminal truncations and blunted intersecting edges (Nelson 1973: 148). Crescents are the most frequent complete microliths.
- c) **Scrappers** refers to tools with unofficially flaked planoclined edges (Nelson 1973). Scrappers are divided into concave, convex edge and nosed side scrappers.
- d) **Cores** refers to stone artifacts with flake scars running at least half way through the specimen. It is from the cores that stone tools are flaked from.

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