

↳ UNDERSTANDING THE MIDDLE STONE AGE
ADAPTIVE STRATEGIES IN EAST AFRICA: AN
EXPERIMENTAL APPROACH. ↳

BY

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DECLARATION

This thesis is my original work and has not been presented

For any degree at another University

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Signature


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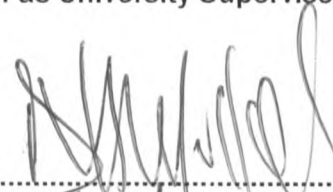
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ABBREVIATIONS

ESA: EARLY STONE AGE

MSA: MIDDLE STONE AGE

LSA: LATER STONE AGE

BP: BEFORE PRESENT

PN: PASTORIAL NEOLITHIC

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”

DEDICATION

To my Mama

GAUDENCIA ELMELDA AMOLLO

For a true spirit of womanhood that has seen her single handedly bring up responsible members of the social order. She is the River and the Source.

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ABSTRACT

In this study, I explore the Middle Stone Age (MSA) technological and subsistence adaptive strategies at two Sites in Kenya, Muguruk in Western Kenya, and Prospect Farm in Kenya's Central Rift Valley. This work is different from two previous studies at the two sites because of its approach, organization and treatment of data. Two major studies have been done at the two sites, yet both of them preoccupied themselves with trench studies, with strong emphasis on time and space. The reader is led from one time sequence to another, and from one quantitative result to another. Real activities that might have taken place at the two sites, is only cursorily probed. In this study I have explored the MSA adaptive strategies in the vein of the experimenter, adopting a general holistic approach. The research strategy allows for direct comparisons and contrasts to be made between the products of the experiments and the excavated materials. This enabled me to investigate the cognitive and socio - economic conditions of adaptation to lithic technology as it was done by the inhabitants of Muguruk and Prospect Farm. The replicated and used stone tools, are compared to those recovered from the two sites, in order to understand the complexity of the derived behaviour patterns in MSA stone tool makers. Based on the analysis of wear edges, and patterns on different tools from Muguruk and Prospect Farm, the Levallois technology appears quite adequate to accommodate the notion of fairly skilled tool makers. Several characteristics of Levallois points, scrapers and knives including standardization of tool angles and evidence from experimentation with re-sharpening of blunted tool

edges, suggest a portable serviceable tool system. The Levallois technology seem to have been maintainable and therefore indicative of a versatile approach to subsistence economy

The results also suggest that: the makers of Muguruk and Prospect Farm artifacts, belonged to one general tradition and that as much as the people of MSA were mobile, they also stayed in certain places for longer periods of time or at least re-used the same places many times over.

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CHAPTER ONE: INTRODUCTION

STUDY BACKGROUND

1.0 INTRODUCTION

The term MSA was first introduced in 1928 by A.J.H. Goodwin in an attempt to classify the Stone Age Cultures of Southern Africa (Malan 1957). His introduction of the term was based on technological attributes and associated hominids (Masao, 1992). The Middle Stone Age currently estimated to have lasted between 250,000 – 30,000 years ago is technologically characterized by the specialized method of flake production also known as the prepared disc core technique or the Levallois technique. In this technology, a large flake of predetermined size and shape is struck from a core (Clark 1988). However, the period is still poorly known, with very few sites discovered and analyzed satisfactorily. The MSA artifacts include, Mousterian and Levallois points, Levallois cores, and a wide range of scrapers (Ambrose *et.al.* 1990, McBrearty 1988,1989, Clark 1988, Merrick *et.al.* 1994). It is during the MSA that material and behavioural traits that preceded the complex traits of Later Stone Age (LSA) in East Africa began to manifest themselves. This is the beginning of the emergence of a system that made possible the conveyance of precise information and abstract ideas by modern human beings (Clark, 1988). According to Melhman (1989), If the time range of MSA and the later developments is confirmed, the immediate response is that we are dealing with an enourmous time span on a vast continent for which we have a staggering amount of data pointing either through time or across space.

This study presents experimental aspects of research concerning the nature of manufacture, use and discard of tools at Muguruk and Prospect Farm. See figure (1.1) for MSA sites described in this study and the rest of East Africa.

The objective of this study is to go beyond typological classification schemes and descriptive quantitative analysis characteristic of past studies. The study adopts a general holistic approach and examines all aspects of MSA technology including the nature and acquisition of raw materials, transport, artifact manufacture, tool use and discard. This holistic approach will give a better overall impression of MSA lifestyle(s) and behavioural patterns.

1.1 RESEARCH PROBLEM

The term Middle Stone Age is used synonymously with the Middle Paleolithic of Europe, North Africa and the Sahara. It includes a variety of lithic industries chronologically related, however, the chronology, lacks precision. The term is used rather too generally to describe a combination of recurring technological and typological characteristics.

The close of MSA can be seen easily in most parts of East Africa with the onset of LSA between 30,000 - 60,000 years ago where blade and micro-blade/flake technology dominates the assemblages from formally flake styled tool-kit (Ambrose 1998).

The beginning of MSA however, is hard to discern and is often identified only with the disappearance of bifaces (hand axes and cleavers) of the Acheulian techno-

complex. But while some areas conform to this rule, and have transitions sharply defined, most do not, either technologically or stratigraphically (Clark 1988).

A major problem in recognizing technical innovations of MSA is that much, or most, of these innovations probably found expression in material objects made of perishable substances - wood, bark, bones - that have not survived (Clark 1988). The stone artifacts that have been used to interpret this period may well have been only a minor part of the tool-kits of MSA populations. Up to now, it has not been possible to correlate precisely primary context assemblages and examine their micro-typology and technology. In such a case it is very unlikely that the study of the stone artifacts alone have contributed much.

Morphological and technological criteria have been extensively used by archaeologists in lithic analysis so that total assemblage differences and similarities have been expressed in precise quantitative terms (L.R Binford and S.R Binford 1968). But in trying to understand changes through time and in the explanation of similarities and differences, problems have always arisen. Since no two objects are alike if examined at a sufficiently refined scale (Spaulding 1977) such blanket approach is bound to create problems. Archaeologists studying MSA materials often decide albeit too arbitrarily which kind of variations are relevant to the problems under study. The arguments and conclusions from such studies have thus created too much speculation and subjectivity in a very important period of modern human's evolution.

Fundamental doubts have also been raised about the accuracy and reliability of certain assumptions and conclusions. The basic assumption that classification (Typology) of everything into neat little pigeonholes can give us a clear picture of what took place in the Paleolithic societies lacks any test limits of interpretation. Though Barbara Anthony (1978) and Sally McBrearty (1986) typed the materials they recovered from Prospect Farm and Muguruk respectively, the classification did not help them much in identification of the exact use of the tools recovered and what could have triggered their manufacture. The best they did was to speculate on the possible uses of the tools. But gazing into the crystal ball is hardly regarded as a legitimate occupation for a scientist.

As a search for the behavioural patterns of the early humans intensifies, most researchers have come to appreciate the fact that humans as a species need to be emotionally part of a group. Intellectually they are equipped to understand and manipulate their environment to suit their needs (Leaky and Lewin 1983). Most of these conclusions however, have arisen from studies of our primate cousins (Jolly 1972; Le Gross 1971). But primate studies are unlikely to give any serious insights into the social organization as in physical appearance and cognitive capacity. In their different ways, both human and primate behaviours are more likely to be the product of particular economic systems rather than in-built patterns. Besides, social behaviour in each species is to some degree flexible and fashioned to a greater extent by prevailing conditions. Therefore, the only way we can begin to understand the adaptive strategies of MSA populations in this study is by turning to their own

activities rather than analogical studies. It is with that in mind that this study has attempted to reach some guideline for envisioning the sort of social organization that the MSA people in East Africa might have adopted to make their potential ways of achieving their goals become a reality.


Archaeologists working in MSA seem to have successfully resolved some of the questions regarding the type of MSA stone tools and the technology involved in their manufacture. However other important questions, specifically the question of traces of specialization remain unanswered. Were MSA People practicing a specialized hunting with a collector strategy or with a more general response to local availability of resources? Then secondly, there is the general speculation of the function of MSA stone tools, but the nature of this functions have never been clearly defined by either lithists or faunal analysts studying the MSA materials.

In their studies at Muguruk and Prospect Farm, McBrearty (1988) and Anthony (1978) placed a significant emphasis on the type of tools at the two sites and the technology involved. However, we do not yet have enough information from Muguruk and Prospect Farm to make a definitive statement concerning the subsistence strategy and the real use of these tools. Discussion of the function of Paleolithic stone tools on typological grounds, that is, on the basis of purely morphological characteristics as was done at Prospect Farm and Muguruk is no-longer viable. The importance of experimentation in technological studies has taken center stage in archeology recently (cf. Kelly 1974, Arndt and Newcomer 1982, Barton and Bergman 1993)

In light of the research gaps outlined above, a case is presented demanding an archaeological understanding of the function of MSA stone tools and the subsistence strategies used at Muguruk and Prospect Farm. It is the intent of this study to contribute to an increased understanding of the function of MSA stone tools and the subsistence strategy at Muguruk and Prospect Farm

This study presents experimental aspects of research concerning the nature of manufacture, use and discard of tools during MSA. Information gained from:

- ◆ Analysis of lithic technology at Prospect farm and Muguruk, and,
- ◆ Replicative manufacture and tool experimentation is examined in light of its potential contribution to recognition of organization, technological and seasonal components of MSA subsistence.

How then do the replicated and tested tools of experimentation and lithic analysis enable the study to distinguish the archaeological traces of specialization in-line with adaptive strategy? 

The behavioural correlates of mobile bands are consistent with a collector strategy (Clark 1988, Kuhn 1995, Ann and Knecht 1993). In this case, specialization infers decisions based on the cost and benefits of a particular tool and area of habitation. In the second situation, which is more consistent with a versatile and opportunistic approach to survival, morphological standardization of tools suggests a more general response to local (including seasonal) variability in resources. To operationalize my approach archaeologically, I pose the following set of hypotheses.

1) If a versatile and opportunistic approach was taken by the MSA people towards meeting their daily subsistence requirements with a more general response to the local (including seasonal) variability in resources, then we should expect:

- ◆ Technology to be maintainable and versatile with generalized application to a variety of circumstances. Either a spare or a set of inter-changeable parts that would be recognized archaeologically by standardization will characterize The tools or,

2) If a specialized collector/gatherer approach was taken by the MSA people, then,

- ◆ The technology would be reliable. That is the tools would be overly specialized with redundant parts capable of being reworked into use, limited chances of failure once in use or absolutely failure free. Such tools would be recognized by the presence of special purpose tools designed for use in special occasions or specific functions.

1.2 JUSTIFICATION FOR THE STUDY

Sally McBrearty compiled the most detailed research on materials from Muguruk after her excavations in 1979 and 1980. McBrearty's work attempted a clarification of the nature of the Sangoan and Middle Stone Age material in Lake Victoria region.

In Prospect Farm (GsJi7), the object of the excavation was to attempt a definition of the prospect industry, which Barbara Anthony did in 1978 after opening four trenches. In 1991, Kodalo J. Tombo, did a comparative study of the Middle Stone Age cores from Kenya Highlands and Lake Victoria in which he used materials from Prospect Farm and Muguruk (Kodalo 1991). But his work, was largely a descriptive study and no experiments were carried out.

Many of the attributes especially those devoted to cores have little value in shading light on the nature of individual industries. It is apparent that past research on these two sites involved handling assemblages, with very large quantities of tools that could not possibly allow a proper analysis and recording of attributes. The relationship between most MSA industries are still not well known, in fact as McBrearty (1988) aptly puts it, different investigators use the term MSA, at many different levels of abstraction, with artifacts being assigned to MSA on purely typological or technological basis.

In his informative Ph.D. dissertation, Toth (1982) points out several factors that can influence the nature of a stone artifact assemblage. Factors not given adequate consideration in the study of Muguruk and Prospect assemblages. They include:

- i. The functional requirements of the architects of the tool and the types of stone tools used for various tasks.
- ii. The spatial distribution of the activities on the landscape or what activities were carried out at or near the sites.

- iii. The cultural norms for artifact manufacture techniques, strategies and stylistic modes.
- iv. The degree of reliance upon lithic materials as tools.
- v. The nature of the raw materials, size, type, shape and availability
- vi. The number of individuals at the site and individual variation in artifact manufacture and use.
- vii. The possibilities of tool-kits reflecting some division of labour such as between sexes or age groups.
- viii. Possible non-functional importance of artifacts e.g. ideological concerns and aesthetics.
- ix. Disturbance (including, partial removal, addition and re-arrangements by geologic and biologic forces.

This study is an attempt to go beyond typological classification schemes and descriptive quantitative analysis characteristic of past studies. The study adopts a general holistic approach and examines all aspects of MSA lithic technology including, the nature and acquisition of raw materials, transport, artifact manufacture and tool use.

Since of special interest here is the general behaviour of MSA people that in many ways is appreciated by qualitative appraisal, statistical and multi-variate analysis is used primarily for descriptive purposes. A certain amount of subjective understanding of the real processes involved was necessary due to the present state

of knowledge of MSA and lithic studies. This is however, followed by perusal of their objective results through experiments. The MSA itself, by contrast, resists categorization.

We cannot make sense of the past through statistics only, through the gathering of information about material circumstances, without tempering this fact-fathering with any kind of imaginative projection as to how an individual's life might actually be perceived and experienced by him or herself. Our world, the past and even present, is not composed of such an easily legible set of signs as certain of us archaeologists wish. The holistic approach this study adopts is best suited to come closest to reality.

The experimental approach proposed herein have never been used to study materials from this period and this too will provide invaluable information.

1.3 HISTORY OF RESEARCH

The Early 1920s experienced what might be seen as the first systematic research on Middle Stone Age in East Africa. Along Lake Naivasha in the Nakuru basin, L.S.B Leaky (1936) worked on several artifact materials made from obsidian. Leaky (1936) describes these artifacts as cores, flakes and blade tools.

At Kinangop plateau in 1936, L.S.B. Leaky found an assemblage of small unifacially and bifacially worked points, and which he named "Pseudo-Stillbay" (Leaky 1936). It was considered a terminal Acheulian technology. Still in 1936, at

Cartwright Farm, Leaky who grouped them as MSA (Leaky 1936) discovered a small assemblage of blades and blade tools

The first evidence of a sequence defined as MSA was published by L.S.B Leaky and W. Owen (1945) from the results of a fieldwork in the Winam Gulf (now Nyanza province) on the Northwest side of Lake Victoria. There was however no attempt of an experimental study or comparative approach in understanding these assemblages.

H.V. Merrick (1975) worked at Prolonged Drift in the rift valley, Lake Nakuru basin and Lukenya Hill in 1969 and 1971. He also analyzed a few materials from Prospect Farm in 1975. The thesis of Merrick's work in all these sites was to understand the transition from the Middle Stone Age to Late Stone Age industries and document changes within lithic industries of these regions. The results of his studies show no use of the experimental approach in the study of MSA materials.

In 1972, Barbara Anthony studied the MSA sites at Prolonged Drift and Prospect Farm. She established tool typologies and the technology of their manufacture. Kodalo Tombo (1991) did a comparative study of MSA cores from Kenya highlands and Lake Victoria basin to establish similarities and differences from the two areas. No experimental approach was used.

S. McBrearty carried out excavations at Muguruk in 1979 and 1980. She studied Songhor and Muguruk materials, and her results showed that they were related to the Sangoan - Lupemban industries described by Isaac (1972, 1982) from Central Africa (McBrearty 1986). The results of Opira Odongo's excavation in 1981 at

Muguruk remain unpublished due to his untimely death. Mwikali Kithuka worked on flakes, cores, points, Outils e'cailles and blades from Cartwright site in 1989 and 1990. Hers was a description of the artifacts in detail (Kithuka 1990)

S. Barut worked at Lukenya Hill in Kenya and Nasera Rock Shelter in Tanzania to examine changes in the use of sites and lithic raw materials during the later MSA and early LSA. She determined technological and typological differences among the assemblages (Barut 1994). P. Willoughby worked in southwestern Tanzania around Rukwa Valley. She investigated Six MSA sites of Idlul, Idlul3, Idlul4, Idlul7, Idlul9 and Idlul10 reported earlier by S. McBrearty, I. Wynn, and A.C. Wanne. Using the evidence from the sites, Willoughby tried to review some arguments concerning the origin and dispersal of modern humans and the importance of MSA for the resolution of the problem (See Willoughby 1993).

The Middle Stone Age is currently seen as being contemporaneous with the Middle Paleolithic of North Africa and Eurasia (Clark 1989). Some scholars like Klein (1989) estimate it at between 130,000 and 50,000 - 35,000 years ago. These dates began to be apparent in 1972 after increasing numbers of old radiocarbon dates from Southern Africa showed that most of those dates giving ages younger than 30,000 B.P for MSA, were from contaminated samples (Beaumont and Vogel 1972)

At Klasies River Mouth, fossils were found that are clearly associated with MSA tightly tied into the stratigraphy (Singer and Wymer 1982). At Laetoli in the Ngaloba Beds, artifacts have been found in association with the Laetoli 18 cranium (Day et.al. 1980). Middle Stone Age artifacts, have also been found in the sediments

that produced the Kanjera cranium, so is the Diridawa Mandible which is said to belong to the MSA occupation of Porc Epic Cave. In North Africa, fossils have been found in association with MSA materials at Dar Es Sultan cave 2. The Middle Paleolithic in the Middle East appears to have the same time range.

In Africa and Europe, the bifaces of the Acheulian techno complex disappear around 200,000 years ago in stages VII and VIII of the Moroccan sequence, the true levalloisian cores take over in place of proto levalloisian forms, so is the case at EL Ma El Abiod in Algeria. In South Africa and Kenya highlands the Fauresmith makes its appearance while in the Middle East we see the Jabrudian (Rust 1950). The Sangoan - Lupemban make their appearance in Central and East Africa respectively (McBrearty 1986). It is during this time that we recognize for the first time, difference in stone tools, with the notable variants being: the Lupemban lanceolates of Western Kenya, the Aterian points of North Africa, the Levallois industries, the prospect industry, and South Africa's Stillbay industry. See figure (?)

J.D. Clark (1988) produced a summary article about the MSA in East Africa while A. Thackeray (1992) did the same for South Africa and T. Maso (1992) for Tanzania.

1.4 THE MIDDLE STONE AGE

The MSA, currently estimated to have lasted between 250,000 and 30,000 years ago (Mehlman 1979, Manega 1995, McBrearty 1994, Clark 1988, Willoughby 1993, Barut 1994) is considered a period of major change in human biological and

cultural evolution. The term "Middle Stone Age" was coined and introduced in 1929 (Goodwin and Van Riet Lowe 1929). It describes a combination of recurring technological and typological characteristics that follow those of the Early Stone Age and precedes those of the Later Stone Age (Clark 1988). It was a time that saw the beginning of cultural identities and biological differentiation as well as the appearance of the first anatomically modern humans from some as yet unidentified gene pool of Archaic *Homo sapiens* in Africa (Stringer and Andrews (1988).

Stone artifacts in which flakes from carefully prepared cores generally abound characterize the MSA and large bifaces disappear. The environmental changes during this time coincides with a time of regressive sea level, aridity and the on-set of glaciation conditions at the end of the last interglacial (Clark 1989). Past research indicates unprecedented shifts in the size distribution, subsistence economy, technology and social organization of human populations. It was a final transition representing a fundamental shift in the pattern of human experience. The complex behavioural traits like painting that foreshadow the LSA in sub-Saharan Africa and the rest of the Old World had began to manifest themselves in the MSA. The possible reasons for the appearance of MSA are still highly hypothetical (Stringer and Andrews 1988, Brauer 1992) have proposed an African origin of modern human behaviour and modern human anatomy within the last 250,000 years. It is around this time too that MSA cultural trait become more visible. Willoughby (1993) has shown the critical role of MSA in understanding the origin and dispersal of anatomically modern humans and bicultural evolution. A number of Paleontologists and archaeologists

(Stringer 1990,1992, Clark 1989, 1992, Stringer and Andrews 1988, Brauer 1984, 1989, 1992, Willoghby 1993) have strongly tried to prove that sub Saharan Africa is the region and the MSA is the period in which modern humans first developed.

Two major theories have emerged that attempt an explanation for the origins of modern humans and by extension, modern cultural traits. One theory fronted by Wolpoff (1992) and Wolpoff *et.al.* (1994) Posits that modern humans evolved more or less simultaneously from earlier, non-modern populations, throughout the occupied world. Thus, there was a geographically wide spread, concurrent evolution toward modern humans. This theory has since been called “multi-regional evolution theory”.

Another theory suggests that modern humans emerged in a circumscribed geographic region and subsequently replaced non-modern populations elsewhere (Klein 1989, Stringer 1992). This theory christened by Howells (1976) as “Noah’s Ark” is currently known as the replacement model, also dubbed “Out of Africa theory” since its proponents look to Africa as the modern human birthplace. 7

Unlike the Out of Africa proponents, multi-regionalists, see no fossil evidence for racial continuity between non-modern and modern humans in widely separate parts of the world (Klein 1989). What they see instead is a gene drift and natural selection driving separate archaic populations during MSA along divergent evolutionary trajectories. A second move out of Africa took place during the MSA. This time, not the Homo Ergurstus of the 1.4 – 1 mya ago is making a move but the anatomically modern human beings (Cann *et.al.* 1987a, 1987b). This coincides with the environmental changes coincident with a time of regressive sea level, aridity and

the on-set of glacial conditions at the end of the last interglacial, definitely favouring movements out of inhospitable regions. This is a period in which we can examine a system moving through a series of transformations. The external environment, for instance, the Sahara was at this time a region of hyperacidity due to significant global lowering of temperatures and glaciation in the high latitudes. This evidence of disequilibrium can explain the apparent evidence of Sangoan - Lupemban industry of Isaac (1982) and McBrearty (1988) which is followed by or is contemporaneous with MSA industries. Described by Clark (1965) as including choppers, picks and core scrapers, and defined by Kleindienst (1962) as heavy duty component of the Acheulian, the industry stands out as a mystery from past research. As evidenced by Clark's (1974) later description of assemblages from Kalambo falls, an excavated open air occurrence of *in situ* Sangoan material, the typical Sangoan assemblage, heavy duty component, vastly outnumber the light duty equipment; 19.0 per cent to 74.8 per cent (McBrearty 1988). In central Rift Valley, only a few kilometers from lake Victoria (190km), where we have the Sangoan (associated with a more closed vegetation pattern, such as savanna woodland and forest), is the Fauresmith (Nanyukian, 174,000 \pm 20,000 associated with montane grasslands and higher plateaus and mountains). If the MSA period is considered the period of the emergence of modern humans in East Africa from a single female as suggested by mitochondria DNA evidence, why is there so much regional diversity within such short distances? What led to this kind of variation? Why was it that the modern genotype

evolved in MSA? At present, all that is available towards an attempt at these questions are broad outlines.

1.5 THEORITICAL FRAMEWORK: CULTURAL ECOLOGY

In view of the shortcomings observed in MSA, this study advanced cultural ecology to help explain the adaptive strategies of MSA in East Africa.

A study of cultural ecology (steward 1955) considers environmental features such as available resources (material, floral and faunal), weather patterns, and landscape in order to look at the adaptive system. This includes the organization of labour, technology, social structure, settlement pattern, land management and other social institutions (Steward 1955).

Behavioural patterns involving subsistence strategy and their effects on the social structure of the group is given more emphasis... the organization, timing, cycling and management of human work in the pursuit of subsistenc~~e~~ ... (Murphy 1977).

Steward (1955) In Theory of Culture Change introduced cultural ecology as a concept. Cultural ecology is defined as "culture change, which is induced by adaptation to the environment" (Steward 1955). Steward recognized a definite relationship between environmental factors and cultural adaptation and attempted to place natural habitat and technology in proper perspective.

Stewards' interests lay mainly in the causal relationships between the environment, social institutions and their involvement with the process of evolutionary change.

To discover the relationships between these elements, Steward (1955) proposed some objectives and procedures in the concept and method of cultural ecology. The objectives he held were:

- ◆ An understanding of the biological nature of man as a species.
- ◆ An understanding of how culture is affected by the adaptation to the environment.

The procedures Steward outlined made up what he felt to be the method of cultural ecology. First, one has to determine the inter-relationship of exploitative or productive technology with the environment (Steward 1955). Steward held that simpler cultures would more directly interact with the environment than complex ones. For example, as a society overcomes its subsistence problems through technology and organization, social complexity increases and the dominant factors of culture shift from the environment to social institutions.

Secondly, one should determine the behaviour patterns involved in the exploitation of the environment by the use of a particular technology (Steward 1955).

The techniques of exploitation, depend upon at least three things:

- (i) The floral, faunal, and material resources available,
- (ii) The history of the area - including technology both diffused and independently invented.

- (iii) The extent to which subsistence behaviour affects other aspects of culture.

Steward based several of his cultural-ecological and evolutionary formulations on his finding from studying the Great Basin Shoshoneans. The basic assertion was that cultural ecology of the area had a "... socially fragmented effect..." (Thomas 1973) on group subsistence there. The unpredictable resources of the Great Basin and their relatively sparse distribution caused, in Steward's view, the social organization to reflect this. He saw a remarkable absence of any traditional institutions other than nuclear formalities (Steward 1977). David Hurst Thomas later published an empirical test for the cultural ecology model, which supported the settlement pattern and subsistence strategy proposed by Steward for the Great Basin Shoshoneans (Thomas 1973).

The concept of cultural ecology has since evolved into a sort of sub-field which looks at relationships between several variables such as settlement, environment, geomorphology, subsistence strategy, social organization and resources - both living and non living.

RELEVANCE OF THE THEORY TO THE STUDY

The rarity of archaeological sites from MSA in East Africa suggests human populations were highly mobile and of low density (Klein 1989). East Africa must have been colder, more arid and lower in animal biomass than at present. Scarcity and high mobility of game animals could have encouraged the use of lightweight and

long use - life tools. Raw materials might have been procured from a wide variety of sources including materials for multi-purpose tools.

Cultural ecology is concerned overall not only with the interaction between social institutions and the environment, but also with a cultures means of adaptation to the environment. Ultimately, cultural ecology will assist the study identify the causal relationships between the environment, social institutions and their involvement with the process of evolutionary change.

The theory will help us understand cultural causes of change in man as a biological organism. Cultures can alter their environments, resulting in both adaptive and non-adaptive conditions. The ways in which cultures go about maximizing the benefits while minimizing the drawbacks is part of the adaptive strategies and therefore a consideration of cultural ecology.

Cultural ecology will help the proposed research place natural habitat and technology in proper perspective and help the analysis of data gain a higher level of sophistication.

Past research in MSA has shown a remarkable absence of any traditional institutions other than nuclear families. Such smaller groups could best subsist by foraging and hunting the widely dispersed resources.

1.6 THE MIDDLE STONE AGE IN EAST AFRICA

There is no clearly defined area of the continent of Africa known as East Africa (Clark 1989). Quite often, East Africa is generally regarded as the countries of Kenya,

Uganda and Tanzania. Where the term changes to Eastern Africa, then countries of Sudan, Somalia and Ethiopia are normally included, and in some cases, parts of the Democratic Republic of Congo (Zaire), Zambia and Malawi. However, for the purposes of this study, East Africa is defined here as Kenya, Uganda and Tanzania.

In East Africa, MSA makes its appearance during the period of aridity (stage 6, Oxygen isotope) and end of the Acheulian, the equivalent of Europe's penultimate (RISS) (Clark 1989). Most reliable dates, for MSA in Africa are radiometric and isotopic. The most reliable dating so far from East Africa is from Isimilia in Central Tanzania, dated by uranium series to ca.260, 000 B.p (Howell 1976). At Kapthurin in Baringo, the youngest K/Ar age for a late Acheulian is 230,000 B.p (Leaky *et.al.* 1969). In general, MSA sites and fossil remains of modern humans in Tanzania at Mumba (Mehlman 1979) Ngaloba, Nasiusiu and Ndotu (Manega 1995), Kapthurin in Kenya, McBrearty (1994), point to 250,000 years ago as a possible earliest date of MSA appearance. Whether MSA peoples were modern or not, it has been argued that their behaviours were less than "modern". Klein (1992) has argued that they did not make ornaments or practice art, had no sophisticated tools of bone and did not exploit fish resources, flying birds or dangerous preys, parameters that Klein apparently considers "modern" behaviour.

The MSA seems to give way to LSA in East Africa at about 50,000 years ago as evidenced from Enkapune ya Muto in Kenya (Ambrose 1992). However, the most important thing here is the fact that modern human behaviour is projected to have occurred during this period in East Africa (Klein 1989; 1992). Evidence suggests that

modern behavioural patterns or resource exploitation and regional variation in technology began here and especially during the transition from MSA to LSA.

MSA occurrences in East Africa are not more specifically differentiated apart from the occurrence within Lake Victoria Basin. The occurrences there are sufficiently different that it has necessitated use of distinctive terms as the associations there appear to be closer to the Zaire basin and equatorial rather than with East African Savannas (Clark 1989).

The term "Sangoan" has since been adopted (formerly Tumbian by Leaky and Owen). The term came from surface collections at Sango on the West Side of Lake Victoria (Wayland 1923). The term Lupemban for stratified assemblages in South Western Zaire and Northern Eastern Angola is also used to describe sealed post Acheulian assemblages from Nsongezi (Cole 1967) and Muguruk (McBrearty 1986).

In terms of its distribution, it is not easy to determine the geographical distribution of MSA in East Africa. The MSA period is one of the least studied periods in Archaeology. The sites in East Africa are sparse and few. Though more sites are believed to exist, they are yet to be discovered and those already discovered are yet to be studied completely. Muguruk and Prospect Farm for instance, are yet to be completely excavated though erosion is virtually destroying the sites.

The environmental setting in which the makers of Middle Stone Age industries occupied the high plains, savanna and the grasslands of East Africa can be determined in large part by worldwide climatic fluctuations, modified in the region by local physiographic features (Clark 1989). There have been significant changes in the

distribution and composition of vegetation zones reflecting climatic fluctuations between glacial and interglacial conditions in the high latitudes. During the glacial periods, temperatures in tropical Africa were lowered, sometimes as much as 7 - 10°C (Butzer, 1978, Hamilton 1976, 1982). The climate was generally drier resulting in significant extension of the dessert and semi-arid grassland in East Africa. Consisting of high inland plateau dominated by some of the highest mountains in the continent, East Africa is bounded in the southern part of Tanzania by a narrow coastal plain 15 - 65 km in width. Cutting through the region is the Great Rift Valley defying the elevated interior plateau.

Some studied sites of MSA in East Africa include Prospect Farm, Muguruk, Songhor, Prolonged Drift, Kanjera, Enkampung ya Muto, Loyangalani, Lukenya Hill, Ntuka (under study) and Kapthurin, Baringo in Kenya among others. In Tanzania, Olduvai Gorge, Magosi, Laetoli Mumba, Nasera, Isimilia and Tendaguru are some of the classic MSA sites, while Uganda has yielded Sango Bay, Nsongezi and Kagera among others. There are possibilities that there are lots more sites of MSA along the Rift Valley and the Lake Victoria Basin.

Geographical distribution of MSA in East Africa suggest the possibility of a hunter gatherer mobile society though there is no serous evidence to prove and support this.

1.7 THE CONTRIBUTION OF LITHIC ANALYSIS

Lithics have a special place in the study of both extinct and extant communities the world over. This is because geological or environmental situations or conditions of preservation rarely control their presence. Lithics have been vital in the construction of the past in more than one way. It has been used as a spatial and temporal indicator of the distribution of prehistoric groups and has also been used to determine prehistoric contacts between or among societies.

Lithic analysis has played a significant role in the construction of past cultures. In our attempt to understand past behaviours, we have come to grapple with the grim reality that behaviour is not preserved or fossilized like bones in the archaeological record. Stone tools remain the best-preserved imprints of man's past activities in the archaeological record.

Lithic analysis has further helped with the interpretation of spatial and temporal indicators of the distribution of prehistoric groups as well as their dietary and defense systems.

Similarity and dissimilarity in stone tools has been used in the classification of what one might term the major phases of human cultural evolution. The Early Stone Age has acquired its identity from the nature of stone tools recovered in certain sites which denote certain constant mosaics and running characteristics distinct from any other phase of cultural evolution. Major or characteristic ESA tools are like the Acheulian hand ax and hammerstones found at Olduvai Gorge. The tools are also known as Oldowan and Acheulian respectively.

The MSA, dominated by Levalloise points and disc cores is also unique in itself and again acquires its name from past lithic analysis, with its tools appearing between ESA and LSA when we experience major regional diversity and rapid technological and general behavioural change.

Stone artifacts are often found in full form and unlike ceramics that break into several pieces exposing analysis to various statistical errors and possible omissions and commission stone tools don't break easily. This allows for speedy analysis with less error.

Unlike other valued goods (e.g. gold, silver, metal e.t.c.), that is restricted to privileged social classes, stone tools are spread and are found everywhere regardless of their social classes. Lithic analysis hence gives a complete picture of the society under study. But stone artifacts have the disadvantage of falling easily to the hands of artifact collectors and pseudo archaeologists from the surface. This leads to their selective removal from the original sites interfering with the original information.

Stone tools have served various functions in past communities and continue to do so among societies today. They have been used for digging, cutting, sawing, butchering and defense among others. The reflection of such functions has enabled archaeologists to bring together useful information essential for the reconstruction of prehistoric societies besides the building of Archaeological record and theories which form the bedrock of archaeological interpretation.

1.8 CONCLUSION

This chapter has defined the background of the study, highlighted previous works in this area at length and presented the major problems and questions to be investigated in this work.

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 later.

In a brief but tacit manner, the chapter has also given the research gaps, problems and shortcomings of past MSA studies in East Africa and the controversies and conflicting information about the emergence of modern beings and by extension, modern behaviour.

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cleared rivers of the vegetation during colonial times and, *Pundo Makwar*, a Luo term for red soil referring to the deep red lateritic soil at the site. It is said the *Pundo Makwar* name has something to do with Archdeacon Owen, his students and their Stone collection activities. (Patrick Thore pers. Comm).

The name Muguruk (Mukruok) refers to an incident involving the collapse of the Muguruk River Bridge during its construction in 1931.

The area receives between 1,000 and 1,300mm of rainfall annually. It experiences the long and short rains in March to May and October to December respectively. The Luo of Kenya populates the area around Muguruk with an agriculture-based economy; cultivation, goats, sheep and cattle rearing. However, of late, climatic changes are being experienced and the short and long rains do not come exactly during these months.

Vegetation at Muguruk consists mainly of grasses and shrubby secondary growth that follows cultivation.

Discovered by Rev. W. Owen in 1936, the materials from the site were later named "Tumbian" by L.S.B. Leakey. Researchers have since abandoned the term Tumbian. Leakey and Owens' description provides the first systematic treatment of Stone Age material from Muguruk giving the first idea of the range of artifacts from the site.

After Owen and L.S.B. Leakey, no activity took place at Muguruk until 1977 when Sally McBreaty visited the site. In 1978, Alex Opira Odongo, excavated a large trench in the North West of the site under the supervision of Onyango Abuje. He

later died before analyzing his data, and no provenience data or field notes are available. The samples were subsequently not used in this study. From May 1979 to September 1980, Sally McBrearty carried out excavations at the site and her study remains the most detailed so far from the site.

Past quarrying activities have greatly disturbed the site, with even greater damage caused by cattle and sheep grazing in the area. Though gazzetted as a national monument, there is no entrance to the site and one is forced to seek permission from a quarrying firm to go through the property before accessing the site.

The underlying Ombo Phonolite dipping gently to the SouthWest controls local topography in the area. Ombo Phonolite overlies Miocene fossiliferous beds at several sites including Ombo and Maboko (McBrearty 1988). It has been dated by potassium-argon method at 13.1 ± 0.6 M.Y (Bishop *et.al.* 1969) Muguruk is dominated by large outcrops of the Phonolite. Most artifacts are equally^{ly} made from the material.

Also overlying the Ombo Phonolite, is the lighter coloured finer textured Kisumu Phonolite cropping out 3km north east of Muguruk. There it is up faulted into a cliff 40m high near the village of Kisian see *figure 2.1*. The Kisumu Phonolite, is the next most frequent raw material after Ombo Phonolite in the Muguruk stone artifact assemblage. Also found here are quartzite and granite. This could be attributed to river lag deposits. A few artifacts are made of these materials at

Muguruk. At the village of Ojolla, 4km north of Muguruk are found basement complex rocks.

The period of faulting along Lake Victoria is placed at either Pliocene or Pleistocene times. Lake Victoria is however considered a more recent feature of the landscape. The uplift of the western and eastern branches of the main Rift Valley system during the Pleistocene created a down warped Basin that resulted in the formation of the lake. Muguruk stood at 40m above the level of Lake Victoria in 1980 (McBrearty 1988), and 3km north of the shore of Winam Gulf. This might have changed now with the effect of hyacinth and reported cases of fall in water table by scientists. There are possibilities a lake might have occupied the depression in the western portion of the Kano valley in the middle and later Pleistocene, which was not part of the expansive Lake Victoria. Due to absence of any beach deposits in the immediate vicinity of Muguruk site, it's not easy to determine the distance from the site to the shore at the time of occupation and whether or not the lake had any contributory factors in the occupation of Muguruk.

2.2 THE MUGURUK FORMATION

Designated the Muguruk formation, the sediments at Muguruk are divided into six members, numbered one to six. (See *figure 2.2*) They are all alluvial in origin.

Member 1 of the Muguruk Formation is the lowest and composed mostly of conglomerate with a maximum thickness of 2m (McBrearty 1988). It is presumed

to be Pleistocene in age and has rounded pebbles and cobbles in a consolidated calcareous sand matrix. Member 2 is approximately 1.5m thick and has coarse to medium sand. A mud cracked clay sand 2.5m thick designated member 3 overlies it in the central site. Overlying member 3 in the central site area is red clay sand 3.0m thick with a dense concentration of artifacts named *Pundo Makwar* (red soil) by McBrearty (1988). Member 2 contains the Ojolla industry. McBrearty attributed the concentration of MSA artifacts in this area to the soil composition, particularly termites, which are very active in the zone.

Member 4 containing the Later Stone Age microlithic artifacts in quartz and obsidian is overlain by a black cotton soil attributed to current weathering regime.

Trending northeast to southwest is an ancient channel with calcareous deposit 1.5m thick with a U-shaped erosion contact at its base with well-sorted sediments of medium sand with distinct ripple cross-bedding.

Member 5 exhibits sheets, veins and nodules of calcite throughout with reworked calcite nodules concentrated at the base of the channel. Overlying member five is member six, with a buff coloured overbank sands and silts gaining a maximum observed thickness of 1.2m. MSA artifacts are mainly concentrated near the top of member 6.

The commercial quarrying in 1977 and which continues to date destroyed the intervening deposits, making the stratigraphic relationship between members 5 and 6, and 2, 3 and 4 in the main site unclear.

According to McBrearty (1986, 1988) member 6, the overbank sand and silts may be a lateral facies equivalent of member 3, the mud cracked gray clay. See Figure 3.

Member 2 is mainly Sangoan-Lupemban occupation and the presence of calcite within the channel sands of member 5 and the concentration of reworked calcite nodules at their base may indicate, a period of aridity during the Sangoan-Lupemban occupation.

The acidity of the soil in the Muguruk formation is very high and this could account for the virtual absence of bones in the formation. The lack of either animal bone or volcanic ejecta has made it difficult to determine the precise age of the sediments at Muguruk. It is estimated that the sediments could have accumulated over a period of 30,000 to 170,000 years. Termites might, have accumulated the deposits overlaying the level in member 4 containing *Pundo Makwar* industry (red soil).

Going by McBrearty's (1988) estimates of termite sediment accumulation and the estimates of Lee and Wood (1971a, 1971b) member 4 accumulations represent a minimum of 10,000 to 100,000 years since the Middle Stone Age occupation.

Materials considered for analysis in this study are mainly from member 2, 4 and 6. Member 2 comprises mainly Sangoan-Lupemban materials while member 6 and 4 constitutes the East Africa Middle Stone Age industrial complex. The

Sangoan-Lupemban is found stratified over Acheulian and below MSA assemblages, but fits comfortably within neither.

From the fieldwork at Muguruk, though the site is very accessible it is in the verge of collapse. The access road to the site is blocked by an Asian quarrying firm that is blasting the site to nothingness and one has to get permission from the firm to gain entry to the site. The site is badly eroded and numerous artifacts are continuously being washed downstream.

During the course of survey, we could not notice anything new besides the typical Muguruk materials already stored at the Kenya National Museum in Nairobi. Farming activities are already picking up on the upper side of the site and it is only a matter of time before someone lands oxen plough on the site given the state of its neglect.

All the sites McBrearty excavated have since been refilled and new levels created by the intense erosion in the area.

2.3 PROSPECT FARM (GsJi7)

Prospect Farm is found in an extensive extinct volcano popularly known as Eburru, located approximately 40km south of Nakuru town, it is located in the Rift Valley and characterized by several ridges radiating out from a number of volcanic cones with rims measuring over 1930m above sea level. The 31km long mountain stretches from Elementaita to Naivasha. The site looks out at an extent of the Rift

Valley with two remnant lakes measuring 5 to 8km in length namely lakes; Nakuru and Elementaita.

It extends in elevation from 1,981m to more than 3,050m at its peak. The area has three zones of precipitation, and vegetation. Rainfall lies between 254 and 305mm at an elevation of 1,981 - 2,044m and 762mm or more a year from 2,042 - 2,164m (Anthony 1978)

The area has long and short rains with the short rains coming between November and December, and the long rains from April to June.

The name "Prospect Farm" is no longer in use today and non-of the current inhabitants of the area know it. To reach the site from Nakuru or Naivasha, one goes up to Kongasisi Market and takes the murrum road to Olesirua Market. The site is about 2km before reaching Olesirua Market and is part of the former expansive block estate property. Small-scale farmers, who were each allocated five acres of the farm by the government of Kenya currently, own the whole area. The area where the site is located has been allocated to two individuals but they are yet to receive their title deeds. The site is littered with obsidian flakes right across the road to Olesirua and is very easy to notice. Councillor Ole Liosono the current owner of the bigger part of Block Property has the best information on the area, but knows little about the site.

Anthony (1978) has argued that during the late MSA, perhaps 35,000 years ago, the two remnant lakes of Nakuru and Elementaita were intermittently

extensive and even much larger during the Later Stone Age when the "Kenya Capsian" people occupied the area.

The surrounding grasslands would have provided ample grazing for wild game and the lakes, an abundant water supply for both game and man. The slopes of Eburru are still strewn with artifacts today giving the impression that a sizable number of prehistoric people inhabited the area. The vegetation of the area is composed of grassland and leafy shrubs that grow as tall as 2 - 3m. Short acacia trees litter the area with Eburru forest forming a tangle of greenery in which live several wild species live. Deeply incised valleys expose sequences of sediments and volcanics.

Formerly rich in springs and streams flowing downhill to provide water to the drier zones below, the area currently has an acute water shortage with the settling inhabitants relying on brown water retrieved from a few sparsely placed boreholes. Today water is a precious but rare commodity in "Prospect Farm"

Mr. George Kleis of Denmark, Manager of the then Prospect Farm, discovered the archaeological site of "Prospect Farm" (See figure 2.3)

Artifacts were recovered from two localities, namely Locality I and Locality II. Locality II yielded the Middle Stone Age materials that were examined in this study. The excavators opened two trenches in locality II. They named the two trenches, pit trench (Phase I) and long trench (Phase II).

Pit trench (Phase I) yielded a total of 4,000 artifacts with a total of seventy (70) tools and twenty (20) cores. Since the number of tools from the trench was few, some tools excavated beyond this trench were included.

The long trench (Phase II) was a floor. It yielded well-preserved materials with undisturbed appearance. Anthony (1978) had argued that the site could have been a workshop given the large size of artifacts and high number of cores recovered from it. A total of sixty-four (64) tools were examined from the trench in this study.

Locality I, believed to contain younger materials, comprised a single trench with the same geological sequence as locality II, Phase I and II artifacts were recovered mainly from spits 23 - 26 with a total of 42 tools and 75 cores.

Phase IV of Locality I comprised mainly debitage with the dominant artifacts being mainly the "cutting edge" tools. I believe the tools from locality one of Leakey's Still Bay belong to the Later Stone Age, and subsequently I have not used them in this study.

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2.4 THE PROSPECT FARM FORMATION

Glynn Isaac had studied the geology of Eburru area at the time of excavation of the material under study. He assigned the point of junction of the former lakebeds with the mantle of tuffs and pumice on the ridges, the "Prospect Farm Formation".

The Prospect Farm Formation consists of a mantle of primary pyroclastics and mainly weathered tuff. The pit trench at locality II, where the material under

study came from, reaches the base of the mantle 1m below the present land surface adjoining the pit and 3m below the top of the escarpment where the excavation started.

According to Barbara Anthony (1978), the top 0.4m of the excavated soils at the locality do not belong to the Prospect Farm Formation. This then leaves the thickness of the mantle, at approximately 3m.

A major fault cuts the site off on its uphill southern end giving a downward deep of 5m or 6m today. At the time of excavation, a barometric reading at water tanks as well as traverse placed locality II at 698m. The locality had an additional 3m of tuffs and pumice extending the series downward with 21 of them belonging to the formation and 12 representing older strata. The latter were dug as an exploratory trench of small dimensions and bore no archaeological material (Anthony 1978). (See figure 2.4) for a simplified form of the strata. Pumice of the upper level occurs continuously in association with some amount of tuff, with at least some accompanying pumice whenever tuff seems to be dominant. Two older stratas have also been identified. They are formed of unconsolidated pumice often bundled by disintegrated pumice altered by chemical weathering from the original gray to reddish - orange. Middle Stone Age materials were found in a series of tuffs and pumice forming a mantle 3 or more meters thick. This was overlain by more recent soils containing the "Kenya Caspian" (Later Stone Age) as well as Stone Bowl culture remains. The pumice beds are prone to colour changes during chemical weathering. Grey when newly deposited, they change in turn, to tan, pink and

orange. More recent pumice becomes greenish or white and clay-like with destruction of the structure.

The tuffs vary less in colour. They have different tones of tan, yellow tan, pinkish tan, greenish tan with one showing heavy signs of ferruginization and ranging in colour from rose-red to a deep orange. Though the thickness of soils can sometimes give an indication of age and duration, the case at "Prospect Farm" is somewhat complicated. This is because, being dominated by volcanic, the possibility that a thick pumice deposit can accumulate in one day just as it can do so intermittently over many days or years, cannot be ruled out. The thickness of the pumice fall in "Prospect Farm" therefore, is no good temporal guide.

From the geological report and the presence of MSA materials closely overlain by LSA (Anthony 1978) Prospect Farm can be temporarily dated between 250,000 to 15,000 years ago. This is mainly the period of occupation, but the rise and fall in water tables from Lakes Nakuru and Elementaita is an obvious pointer to the fact that the area was occupied, abandoned and re-occupied several times.

At the time of this study, no dates had been secured for the Prospect Farm Formation. Dr. Stanley Ambrose is however in the process of working at the site with the intention of dating it. (Ambrose, Pers. comm.).

2.5 THE PALEOENVIRONMENT OF MSA

The East Africa region is dominated by some of the highest mountains in the continent. It is characterized by a high inland plateau area with a narrow coastal

plain 15 - 65km in width in the southern parts of Kenya and Tanzania. The great East African Rift Valley enters through the elevated interior plateau.

The climatic fluctuations between the glacial and interglacial conditions in the high latitudes created significant changes in the distribution and composition of vegetation zones in the East African region. Whereas during the interglacial, conditions would appear to have been in general similar to those of the present-day interglacial episodes, during the glacial periods, temperatures in Africa were lower by as much as 7° - 10°C (Clark 1988). The lowering of the temperatures resulted in major readjustment of vegetation zones with higher altitude vegetation descending some 1000m below the present limits (Hamilton, 1976, 1982; Butzer, 1978). The semi-arid land was fairly extended due to the drier desert conditions. Worldwide climatic fluctuations greatly modified the environment setting in which the makers of MSA industries occupied the high plains and savanna country in East Africa (Clark 1989) with a few differences due to local physiographic features.

Adverse climatic changes must have forced some major demographic re-adjustments and subsequent abandonment of some habitats and a possible seasonal re-use of others. This could have led to interaction with adjacent populations.

The early last glacial period in East Africa, was one of movement and interaction that stimulated the development of more efficient subsistence strategies (Clark 1988). In a changing and deteriorating habitat, this was inevitable. People must have been forced to move to less harsh surroundings of East Africa.

Well dated evidence for climatic and vegetation changes in East Africa however begins only 40,000 - 30,000 years B.p, with only scattered and isolated data existing before this time. The Middle and early Later Pleistocene are particularly lacking in reliable and meaningful data. Lake Victoria had more grasses proliferating than forest species (Clark 1988). During the major worldwide episodes of lowered temperatures it is estimated that montane forests on the East African high regions descended some 1000m lower than the present limit (Hamilton 1982). There is evidence for three earlier periods of expanded glaciation on Ruwenzori, Kilimanjaro and Kenya Mountains; with the most recent correlated with *Wurm* III of the last glaciation. Another glaciation on Ruwenzori is estimated at 100,000 B.P with yet another, the Katabarua glaciation being older than this.

There is no doubt that significant change in climate, rainfall, temperature, evaporation rates and humidity took place during the making of MSA. However, it is still not very possible to reconstruct MSA paleoclimates and environments. What is given currently is more of an estimate and speculative in nature. Clark (1988) argues that "at times of lowered temperatures, and glaciation in high latitudes, the climates of large parts of East Africa, would have been cooler and drier and that during the interglacial stages, rainfall, humidity and temperature, would have increased, producing conditions similar to those of present day".

2.6 CONCLUSION

This chapter has described the two sites under study, given a justification for their choice, the geological formation of the sites, and their geomorphology. A history of archaeology at the two sites is also given. A brief history of MSA Paleo-environments is also described.

”

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

The Primary objective of the study was to carry out experimental tests to understand adaptive strategies reflected in MSA tool assemblages from Muguruk and Prospect Farm.

Specifically I carried out Edge-wear experiments with replicated tools of the Muguruk and Prospect Farm assemblages. I tested for different possible uses of the tools with (Roots, tubers, meat - cutting, tool manufacture, sawing among others). This helped reconstruct the activities of MSA populations in Muguruk and Prospect Farm, determine where these tasks were carried out, time consumed on the preparation of one tool and the sequence in which the activities took place.

Edge analysis was done to determine the amount of wear on tool edges (See section 4.1). Edge analysis studies provided the best indicators of functions. The raw materials for carrying out the experiments were collected from the two sites and analysis was done at the National Museums of Kenya archaeology Division Laboratory in Nairobi. Refitting studies combined with systematic flaking experiments can shed light on the reduction process and the extent to which the artifacts have been moved or transported in or out of an activity area (Clark 1988). Use-wear analysis provided a unique opportunity of reconstructing activities at the two sites where the tasks were carried out, and the sequence in which they took place. Comparison of data from Muguruk and Prospect Farm reduced the obvious

risk of dealing with materials that give an incomplete range of activities that took place in an entire cultural period. If the MSA conditions were unpredictable and required rapid adaptive strategies, then high mobility, short-term site occupation and inconsistent land use patterns should be reflected in the lithic assemblage. There should be smaller amounts of non-local materials in the assemblage or none at all. Herd following and a large home range sign should be reflected by the presence of non-local materials primarily found as discarded heavily reduced pieces, minimal cores and debitage.

Among modern hunter-gatherers, the timing and movement from one place to another determines the scheduling of both the needs for tools and the opportunities to make them (Stiner and Kuhn 1992). Different technological strategies may be employed to manipulate the utility of the artifacts, thereby bridging the spatial and temporal discontinuities between need and opportunities (Binford 1977, 1979; Bleed 1986; Kuhn 1989b; Nelson 1991; Short 1986; Torrence 1983). In determining how long materials will last, tactics for producing flakes and blanks 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 will help the study acquire information about the contingencies faced by MSA populations in making tools available when and where they were needed.

3.1 LITHIC ANALYSIS

Variability in this study is examined through analysis of artifact attributes. For example, to understand intra- and inter-site assemblage variation in tool type

and size, different characteristics of stone tool assemblages were examined such as frequency of different tool types (e.g. scrapers, points, burins) or, the amount of retouch on flakes, to assess different models of land use (e.g. Ebert 1992).

A study by Kuhn of Neanderthal technology, foraging strategies, and land use in west central Italy addressed issues of mobility, strategic planning and supplying of sites with stones in various stages along a reduction sequence (Binford 1977). In looking at these adaptive strategies, Kuhn discussed how certain lithic assemblage patterns are indicative of either expedient or reactive tool manufacture (C.F. Binford 1977) or on the other hand, the manufacturing of tools in anticipation of a later need (curation). To Kuhn issues of planning was a function of balancing the technological "provisioning of individuals" with "provisioning of places".

Practically speaking, his methodology, following the theoretical lead of Binford (1977) and Kelly, (1992) involved taking measurements and making observations of core reduction technology, the re-sharpening of tools and stone transport. He perceives the transport of raw material and tools to sites as key to translating the relationship between provisioning strategies and land use in archaeologically relevant terms.

Specifically, he analyzed frequencies of core types (e.g. centripetal, pseudo-prismatic, prepared platform, and bipolar cores), cores blank types (e.g. pebble or flake), types of striking platform (e.g. cortical, plain or faceted), flake scar patterns, retouched tools, un-retouched flakes and cortical flakes and tools. He also measured various core types, unbroken flakes and core thickness. These

measurements were then translated into probable strategies for provisioning of either places or individuals at various cave sites in different time periods. Assemblage dating to before 55,000 years ago displayed characteristics expected of the provisioning of individuals: heavy retouch and reduction, many exotic artifacts and the use of centripetal and bipolar cores to produce flakes that can withstand repeated re-sharpening. After 55,000 years ago assemblages tended to fit the pattern of the provisioning of places: little retouch, relatively low frequencies of exotic raw materials and use of pseudo-prismatic and parallel cores to manufacture lamina blanks (Kuhn 1995).

One inference from these lithic patterns is that before 55,000 years ago, Neanderthals in this part of the world were extremely mobile, whereas after 55,000 years ago, they began to stay in the same place for longer periods of time or re-use the same places many times over.

Though such an inference has no direct relationship to adaptation, still in this study, Kuhn's (1995) study reveals that the temporal shift coincides with a shift from mainly scavenging carcasses to hunting them, based on analysis of the Fauna at the same cave site (Stiner 1994). The ways in which hominids went about maximizing the benefits from their habitat while minimizing the drawbacks, like in the case of shifting from scavenging to hunting is part of the adaptive strategies and therefore a consideration of this study.

Barut (1994) studied lithic technology and attempted to perceive differences in mobility and planning through time. While examining LSA and MSA lithic

assemblages from Nasera Rock shelter in Tanzania and Lukenya Hill in Kenya, Barut (1994) used the same observations used by Kuhn (1995). She however also incorporated raw material (e.g. quartz, chert, obsidian) into her analysis because of their different stone texture properties and because stones were brought to the sites from a much further distance. The proportion of local versus non local material then serves as a good index for how widely a group may have ranged. This method was applied in this study.

These two studies of land use patterns illustrate the theoretical framework and methodological techniques that Paleolithic archaeologists are using in order to address topics of foraging strategies, and technological organization over a landscape. As Rodger (1997) observes, issues such as mobility, sedentism, foraging versus collecting or expedient versus curated technologies dominates the studies. Little consideration is given to determining whether recent hunter-gatherers were central placed or routed foragers. Home bases are assumed to exist, therefore, the debate is over how often, for what duration and in what way they were occupied (Rodger 1997).

3.2 TECHNOLOGICAL ORGANIZATION, RAW MATERIAL

ACQUISITION AND PLANNING

The nature of raw material can give some idea on movement pattern of hunter-gatherer groups. Procurement of raw material is generally embedded within a mobility pattern determined by plant and animal distribution and predictability

(Barut 1994). Raw material distribution and quality can significantly alter the relationship between mobility and lithic procurement. Through a nine days' visit and survey of Muguruk and Prospect Farm, I assessed site proximity to raw material sources and have described local raw material availability, locations of occurrence, type of raw materials, form and texture (See Chapter 4). I experimentally determined raw material flaking suitability. Also assessed were variations in site proximity to water sources and raw material sources. At Muguruk, tools made from obsidian have been found. Obsidian being an exotic material, it is possible that other available materials were considered inferior. Strategies of procurement and transport of non-local materials vary according to mobility patterns, including home range size, duration of site occupation and number of residential moves between raw material sources and site. This can reflect a response to stress environment characterized by small nomadic bands. The appearance of non-local raw materials as highly portable items, smaller in size or heavily reduced and used for generalized purposes is evidence of a mobile mode of life style (Binford, 1979). The provisioning of places with usable raw materials is expected at longer occupations and may also indicate more predictable or planned site use. Reduction intensities were measured for cores by weight, size and number of negative flake scars. Reduction due to source distance was separated from that attributed to raw material and function by measuring it for raw material type and edge angle

3.3 VARIABILITY

In view of lithic assemblages as sets of tools designed to perform specific tasks, then differences between assemblages on the same broad cultural level can be interpreted as reflecting.

- (i) Differences in the jobs being performed.
- (ii) Differential site utilization - that is a different settlement type.
- (iii) Replacement of one functional unit of the assemblage for another - what is commonly termed stylistic variability.
- (iv) Sampling error.

A functional view of artifactual material was adopted rather than lithic evolution or mutations, for it helped the study cope with several variables simultaneously when interpreting variability. The mode of analysis was geared towards dealing with multivariate causation to appreciate the complexity of the relationship between the nature of the assemblage.

3.4 TECHNOLOGICAL ANALYSIS

In this study, lithic analysis focussed on two dimensions of the technological record;

- (i) The intensity or duration of tool use and renewal; and
- (ii) Core reduction techniques, the tactics used in manufacturing flakes and tool blanks.

These required different analytical approaches.

The intensities of tool use and reduction is measured using two variables:

- i. The frequency of retouched tools relative to unmodified but potentially usable flakes (>2.0cm in length), a measure that has been employed in other studies (e.g. Rolland 1981)
- ii. The experimentally derived index of scraper reduction as used by Kuhn (1990b). The index monitors how much of a tool blank has been removed by previous retouch, based on the angle of the retouched edge and the extension or retouch scars relative to the medial thickness of the blank. This variable is ignored in the study as replication experiments and edge-wear analysis as proposed by Roger (1989) adequately covered the points of interests here.

3.5 TYPOLOGY AND ADAPTABILITY

A count of tool types divided by the number of tools in an assemblage, and variety in edge angles (Siegel, 1985) can indicate diversity in activities. This² can be correlated with assemblage size in residential camps where a variety of resources are brought in as a strategy for ensuring self-sufficiency or maximization of group efforts among small and mobile families (Yellen 1977). The total number of tools in the assemblage from Muguruk and Prospect Farm was counted. The variety in tool types (number of types) was also taken and the two divided to help in interpreting diversity in activities.

3.6 EDGE (FUNCTIONAL) ANALYSIS

Functional analysis was done for the materials excavated in Prospect Farm and Muguruk and the replicated materials.

A multi-dimensional approach to functional analysis as advised by Grace (1989) was used. This approach does not rely on any single variable being diagnostic, but on the agreement of all variables which lend a logically consistent functional reconstruction. It proceeds on the assumption that working different materials produces distinctive polishes, hence, bone polish, hide polish, among others (Roger 1989). The approach is based on a model of polish development as a continuum with no attempt at assigning a polish as material specific. The important variables of this model are the hardness of the worked material and the duration of use. (See Fig 3.1).

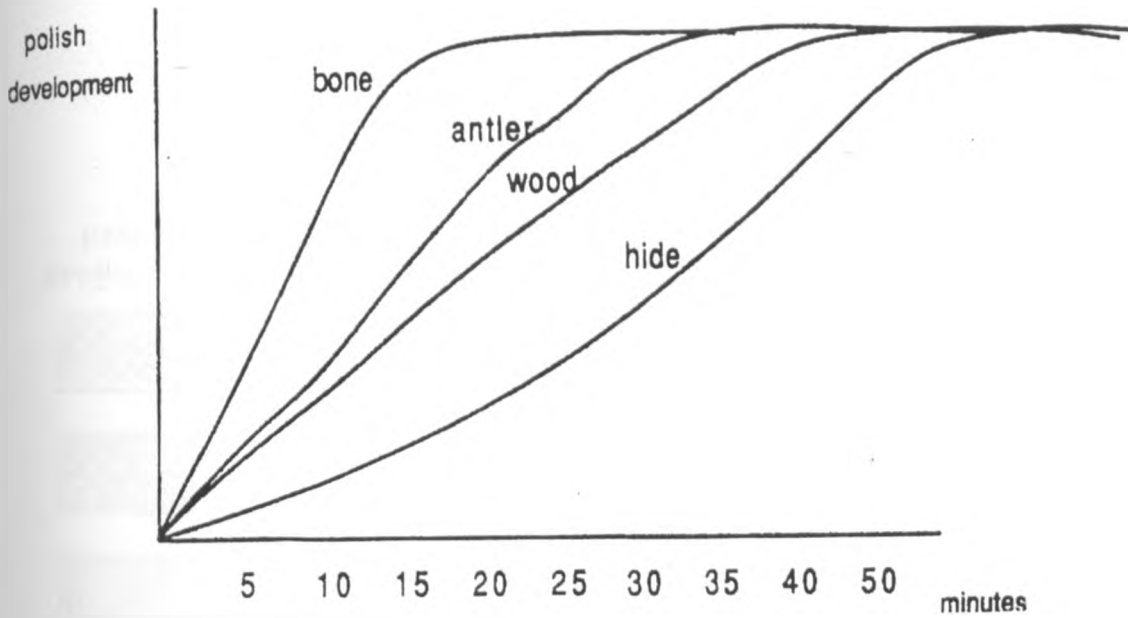


Fig 3.1 Polish development as a continuum

In the above model, polish develops as a continuum until the used area is completely polished with no unused flint texture remaining. The hardness of the worked material, determines the shape of the curve so that tools used on bones developed polish more rapidly than polish produced by working a softer material like hide. This translates as demonstrated in (Fig 3.2) that a particular level of polish development observed such as in X may be produced by, for instance, use on bone for six minutes, antler for eleven minutes, wood for fourteen minutes or hide twenty seven minutes.

polish
development

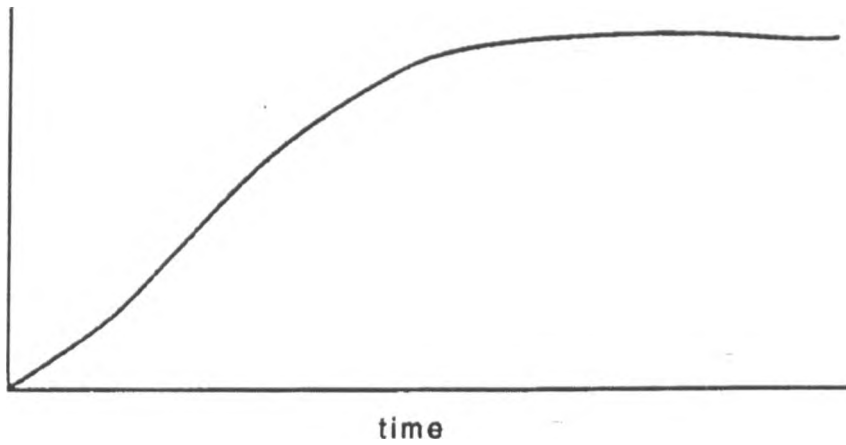


Fig 3.2: Effect of hardness of worked material on tools.

Since we cannot tell the duration of tool use, polish X could be the result of working any of the different materials.

Therefore, in this model, the idea is to treat polish as a single continuum.

See Fig 3.3 below.

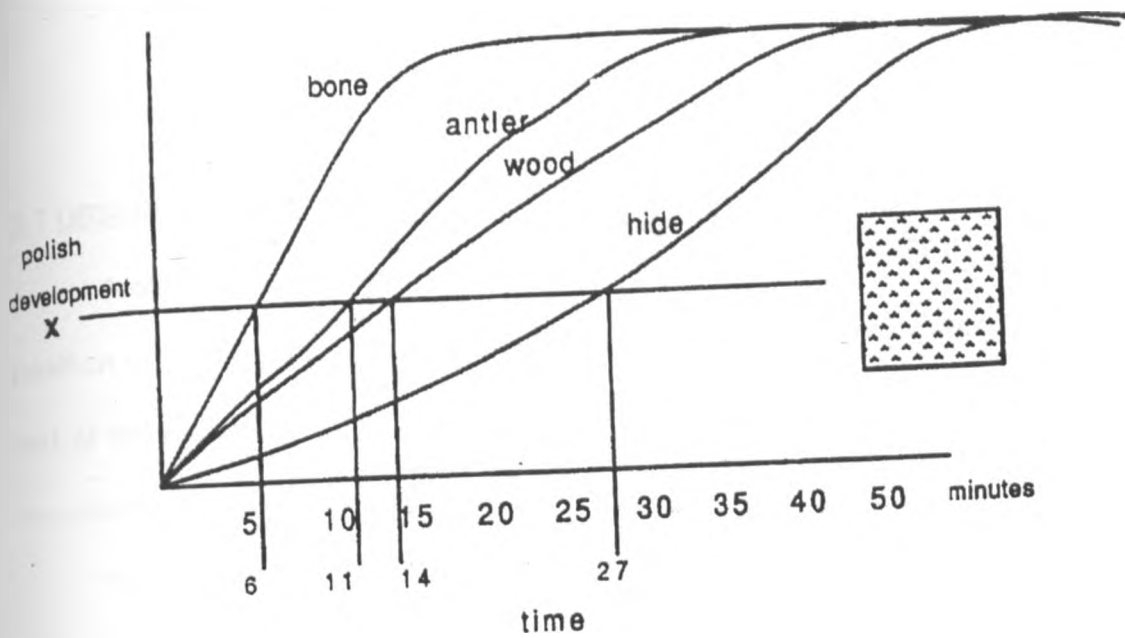


Fig 3.3: Polish development as a single continuum

This approach affords the simplest explanation that concurs with the observed data. The following aspects were undertaken in the use of the multi-dimensional approach.

CLEANING

The tools were washed with a domestic detergent and water to remove dirt and soil deposits. The tools were immersed in the detergent for ten minutes. The cleaning of the tool surface was carried out by wiping the surface with a cotton bud dipped in alcohol.

3.7 OBSERVATION RECORDING

A simple outline drawing of the tools were made on which was recorded position of any features and the location of any photographs that were taken. The rest of the recording was carried out by filling in the values for the variables on the observation sheet, (See Fig 3.4).

The observation sheet helped record the variables in a systematic way and kept the observations consistent between one tool and the next. The information presented provides primary data, which can be referred to in the future by other analysts assessing functional reconstruction made from the data. The tools reference numbers and type were also recorded. Tools with more than one working edge were given unit numbers and treated separately and a new observation sheet used.

3.8 THE VARIABLES

The variables studied included the raw material characteristics, edge morphology, macroscopic edge wear and polish distribution and characteristics. The raw material was described with respect to its grain size, surface topography and topographic features. All these characteristics affect the appearance of wear traces on stone tools under the microscope.

Grains size was recorded according to visual appearance of the tool and related mainly to the colour of the stone.

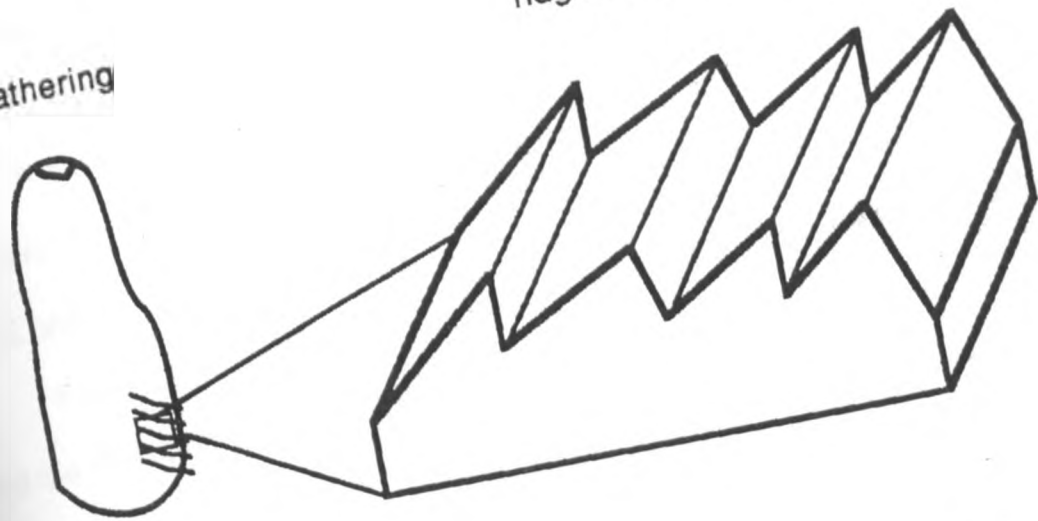
In Topography, an undulating or ridged topography of the flint surface away from the polished area can affect the distribution of the polish (Roger 1989). Topography was thus recorded as it may correlate with polish distribution variables and so indicate that the distribution is not functionally determined but a product of the original topography of the un-used surface.

Topographic features can explain the origin of the topography (Roger 1989). Since percussion ripples are produced during conncoidal fracturing of the blank, such percussion ripples often produce an undulating topography.

Edge feathering, a product of detachment often occurring in thin edges resulting in overlapping fracture planes that have a feathered appearance resulting in a ridged topography on the edges of the tools (see *Fig 3.5*)

edge feathering

ridged topography



percussion ripples

undulating topography

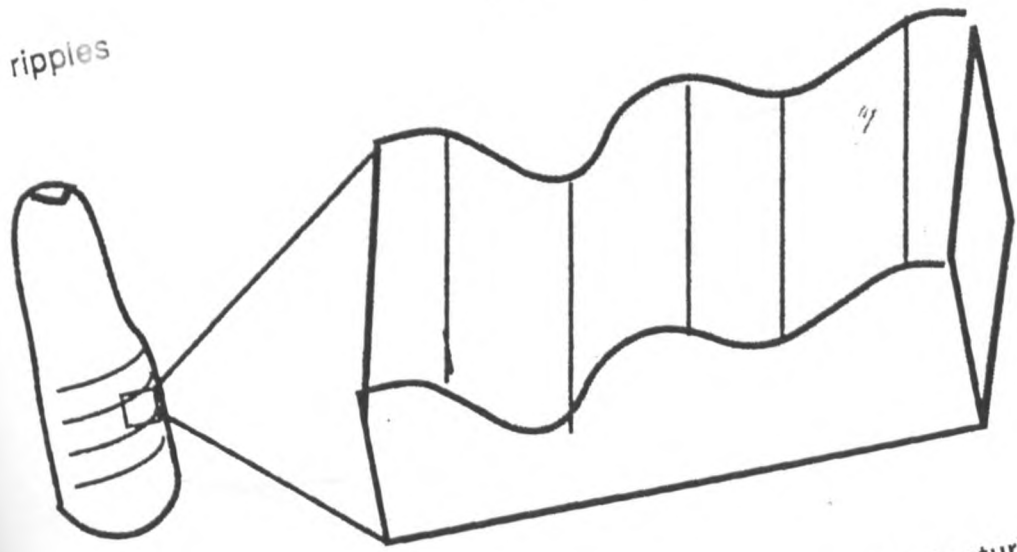


Fig 3.5: Examples of resultant topographic features due to conoidal fracturing

EDGE

Edge in this study refers to the working edge of the tool.

EDGE MORPHOLOGY

The variables studied for edge morphology included edge angle, edge length, edge profile, thickness and the shape of the tool

EDGE ANGLE

Edge angle in this study is defined as the angle between the ventral surface and the retouched or utilized edge. It was measured as the angle created by the convergence of the two edges. Edge angle measurements were taken with a goniometre (See Fig 3.6).

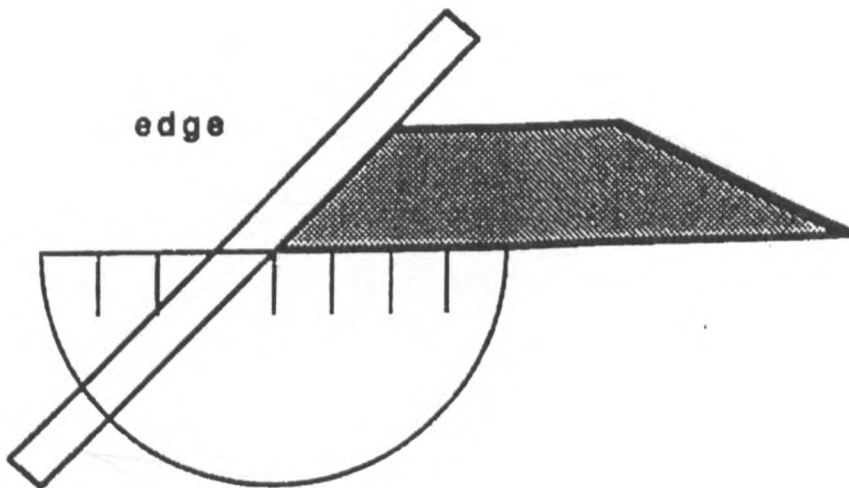


Fig. 3.6: A goniometric measurement of edge angle

EDGE LENGTH

Edge length was defined as the maximum length of the working edge created by retouch, utilization, or length of the natural edge indicated by backing

retouch as the opposing or lateral edge. The curvature of the edge was allowed for by fitting a line using pieces of thread that was then straightened and measured against a ruler (as shown in figure 3.7)

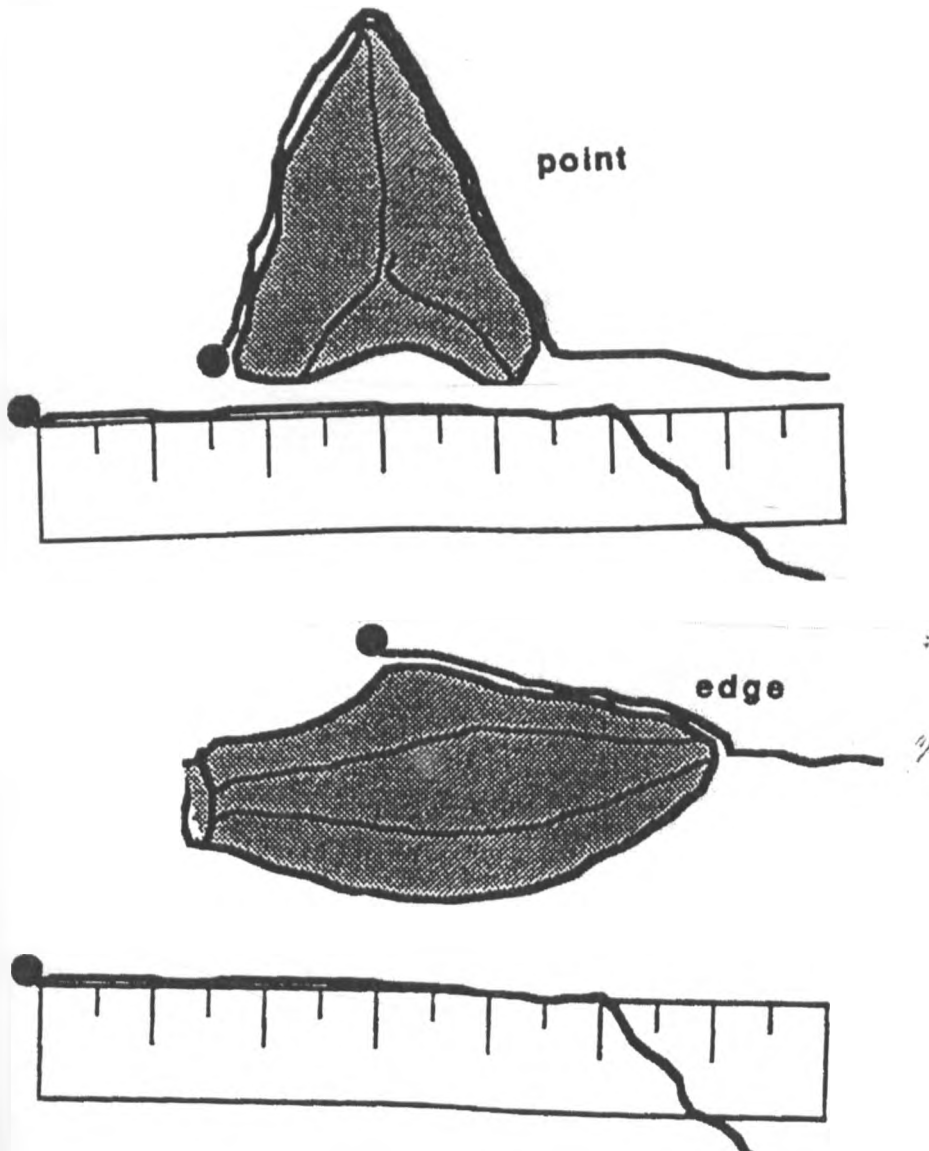


Fig 3.7: A measurement of edge length

Thickness is the maximum thickness of the support piece taken perpendicularly to the mid-point of the working edge. Calipers were used for measuring (as shown in Fig 3.8)

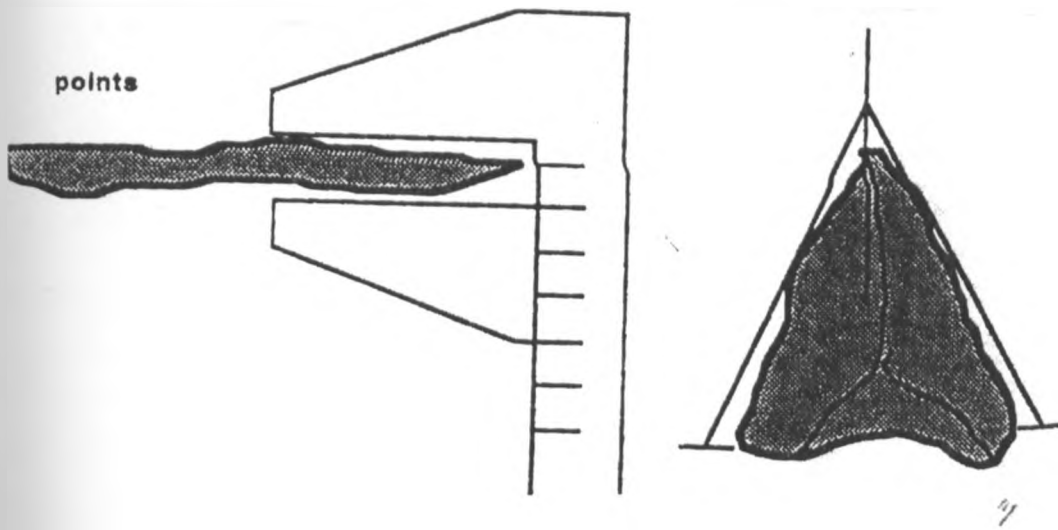


Fig 3.8: A demonstration of thickness measurement as done in this study.

EDGE PROFILE

This is the shape of the working edge in plan which may be convex, concave or straight as measured by the ratio of the perpendicular measurement divided by the chord, the linear distance between the extreme ends of the working edge (Roger

1989). It was measured by aligning the ends of the working edge along (the Y-axis) a millimeter graph paper and reading off the measurement from the graph. The maximum distance between the working edge and the Y-axis is the perpendicular measurement read from the X-axis. Concave profiles were given as negative scores. Hence by dividing the perpendicular by the chord, straight edges have a value of 0. Profile point is calculated with the base of the point placed on the Y-axis.

profile = a/b

PROFILE

a = perpendicular

b = chord

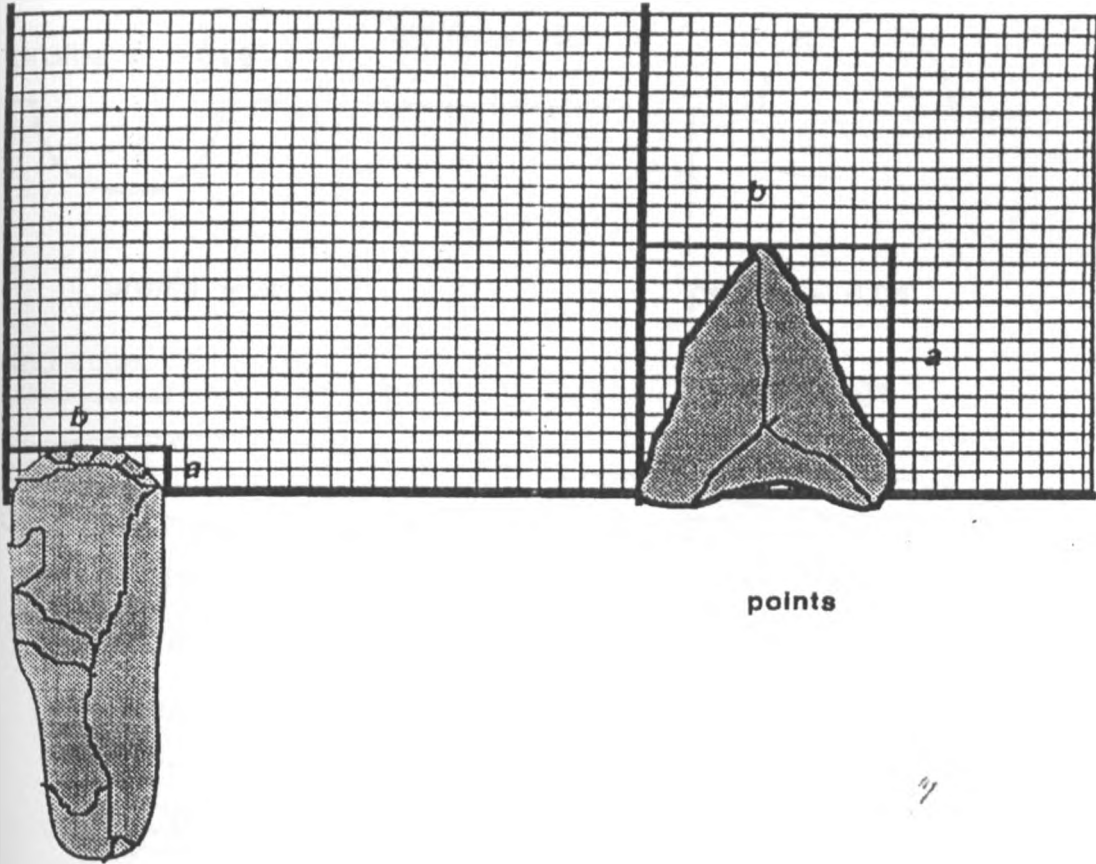


Fig 3.9: Profile measurement

examples of profile

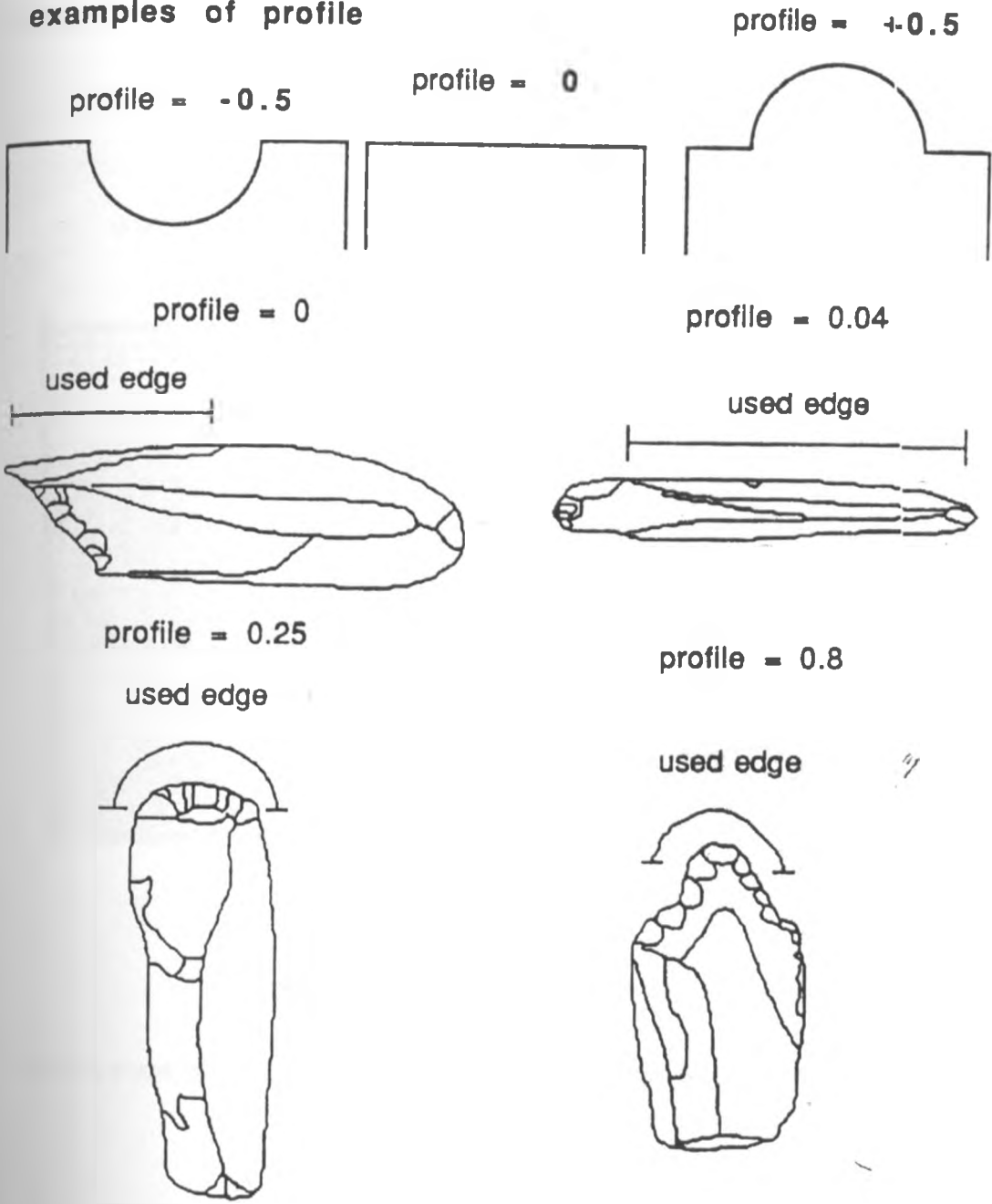


Fig 3.10: Examples of profiles.

Shape: The shape ratio was calculated by dividing the length by the breadth.

With length being the maximum lateral dimension of the piece, with the working edge as the base.

11 shape = c/d SHAPE c = length points
d = height

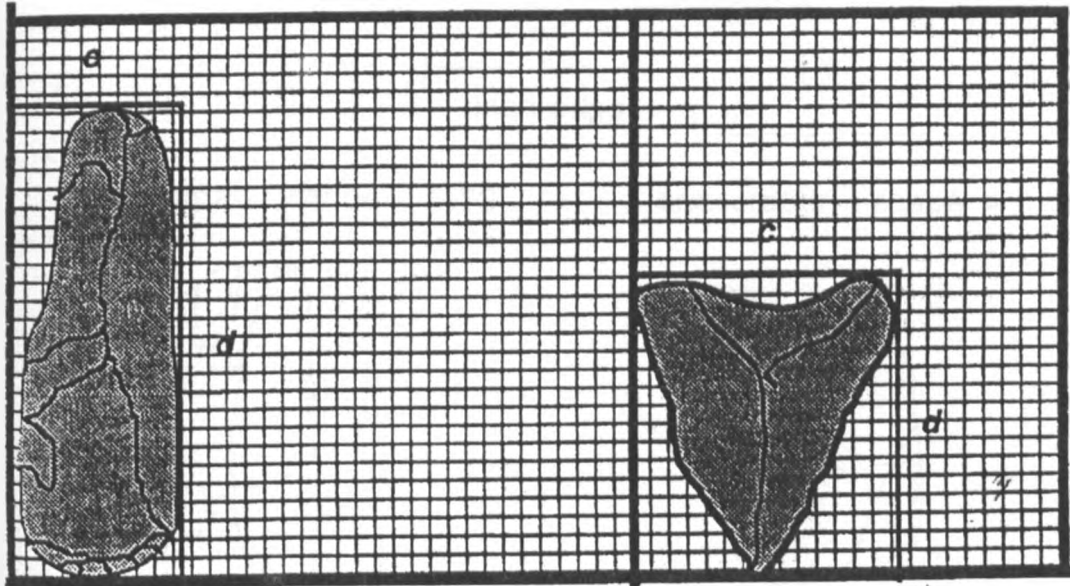
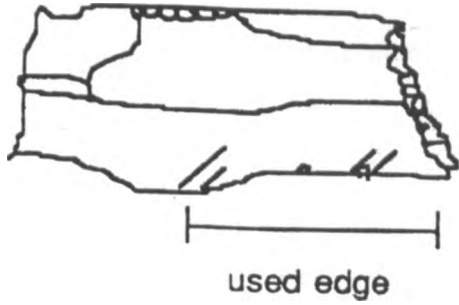


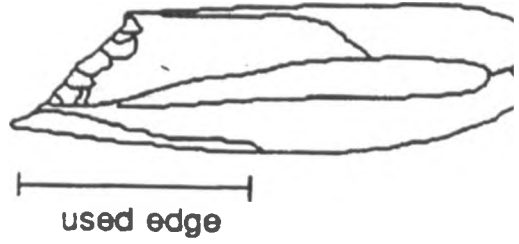
Fig 3.11: shape measurement for different 'used' (utilized) edges

examples of shape

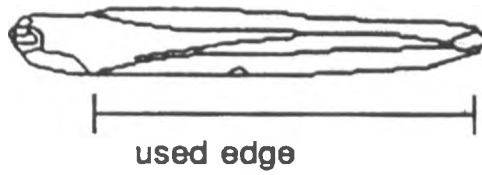
truncated blade shape = 2.24



truncation burin shape = 3.9



blade shape = 4.57



endscraper shape = 0.32



endscraper shape = 0.48



Figure (3.9) A cross-section of shape examples and their resultant values after measurement.

Since the presence of bifacial polish demonstrates that both surfaces were in contact with the worked material, polish variables for both ventral and dorsal surfaces were recorded.

EDGE WEAR

Modification to the edge from other sources other than intentional retouch can be determined by macroscopic edge wear. Thus considered were the presence, amount and type of fractures, the presence and degree or rounding of the edge and, the presence or absence of visible gloss in the macroscopic category. Microscopic tests were not done due to the nature of the raw materials and the presence of high polish.

MACRO WEAR

These are features that can be discerned by the eye. The number of fractures was recorded as greater or less than five fractures per 10mm of working edge. This helped quantify minor edge wear that may not be significant and those that may be functionally diagnostic. A less than five fractures per 10^{mm} Value could result from accidental damage or be produced by retouch.

Appearing as crescentic or half moon are the snap fractures, occurring when the edge of the tool breaks off under bending stress leaving negative scar after percussion against one surface of the edge of the tool.

Step scars were defined as those terminating abruptly in hinge fractures leaving a scalar negative scar. Percussion produced these more directly on the edge rather than against one side as with flake fractures.

See illustrations below;

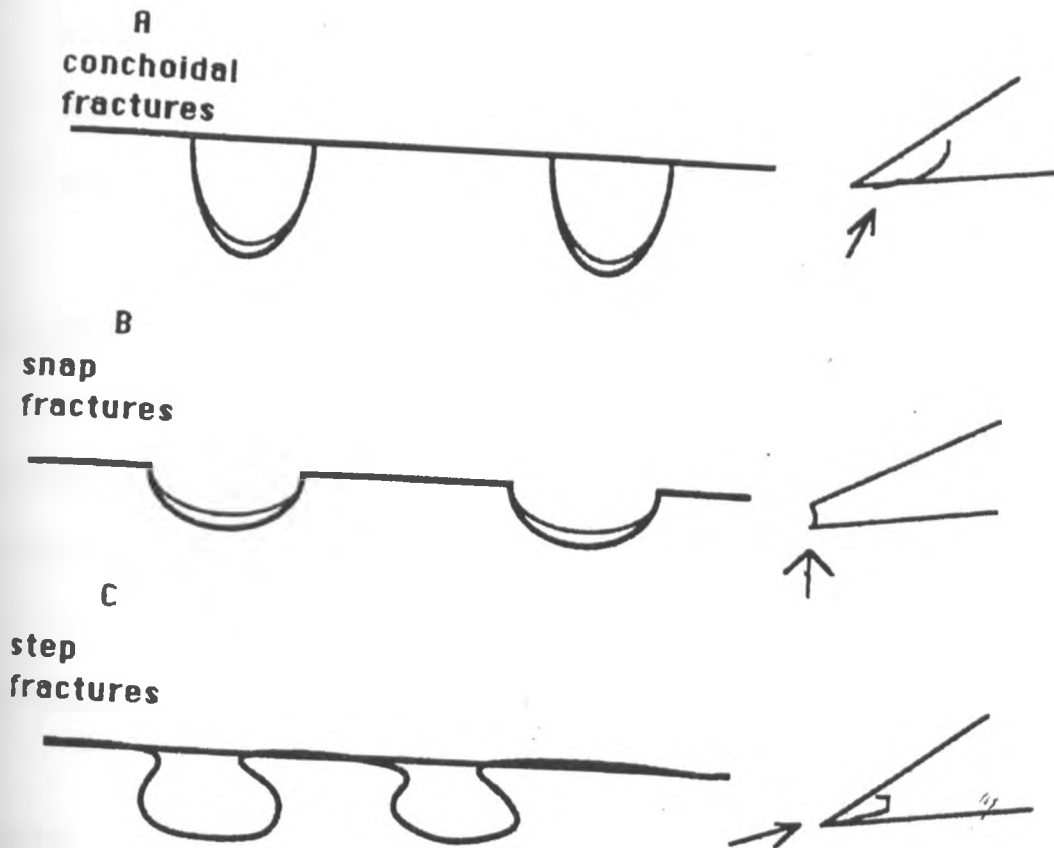


Fig 3.12: Different types of fractures examined in this study.

- i. **Retouched edges:** Only fractures on the UN-retouched surface were considered.
- ii. **Patterning of Fractures:** Wear was determined by a pattern of consecutive fractures occurring on a potentially used edge. Consideration was however given for unpatterned random oriented fractures that could not have been possibly produced by damage.

- iii. **Corroborative Evidence:** The presence of polish striations, linear fractures and rounding strengthened evidence for definite edge wear.
- iv. **Positioning of fractures:** Where fractures were located on one edge only and not other edges, with the edge of location being the potentially used edge, it was taken as a strong indicator of the use damage. Edge damage tends to occur on any edge.

ROUNDING

Light or heavy is the way the presence of rounding was recorded. This however, I must concur with Roger (1989) that it is rather subjective, and two analysts might not necessarily end up with the same results.

Heavy microscopic rounding could be felt with the fingers as significant smoothing and blunting of the sharp edge of the tool.

GLOSS

Gloss was recorded as present or absent and referred to the presence of polish visible to the eye.

3.9 FUNCTIONAL SIGNIFICANCE OF THE VARIABLE

This being a functional approach to the understanding of the tools, all the variables selected had a functional meaning attached to them. Some variables, like the raw material for instance, have no direct functional significance, but were

recorded because of their potential effect on variables that are functionally diagnostic, like polish distribution for instance. Raw materials here are used to refer not to differences between obsidian, chert, Phonolite and quartz, e.t.c but to such variables as grain size, and topography.

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 material have some relationship. For instance, a tool with an acute edge angle used for cutting meat gives insignificant edge wear whereas the same edge used for breaking a bone registers considerable edge wear. The combination of an acute edge angle and absence of edge wear rules out the use of the tool on a hard material even if it was used only for a short period, as edge wear occurs almost immediately in these cases.

The relationship between edge angle and the hardness of worked materials allows for probability projections to be made about the possible use of a tool. Morphological attributes alone allow us to give a possible explanation of functional capability of tools. For example, with an acute angle, working edge cannot scrape bone effectively as the resulting edge wear makes the tool ineffective after a short period of use. The profile of a tool equally limits its functional capability. Edge length as an indicator of functional capability has double implications. A short edge may be used for sawing wood but a long edge is more efficient for the same

purpose. Thickness as a measure reflects the strength of the cross-section of the tool in relation to the working edge. It can also limit the likely use of tools. For example, a thin end scraper is more likely to break from a percussive action such as chopping than a thicker, more robust tool. It is possible that MSA people were conscious of such complexity of tool shapes as some technological knowledge is required that demonstrates an awareness of the mechanized properties of the tool that applies to both manufacture and use. Shape takes into account the overall morphology of the tool as opposed to specific working edge measurement. It reflects the handle of the tool and was taken using the working edge as the base. Handling properties of the tool can indicate the probable motion.

Polish distribution also indicates possible motions. An edge used transversely at a high contact angle, as in scraping hide, can produce polish that is intermittent, with an obtuse angled retouched edge (Grace 1989). When such a variable is considered in relation to other variables, the origin of the distribution can be interpreted and related to function. Edge rounding fractures helped in the recognition of worked edges and the motion of the tool where for instance, the presence of rounding indicated a transverse scraping motion. When rounding occurs on one surface, it indicates a uni-lateral motion, and when it occurs on both sides, it indicates a bi-lateral motion. This is confirmed by Vaughan (1985) who points out that when a tool is used in a transverse motion, rounding is greater on the surface of the edge in contact with the material whereas rounding can be equal on both sides if the contact angle is high, say approaching 90°. Rounding, however,

is only useful when considered with other variables as longitudinal motions can also produce equal rounding on both surfaces of the edge.

Rounding also helps eliminate possible worked materials. For example, heavy rounding would indicate a harder material while light rounding would indicate a soft material or duration of use. Rounding can best indicate use on softer materials like hide. The abrasion involved is enough to produce rounding since the tools, which are often used for such a purpose, have thick, obtuse angle edges.

3.10 DATA INTERPRETATION

The multi-dimensional approach to use wear analysis used in this study depends on the cumulative evidence from all the variables. Interpretation is structured hierarchically to allow a confident level of interpretation. Since the level of use-wear varies on different tools, interpretation can only be made to the level that evidence allows. The interpretation sheet was modeled after Roger (1989).

Description	Use
Tool No.:	e.g. 14
Used area:	Point
Direction of use:	(e.g. longitudinal/transverse)
Motion of use:	(e.g. cutting/digging)
Hardness of worked material:	(soft, medium, hard)
Name of worked material:	(wood, meat)
Most probable function:	(e.g. cutting, scrapping)
Other information:	(working angle, halfted e.t.c.)

A used edge has some use-wear and polish and functionally suited to some task that suits the tool's design. Direction of use is determined by the tool's morphology (See also Chapter Five). It could indicate transverse, longitudinal or rotational motion. For example, the morphological attributes of an end-scrapper suggest a transverse motion while those of a lateral edge of a flake would suggest a longitudinal motion.

Motion of use is seen through the combination of several variables including polish distribution, edge wear and linear features or striations. It makes it possible to eliminate motions until only one is consistent with the observation.

There are different kinds of motions as used in this study: cutting is defined as a uni or bi-directional longitudinal motion with the edge parallel to the direction of use, perpendicular to the worked material with both surfaces in direct contact with the material. Another motion is sawing, and is determined as a bi-directional longitudinal motion parallel to the direction of use, approximately at right angles to the worked material. Grooving motion is the insertion of the tool into the worked material, to create a groove. This may be uni or bi-directional.

3.11 EXPERIMENTAL REPLICATION

One of the primary objectives of this study was to carry out experimental tests to understand the flaking properties of different raw materials used for the manufacture of tools in Muguruk (Gqc1) and Prospect Farm (GsJi7). An integral part of the multi-dimensional approach to use-wear interpretation is the testing functional interpretations by experimental replication.

Experimental tools were thus made using the materials recovered from Prospect Farm (comprising mainly obsidian) and Muguruk Farm (Ombo Phonolite). The observed wear - traces were then checked on the tool being analyzed against the experimental tools of similar types. (See Fig 5.10)

The tool had a thin edge with relatively minor damage. It had a well-developed polish and heavy rounding. To create the same polish, you would require a hard or medium material such as wood. Replicas of the tool were used on wood and bone.

Use on bone replicated the polish, but created more edge damage, than was present on the test tool. The one used on the wood replicated the edge damage but after 10 minutes the rounding or polish development, had not been achieved. Quite often, attempts to experimentally replicate the wear traces suggested an unknown material. This could be attributed to other factors like chemical and biological effects on the tool before its recovery. The tool could have undergone some changes despite being recovered *in-situ*. The following tools with the given measurements were tested on in woodcutting.

See Figures 5.5 and 5.8 for Test Results.

3.12 CONCLUSION

This chapter has outlined, the approaches used in the analysis of the Muguruk and Prospect farm assemblages. It fronts holistic approach as the most appropriate methodological option for the study. The approach examined the nature and acquisition of raw materials, transport, artifact manufacture, tool use

and eventual discard by the MSA inhabitants of GsJi7 and GqJc1. Though one can make many of these aspects independent topics of study, I believe this holistic approach, will give a better overall impression of MSA behavioural patterns in these two sites.

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CHAPTER FOUR

DESCRIPTIVE ANALYSIS

4.0 INTRODUCTION:

This chapter presents a brief summary of the data used in this study. The materials described here are those from locality II of GsJi7 recovered and first analysed by Barbara Anthony in 1978 and the member 6 and 4 artifacts from GqJc1 recovered and first analysed by Sally McBrearty (1986). It gives typological assemblage compositions and gives tables and illustrations of different artifacts from the two sites.

The final part of the chapter presents the results of on - the - site studies conducted at the two sites during my visit to determine raw material procurement and mobility patterns. It also presents quantitative analysis of tool types to determine the presence or absence of intra and inter - site assemblage variation in tool type and size in GqJc1 and Gsji 7.

4.1 MUGURUK GqJc1

Materials studied in this project from GqJc1 were from members 4 and 6. Member 2 which is also from the same excavation comprised the sangoan - Lupemban artifacts and were subsequently left out. This is because the materials do not fit comfortably in the Middle Stone Age.

4.2 THE MEMBER 4 ASSEMBLEGE:

Member 4 sediments are attributed to the forces of Muguruk river. Excavations in this member, were performed in arbitrary 5 cm units to a depth of 125 cm below the eroded surface. The excavation yielded a total of 6509 artifacts, with most of these being recovered from two nearly contiguous trenches, exposing a total of 15m². The materials were dispersed through approximately 45 cm of uniform laterised clay rich red sands. This prompted S. McBrearty (1986) to name the industry Pundo Makwar (Red soil)

4.3 TOTAL ASSEMBLEGE COMPOSITION

Member 4 yielded a total of 63 tools making a mere 1 % of the total assemblage composition. Angular waste and flake fragments make the bulk of the assemblage, comprising 3240 and 2088 pieces respectively, or 49.7 % and 32.1%. 90 cores were recovered too, 226 hammerstones, 25 anvils and 3 splits cobbles.(Table 4.1), gives a complete breakdown of the total assemblage composition at member 4.

CATEGORY	N	%
Formal tool	63	1.0
Tool fragment	2	0.0
Flake	762	11.7
Flake fragment	2088	32.1
Angular waste	3240	49.8
Core	90	1.4
Core fragment	7	0.1
Hammerstone	226	3.5
Battered chunk	1	0.0
Anvil	25	0.4
Pigment	2	0.0
Split cobble	3	0.0
TOTAL	6509	100.00

Table 4.1: member 4 total assemblage composition .

Flaking debris make the vast majority of the artifacts as they account for up to 93.7% of the MSA assemblage. McBrearty (1986) postulated that the anvils comprising 0.4% (n = 25) of the assemblage composition and hammerstones 3.3% (n=226) may have been collected as raw materials for artifact manufacture. This argument though acceptable, is revisited later in this study after experimental replicative studies confirmed more functions of these artifacts than just tool manufacture (see Chapter Five).

4.4 RAW MATERIAL FREQUENCIES

The overwhelming majority of raw materials used in the manufacture of artifacts in member 4 are Ombo Phonolite. Of the artifacts recovered, 6325 were made from Ombo Phonolite, with 4 artifacts made from Obsidian, 84 from quartz and 30 from Kisumu Phonolite.

The frequency of raw materials in this assemblage is given in Table 4.2

RAW MATERIAL	N	%
<u>Ombo Phonolite</u>	6325	97.1
Kisumu Phonolite	30	0.5
Quartz	84	1.3
Chert	13	0.2
Obsidian	4	0.1
Basement complex	47	0.7
Not recorded	4	0.1
TOTAL	6509	100.00

Table (4.2) frequency of raw materials from member 4.

FORMAL TOOLS

Member 4 yielded a total of 61 pieces with 66.6% of these being scrapers. End scrapers were the dominant type, forming 14.3%(n = 9). Nosed scrapers made up 9.5% of the sample. Other tools included technical burins, 4.8% (n= 3), Percoirs 3.2 % (n = 2), convex and concavo - convex forms

11% (n =7) Heavy duty tools 15.9 % n=10 and a single double ended pick.(See

Table 4.3).

TOOL TYPE	N	% TOTAL
Steep Scraper	1	1.6
End Scraper	9	14.8
Chopper	3	4.9
End Chopper	5	8.2
Side Chopper	1	1.6
Pick, double ended	1	1.6
Point fragment	1	1.6
Unfinished point	2	3.3
Side scraper, straight	2	3.3
Side scraper, convex	4	6.6
Side scraper, concavo - convex	1	1.6
Double side scraper	5	8.2
End and side scraper	4	6.6
Double end scraper	2	3.3
Denticulate scraper	5	8.2
Convergent scraper	1	1.6
Nosed scraper	6	9.8
Side and nosed scraper	1	1.6
Circular scraper	1	1.6
Technical burin	3	4.9
Percoir	3	4.9
TOTAL	61	100.00

Table 4.3: Type category at member 4

As pointed out later in chapter 5, flake production in member 4 is overwhelmingly by radial core reduction. Radial cores make up 80.2% of the total sample from member 4. Single platform, opposed platform and casual types form the remaining 19.8%.

A low number of artifacts from this member exhibit evidence of retouch and modification of their edges. Retouched pieces form only 1.0% of the total sample with 1.9% of these showing deliberate retouch.

Material	N	%
Deliberate retouch and evidence of utilization	69	1.1
Modified but not used	126	1.9
Edged damaged	177	2.7
No trimming utilisation	6137	94.3%

Table 4.4 : proportion of retouched and edge damaged artifacts from member 4

4.5 MEMBER 6

Member 6 yielded a sample of 5,726 artifacts from a total area of 22m², excavated to an approximate depth of 40 cm below the eroded surface. The deposit was uniform giving no visible microstratigraphy. Excavation was thus done on arbitrary 5 cm levels.

TOTAL ASSEMBLAGE COMPOSITION

The member 6 was undisturbed and unbraded at the time of excavation.

The vast sample was made up of flakes, flake fragments and angular waste (95.2%). Tools comprised 2.4 % of the assemblage. The rest were hammerstones, choppers, and buttered chunks.

CATEGORY	N	%
Formal tool	139	2.4
Tool fragment	40	0.7
Flakes	608	10.6
Angular waste	4845	84.6
Core	59	1.0
Core fragment	3	0.1
Core / chopper	5	0.1
Hamerstone	9	0.2
Buttered chunk	12	0.2
Anvil	6	0.1
TOTAL	5726	100.00

Table 4.5 : Total assemblage composition from member 6

Like in member 4 Ombo Phonolite is the overwhelming choice for artifact manufacture, making up to 96.2 % of the sample.

Besides Kisumu Phonolite and obsidian recovered 6km and 190 km away, the rest of the raw materials are locally available and within the vicinity of the site. Of the five obsidian pieces found during excavation, McBrearty (1986) notes that four were found within a restricted area of 1m in diameter, 5m to the north, she recovered a modified distal flake fragment. The obsidians were traced to the Sonanchi crater eruptive locality, 4 km east of Lake Naivasha in the Great Rift Valley, 190 km from Muguruk. Another piece was traced to the upper slopes of Mount Eburru, 185 km from

Muguruk. It is possible that these obsidian pieces, particularly the partially finished pieces with little show of other flaking debris was traded or transported in partially finished forms to Muguruk where they were further retouched or put to immediate use. See chapter five for more detailed explanation of this concept after experimental tests.

RAW MATERIAL	N	%
Ombo Phonolite	5508	96.2
Kisumu Phonolite	74	1.3
Quartz	102	1.8
Chert	18	0.3
Obsidian	5	0.1
Basement complex	19	0.3
TOTAL	5726	100.00

Table 4.6: Raw material frequencies in the member 6

FORMAL TOOLS

Light duty tools make up the bulk of the assemblage of tools in member 6, with the side scraper dominating the type category. End scrapers, and side scrapers are next in popularity followed by circular scrapers. All the scrapers are made on Levallois flakes with a substantial portion of their margins showing evidence of trimming. Points that characterize most MSA sites in East Africa are conspicuously missing from member 6. Heavy-duty tools recovered include three bifacially trimmed slabs, a chopper and a large steep scraper. Type category frequencies of formal tools of member 6 are given in Table 4.7

TOOL TYPE	n	% Tools	% Total Assemblage
Unfinished bifacial foliate point	1	0.7	0.0
Side scraper	22	15.8	0.8
Double side scraper	10	7.2	0.2
End scraper	17	12.2	0.3
End and side scraper	17	12.2	0.3
Double side and end scraper	11	7.9	0.2
Convergent scraper	6	4.3	0.1
Steep scraper	2	1.4	0.0
Nosed scraper	7	5.0	0.1
Notched scraper	10	7.2	0.2
Denticulate scraper	7	5.0	0.1
Side and notched scraper	3	2.2	0.1
End and notched scraper	4	2.9	0.0
Circular scraper	9	6.5	0.1
Circular scraper with bec	2	1.4	0.1
Technical burins	2	1.4	0.0
Side chopper	1	0.7	0.0
Bifacially trimmed slabs	3	2.2	0.0
Trimmed chunks	1	0.7	0.0
Trimmed pebbles	4	2.9	0.1
Total	139	100.00	2.3

Table 4.7: Tool type category at member 6

Flakes were probably the desired end products of artifact manufacture at Muguruk. Flake production was overwhelmingly by radial cores making up 22.3% of the core sample with sub-radial cores comprising 18.6%, levallois cores 78% and high backed cores 6.7%.

RETOUCH AND MODIFICATION

Though the number of formal tools is quite low in both members 4 and 6, the member 6 contains a fairly high proportion of pieces showing modification.

Modified pieces in this study, are those pieces that show a substantial amount of retouch of their edges or some trimming scars.

MATERIAL	N	%
Retouched formal tools	147	2.6
Modified	270	4.7
Edge damaged	569	9.9
Not trimmed	4740	82.8
TOTAL	5846	100.00

Table 4.8: Proportion of Retouched, modified and edge damaged Artifacts from member 6

4.6 TOTAL ASSEMBLAGE COMPOSITION FROM MUGURUK

The total assemblage composition from Muguruk members 4 and 6 though substantial has a low number of varieties. The majority of the sample comprises mainly angular waste, comprising 8067 Pieces or 65.9 %. Tools make up 0.6 % n = 202 and flakes 11.3 % n = 1384. A total of 149 cores and 10 core fragments making up 0.9 % and 0.1 % respectively, and 235 or 1.9 % Hamerstones point to possibility of workshop at the site. Table 4.9 is a summary of total assemblage composition.

CATEGORY	MEMBER 4	MEMBER 6	N=4+6	% TOTAL
Formal tool	63	139	202	0.6
Tool fragment	2	40	42	0.3
Flake	774	608	1384	11.3
Flake fragment	2096	0	2096	16.9
Angular waste	3220	4845	8067	65.9
Core	90	9	99	0.8
Core fragment	7	3	10	0.1
Hamerstones	226	12	235	1.9
Battered chunks	1	6	13	0.1
Anvil	25	0	31	0.3
? Pigment?	2	0	2	0.0
Split cobble	3	5	3	0.0
Core/ chopper			5	0.0
TOTAL	6509	5726	12235	100.00

Table 4.9: Total assemblage composition at Muguruk member 6 and 4

FORMAL TOOL TYPES AT MEMBER 4 AND MEMBER 6

As can be seen from Table 4.3 and 4.7 majority of tools in members 4 and 6 of Muguruk are mainly scrapers of diverse shapes and orientations. Heavy-duty tools are lowest in the total tool type category and variety in tool types is rather too low.

Table 4.10 is a summary of total tool type composition from the two sites.

TOOL TYPE	MEMBER 4	MEMBER 6	TOTAL NO. GqJc1	% OF TOTAL TYPES
Unfinished bifacial foliet point	2	1	3	1.5
Side scraper	0	22	22	10.9
Double side scraper	5	10	15	7.4
End scraper	9	17	26	12.9
End and side scraper	4	17	21	10.4
Double side and end scraper	0	11	11	5.4
Convergent scraper	1	6	7	3.5
Steep scraper	1	2	3	1.5
Nosed scraper	6	7	13	6.4
Notched scraper	0	10	10	5.0
Denticulate scraper	5	7	12	5.9
Side and notched scraper	0	3	3	1.5
End and notched scraper	0	4	4	2.0
Circular scraper	1	9	10	5.0
Circular scraper with bec	0	2	2	1.0
Technical burins	3	2	5	2.5
Side chopper	1	1	2	1.0
Bifacially trimmed slab	0	3	3	1.5
Trimmed chunk	0	1	1	0.1
Trimmed pebble	0	4	4	2.0
Percoir	3	0	3	1.5
Side and nosed scraper	1	0	1	0.5
Double end scraper	2	0	2	1.0
Side scraper, concavo-convex	1	0	1	0.5
Side scraper - convex	4	0	4	2.0
Side scraper - straight	2	0	2	1.0
Point fragment	1	0	1	0.5
Pick, double ended	1	0	1	0.5
End chopper	5	0	5	2.5
Chopper	3	0	3	1.5
TOTALS	61	139	202	100.00

Table 4.10: Summary of the total tool type composition from Muguruk

The number of retouched artifacts from members 4 and 6 as illustrated in Tables 4.4 and 4.7 is comparatively low. Most of the artifacts are not modified as shown in Table 4.11 below.

STATUS	Member 4	Member 6	Total N	% total
Deliberate retouch And evidence of use	69	147	216	1.8
Modified but probably Not used	126	270	396	3.2
Edge damaged	177	569	746	6.1
No trimming utilization	6137	4740	10877	88.9
Total	6509	5726	12235	100.00

Table 4.11: Retouch, modification and edge damage of artifacts at Muguruk

The majority of the raw material used in the manufacture of artifacts is Ombo phonolite followed by Kisumu phonolite, quartz , basement complex and chert. Obsidian recovered comprised only four pieces from member 4. See Table 4.12 for total raw material frequencies from the two excavated MSA sites.

RAW MATERIAL	Member 4	Member 6	N	% Total Assemblage
Ombo phonolite	6325	5508	11833	96.7
Kisumu phonolite	30	74	104	0.9
Quartz 2	84	102	186	1.5
Chert	13	18	31	0.3
Obsidian	4	5	9	0.0
Basement Complex	49	19	68	0.6
Unrecorded	4	0	4	0.0
TOTAL	6509	5726	12235	100.00

Table 4.12: Summary of the principal raw materials exploited in Muguruk

4.7 PROSPECT FARM: GSJi7

The material from the above site analyzed in this study came from Locality II of the GsJi7 site. Locality II comprised two trenches: pit trench (phase I) and the long trench (phase II). The pit trench was the lowest level, overlaid by several meters of tuff. The long trench though standing at a higher level, is still of the same time and traditional sequence.

Locality II yielded the oldest artifacts while Locality I, which comprised phases III and IV, and came from a different ridge, yielded later Stone Age materials. Anthony and G. ISAAC did the excavation and the first analysis of the artifacts between 1963 - 1964.

PIT TRENCH (PHASE 1)

Artifacts recovered from the pit trench were found within a laterized tuff. Laterization could be due to sub - surface weathering and surface exposure in the past (Anthony 1978). Chiselling had to be done to recover the artifacts, as they were mostly found cemented onto the surface of the tuff. As a result of contraction many of the artifacts were recovered broken *in-situ* while some got broken in the process of excavation. The edges of most artifacts looked quite fresh despite the fact that the obsidian surface was found dulled due to encrusting with tuff. Approximately 4000 artifacts were recovered from phase I grid square with a total of about 70 tools and 20 cores.

Table (4.13) is a break down of the total assemblage composition of phases I.

CATEGORY	N	%
Formal tools	73	1.7
Tool fragments	14	0.3
Flakes	285	6.6
Cores	22	0.5
Core fragments	34	0.8
Angular waste	3116	72.0
Butts	782	18.1
TOTAL	4326	100.00

Table 4.13: Total assemblage compositions at phase I.

Of the tools recovered in phase I, 69% were made from obsidian, 1, dulled, 6 from coarse grained obsidian, 2 from rhyolite and one from quartz.

In determining assemblage composition, a total recount of all the artifacts from phase I was carried out. In the course of doing this, artifacts were separated into their respective raw material of manufacture. Anthony (1978) did not do this. The frequency of raw materials used for artifact's manufacture in pit trench is given in Table 4.14

RAW MATERIAL	n	%
Obsidian Black	4120	95.2
Obsidian black mixed with coarse grained	158	3.7
Chert	17	0.4
Silified tuff	31	0.7
TOTAL	4325	100.00

Table 4.14: Frequency of raw materials from pit trench (phase I) locality II.

FORMAL TOOLS

Phase I yielded a total of 73 tools, 69 of those made from obsidian material. This forms 1.7 % of the total assemblage.

Though Anthony (1978) did type the tools from GsJi7, she categorized some of the tools in a rather wide and generalized form. One noticeable example is the category she called "cutting edge tools" which comprised 20 tools from phase II. Most of these tools dubbed "cutting edge", were mainly scrapers. (Following Kleindiest 1962 classification approach). Though for functional interpretation purposes the grouping was highly significant, for purposes of comparison, they were re-classified into different types. See Table 4.15 for a break down of type category at phases I.

TOOL CATEGORY	N	% Total	% Total Assemblage
Bifacial point	3	4.1	0.0
Unifacial point	4	5.5	0.1
Tanged point	2	2.7	0.0
Double side scraper	5	6.8	0.1
Side scraper	5	6.8	0.1
End and side scraper	4	5.5	0.1
Convergent scraper	3	4.1	0.0
Obliquely truncated scraper	4	5.5	0.1
Transverse and straight scraper	5	6.8	0.1
Convex scraper	6	8.2	0.1
Norched and nosed scraper	9	12.3	0.1
Circular scraper	4	5.5	0.2
Heavy duty tool	1	1.4	0.1
Knives	1	4.1	0.0
Disc	3	1.4	0.0
Wedge	1	1.4	0.0
Retouched core	1	4.1	0.0
Awl	3	4.1	0.0
Bec	3	2.7	0.0
Percoir	2	2.7	0.0
Angle burin	2	2.7	0.0
Backed point	2		
Total	73	100.00	1.00

Table 4.15: Type categories at phase I of locality II

As can be seen, scrapers are the dominant tools in the type category forming 61.5% (n = 45) of the total number of tools. Points are equally prominent forming 15% (n = 11). This phase also yields two backed points, percoirs and awls. The number of different tools in locality II, pit trench, is more varied than any of the previously observed members 6 and 4 of Muguruk.

A total of 4326 artifacts compared to the previous Muguruk materials exhibit evidence of retouch and modification as shown in Table 4.16. Up to 25% of the artifacts are retouched.

MATERIAL	N	%
Retouched formal tools	73	1.7
Modified and or retouched pieces	313	7.2
Edge damaged	690	16.0
Not trimmed/ utilised	3250	75.1
Total	4326	100.00

Table 4.16: Retouch and modification rates at pit trench.

LONG TRENCH (PHASE II)

The long trench lies above the level of the pit trench (phase I). It is separated from the pit trench by about 20.4cm of unconsolidated tuffs and pumice. The pumice is totally sterile. The long trench yielded well preserved artifacts lying in abundance as a floor. The material according to Anthony (1978) was completely undisturbed in appearance. It seems possible that it was covered by the tuff of a new volcanic eruption shortly after its formation. About 7000 artifacts were recovered with 103 or 0.5 % being cores and 0.9 % (n = 64), formal tools. Of the tools recovered, 56 % show evidence of some use. Most artifacts also show features of truncation or backing with a tendency to making one step and one low angled edge on a tool. One scraper recovered was made from quartz. See Table 4.17

Category	N	%
Formal tools	64	0.9
Tools fragment	11	0.2
Flakes	657	9.5
Cores	103	1.5
Core fragment	64	0.9
Angular waste	4856	70.1
Butts	1172	16.9
TOTAL	6927	100.00

Table 4.17: Total assemblage composition at phase II

Flake productions in both phase I and II at GsJi7 was mainly by Levallois method and total surface core reduction. Total surface and levallois cores make the bulk of cores. Others are trimmed single surface and discoidal cores. Most blades are made from thin flakes, so are the knives and most of the scrapers. This is described in detail in chapter five.

Majority of scrapers from the long trench are unifacial with five of them showing remarkable evidence of retouch. The length range of tools is 17 - 57 mm with a mean and median of 31mm and a mode of 28 mm. Pit trench (phase II) yielded a total of 103 cores, the highest number of cores found in any trench under study in this project. This could mean it was a workshop rather than a habitation site. The artifacts are equally larger than those from pit trench. In total it only yielded 64 tools comprising 0.5 % of the total assemblage.

Table 4.18 is a type category of tools from the long trench. Notice the dominance of the tool types by scrapers. The strong presence of points making up 28.1% (n = 18). This phase also yields fabricators and one chopper. The number of knife rises to 3 making 4.7 % of the total composition.

Tool type	N	% tools	% total assemblage
Tanged points	2	3.1	0.0
Unifacial points	3	4.7	0.0
Bifacial point	8	12.5	0.1
Double side scraper	3	4.7	0.0
Side scraper	2	3.1	0.0
Convergent scraper	5	7.3	0.1
Transverse and straight scraper	3	4.7	0.0
Convex scraper	3	4.7	0.0
Notched scraper	5	7.8	0.1
Backed/straight and convex scraper	3	4.7	0.0
Circular scraper	2	3.1	0.0
Backed points	5	7.8	0.1
Discs	1	1.6	0.0
End and side scrapers	2	3.1	0.0
Denticulate scraper	1	1.6	0.0
Convex and straight scraper	3	4.7	0.0
Awls	1	1.6	0.0
Becs	2	3.1	0.0
Angle burins	2	3.1	0.0
Fabricators	4	6.2	0.1
Chopper	1	1.6	0.0
Knives	3	4.7	0.0
Total	64	100.00	0.5

Table 4.18: Tool type category at phase II

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4.8 RETOUCH AND MODIFICATION

Like phase I, phase II had quite a good number of retouched pieces. Though the site leans strongly towards a workshop rather than a habitation site, it yields tools and other retouched pieces, most probably abandoned at the site of manufacture before being put to any serious and or meaningful use Table 4.19 is a break down of levels of retouch and modification on the tools.

Material	N	% of total
Retouched formal tools	64	0.9
Modified and or retouched pieces	667	9.6
Edge damaged	893	12.9
Not trimmed /utilised	5303	76.6
Total	6927	100.0

Table 4.19: Retouch and modification at phase II

Obsidian remain the dominant raw material at the long trench with 55 of the tools made from fine grained obsidian, 1 from rhyolitic matrix, 4 from obsidian coarse grained, 1 from quartz and 3 from silicified tuff.

4.9 GsJi7 TOTAL ASSEMBLAGE COMPOSITION

The bulk of the assemblage composition from GsJi7 phase II and I is angular waste comprising 70.8% n = 7972 of the total assemblage. Flakes make up 8.4% (n= 942) long trench gave the highest number of cores 103, together with the 22 from pit trench they make up 1.1 % (n = 125). A total of 137 formal tools were recovered compared to an assemblage volume of 12038 artifacts. Table 4. 20 below show the total assemblage composition of locality II.

Category	Phase I	Phase II	N	% total
Formal tools	73	64	137	1.2
Tool fragment	14	11	25	0.2
Flakes	285	657	942	8.4
Cores	22	103	125	1.1
Core fragment	34	64	98	0.9
Angular waste	3116	4856	7972	70.8
Bufs	782	1172	1954	17.4
TOTAL	4326	6927	11253	100.00

Table 4.20: GsJi7 total assemblage composition

4.10 FORMAL TOOL TYPES AT LOCALITY II GSJI 7

Scrapers are the dominant tools from locality II. This was also the case at Muguruk GqJc1. The apparent dominance of scrapers in the assemblage is attributed to their simple approach of manufacture and their multipurpose functions. These multi-purposeness and relative efficiency is described exhaustively in chapter five and will not be explained here. Points, which are missing at GqJc1, are a normal occurrence here. A comparative look at this data is however presented in chapter six. Locality II has exhibited a higher level of tool types reflecting variety of activities that might have taken place at this site. It can be argued that there were perhaps more activities taking place at GsJi7 than GqJc1. This is reflected in the number of specialized formal tools left behind in the break down of the total tool types at locality II of GsJi7. This point is however explained later in this chapter.

Tool type	Phase 1	Phase II	Total n	% Total Types	% Total Assemblage
Tanged point	2	2	4	2.9	0.0
Unifacial point	4	3	7	5.1	0.1
Bifacial point	3	8	11	8.0	0.1
Backed point	2	5	7	5.1	0.1
Double side scraper	5	2	7	5.1	0.1
Side scraper	5	5	10	7.3	0.1
Convergent scraper	3	5	8	5.8	0.1
Notched scraper	-	3	3	2.2	0.0
Back, straight and convex scraper	-	3	3	2.2	0.0
Circular scraper	4	2	6	4.4	0.1
Convex scraper	6	3	9	6.6	0.1
Disc	3	1	4	2.9	0.0
End and side scrapers	4	2	6	4.4	0.1
Denticulate scraper	-	1	1	0.7	0.0
Convex and straight scraper	-	3	3	2.2	0.0
Awl	3	1	4	2.9	0.0
Bec	3	2	5	3.6	0.0
Angle burin	2	2	4	2.9	0.0
Fabricator	-	4	4	2.9	0.0
Chopper	-	1	1	0.7	0.0
Obliquely truncated scraper	4	-	4	2.9	0.0
Transverse and straight scraper	5	3	8	5.8	0.1
Heavy duty tool	1	-	1	0.7	0.0
Notched and nose scraper	9	-	9	6.6	0.1
Percoir	2	-	2	1.5	0.0
Knife	1	3	4	2.9	0.0
Wedge	1	-	1	0.7	0.0
Retouched core	1	-	1	0.7	0.0
Total	73	64	37	100.00	1.1

Table 4.21: total tool type category at GsJi7

Like GqJc1 the percentage of retouched modified artifacts to unmodified, untrimmed /unutilized is very low. Majorities of artifacts have no signs of retouch or modification. See Table 4.22.

Status	Phase I	Phase II	N	% total
Retouched formal tools	73	64	137	1.2
Modified and or retouched pieces	313	667	980	8.7
Edge damaged	690	893	1583	14.1
No trimming /utilisation	3250	5303	8553	76.0
Total	4326	6927	11253	100.0

Table 4.22: Retouch and modification at Phase II)

4.11 DISCUSSION AND SUMMARY

The most noticeable aspect of the artifacts from GqJc1 and GsJi7 was their sizes, for the artifacts from GqJc1 were appreciably larger than those from GsJi7. The impression of difference in size has been confirmed by a study of the tool and flake dimensions from GqJc1 and GsJi7 7. This is presented in chapter 6. The difference in sizes is almost dramatic.

Despite the change, the range of types is astonishingly similar. When one considers that there are only 137 tools from locality II and 202 from GqJc1 member 4 and 6, it is surprising that one type recurs always in very high frequencies. The other types though recurring too, do the same at very low frequencies. One might as well argue that people of the same general tradition made the two assemblages.

4.12 INTRA AND INTER - SITE ASSEMBLEGE VARIATION IN TOOL TYPE AND SIZES

Tables 4.10 and 4.20 have given us a breakdown of the tool types from the two assemblages. Though assemblage variation in tool type from GqJc1 is limited, the variance standing at 20, the variation at GsJi7 is fairly high standing at 28. Account of tool types and angles divided by the number of tools in an assemblage,

can indicate diversity in activities. From Table 4.17 a total of 139 tools were recovered from member 6 of GqJc1, and 61 from member 4 of the same site. Of the 137 tools from member 6, 20 different types were identified. This, it can be argued that, at least about 7 different activities took place at member 6 and at least 3 at member 4. From GsJi7, 73 tools were recovered from pit trench and another 64 from long trench. Pit trench had about 3 different activities taking place there and another 3 at long trench.

This argument must however be approached cautiously. Phase II of locality II (GsJi7) yielded the highest number of different tool types. One might then accept that under normal circumstances, the more different types of tools in a site, the more varied the activities being carried out there. However, this is not shown from the outcome of the division. It then emerges that, the larger the assemblage and the fewer the types, the higher the number of postulated activities. But this may be also looked at from a different perspective. Where the tools were function specific and specialized, the results are bound to reflect what emerges in this study. It is therefore, possible that though the tool types are higher in GsJi7 with the number of activities lower, it could be due to a higher chance of specialized tool function, as opposed to the general function of tools at GqJc1.

To overcome this uncertainty, experimental studies were conducted to test the possible areas of tool usage and their effectiveness. Scrapers are by all means, multi-purpose tools with varying degrees of efficiency on different activities, cutting, digging, skinning, digging tubers and opening tree backs (experiments carried in

this study). We ought to note that they dominate both of the assemblages, taking 57.6% of the total tool assemblage at GsJi7 and 85.7% at GqJc1. Their effectiveness was however, determined by the ecosystem and the range of resources that the MSA people could exploit profitably.

In essence, I think that a variety of resources were brought into residential camps as a strategy for ensuring self - sufficiency and maximization of group efforts among the small, mobile families of GsJi7 and GqJc1. Tools were made that could handle various activities and this could explain the dominance of the tool assemblages by scrapers.

VARIABILITY

Tools in this study were viewed as sets of implements designed to perform specific tasks. Thus, the intra- and inter-site assemblage variation in tool type and size, demonstrates at the level of variability alone that:

- (i) There were different tasks performed at GsJi7 and GqJc1
- (ii) That there was a sizeable differential site exploitation and utilization that possibly involved use of different tools.
- (iii) That all these were applied as adaptive strategies in the two sites.

RAW MATERIAL ACQUISITION AND PLANNING

Tables 4.2, 4.6 and 4.12 have given us a breakdown of raw material exploitation patterns at GsJi7 and GqJc1. As can be seen, the inhabitants of GsJi7 relied almost completely on Obsidian (over 90%) as raw material while the inhabitants of GqJc1, on the locally available phonolite. During the field study, the

raw materials were found to be within the local vicinity of the site. GqJc1 for instance, is located on top of the ombo phonolite, while Kisumu phonolite is about 6 km east of the site.

Availability of raw materials for tool manufacture dictated the settlement pattern of the inhabitants of GqJc1 and GsJi7. The sites also located within short distances of water sources, with the river muguruk, only a few meters from the site and Lakes Nakuru and Elementaita supplying enough water to GsJi7 residents. In the event of them regressing, numerous streams that littered the area then still supplied water and wild game to the inhabitants. I think, in determining any settlement pattern at GsJi7 and GqJc1 two factors remained constant, raw materials for tool manufacture and water sources. Animals were most probably trapped while drinking and or grazing around the water sources. In essence, a scenario like the one in Figure 4.23 emerged.

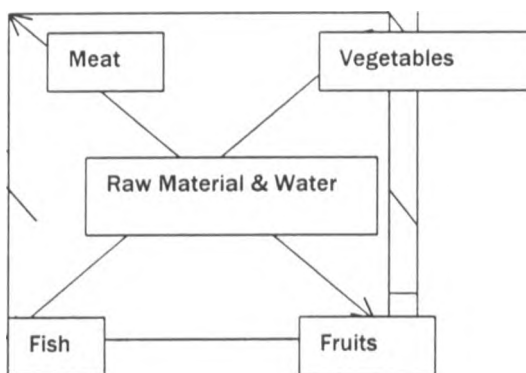


Fig. 4.23: Raw material availability and water as determinants of settlement patterns at GsJi7 and GqC!1

Water sources assured the inhabitants of a continued supply of water, meat, vegetables and other food requirements. The mobility pattern of these people was

thus defined within strategies of procurement and exploitation of local resources. The presence of 4 obsidian pieces a non-local raw material at Muguruk could signify a number of things.

- (I) An awakening to the requirement of a more easy to knap raw material than the hard phonolite.
- (II) Carrying (after trading or not) of the material from Naivasha 190km away, by a band of nomadic MSA people moving away from the areas of the great rift due to receding of water sources brought about by the regressing lakes. The trading hypothesis is however not taken seriously, as there is little evidence to support it except for the four pieces of Obsidian. I prefer to think they ended up here due to migrations.

4.13 CONCLUSION

The variety in tool types and general assemblage presented in this chapter can be seen in a number of ways.

- (1) That it was the inhabitants of GsJi7 and GqJc1 ability to visualize² their needs and delights that made them survive.
- (2) That adequate choice of tools was a determinant for development, its extent and form dictating the pace at which life fared on the process of discovering effective manipulation of the environment.
- (3) And finally, that there was a collective consciousness among the inhabitants of GsJi7 and GqJc1 that put them at a higher level compared to their animals in the journey to a future vaguely defined. That, the inhabitants of GsJi7 and GqJc1

belonged to one general tradition, and possibly roamed the entire space between the Central Rift valley and the lake basin in small nomadic bands.

CHAPTER FIVE

EXPERIMENTAL AND EDGE ANALYSIS STUDIES

5.0 INTRODUCTION:

This chapter deals with investigation into how characteristic artifact forms recovered from Gqcj1 and GsJi7 can be recreated, and by looking at some excavated tools, what type of artifact patterning one might expect from East African MSA sites. The chapter also presents functional study experiments to gauge the relative efficiency of various artifact forms for specific tasks at Gqcj1 and GsJi7. It also presents the results of micro-wear studies.

5.1 EXPERIMENTAL REPLICATION

Experimental replication of stone artifact forms can help gain a sound understanding of the technological ways of manufacture and to speculate about what was going on in the heads of the tool makers (Toth 1982). Such studies designed to reproduce prehistoric stone artifacts can potentially yield valuable types of information concerning behaviour and technology. Nicholas Toth (1982), has pointed out some valuable information that such studies can reveal, including:

- Understanding which technique was employed.
- Understanding which production strategies were used.
- Appraising the relationship between raw material and form and actual end products.

- Judging which forms are made intentionally according to “cultural” norms which are “paths of least resistance” in lithic production.
- Appraising degrees of skill, strength, manual dexterity and foresight on the parts of the people (or hominids) involved.
- Identifying distinctive by-products of certain technological modes, including types of debitage created.
- Understanding the relationship between the cores/retouched pieces and debitage (flakes and fragments) in an archaeological site.

The replicative study used here followed one used by Nicholas Patric Toth (1982) and was carried out at a number of different levels.

LEVEL 1

General

This level involved general experiments in flaking raw materials from GqJc1 and GsJi7 to gain some creative knowledge (understanding) of suitable techniques, fracture patterns and reduction strategies needed to arrive at or reproduce certain forms. This involved several hundreds of experiments.

LEVEL 2

Generic

This involved use of a specific reduction mode to replicate special artifact forms and study flake populations in details to form the basis for site simulation studies.

LEVEL 3

Specific

This level involved detailed experiments in replicating cores in sites GqJc1 and GsJi7, blow-by-blow and comparing experimental flake populations with the excavated samples (50 experiments).

LEVEL 4

Naïve Studies

Involved use of two colleagues, Kizito Mukhwana, a post-graduate student at the Institute of African studies, University of Nairobi, and Rosemary Okoth, an undergraduate literature major at the University of Nairobi. The two had no experience in stone flaking or typological studies. I examined how these two naïve subjects worked and how their experimental flaking compares with the excavated samples.

5.2 TECHNIQUES OF MANUFACTURER

Materials recovered from Muguruk member 2 by McBrearty (1986) and analyzed in the study, were mainly Sangoan-Lupemban with a considerable amount of heavy-duty tools and lanceolates. Member 6 comprising MSA materials and the Prospect Farm artifacts could be attributed to the Levallois technique.

The following methods were tried for the production of the technologies found at both Muguruk and Prospect Farm.

- i. Hard hammer percussion
- ii. Bipolar technique
- iii. Anvil technique

- iv. Throwing
- v. Disc-core method
- vi. Levallois

i. **The Hard Hammer Percussion**

In this method, one stone is flaked for use as a hammer and flaking a core or a potential core with it, by a series of directed blows (Toth 1982). Both the hammer and the core are held on the hand, but for heavier cores, it is practical to set them down for flaking. The technique works well for all flakable raw materials and was especially useful for Muguruk's Ombo Phonolite. Using this method, a relatively thick buff and a pronounced bulb of percussion is left behind as a fracture. A negative image of these features is seen on cores with deep flake scars representing the areas where flakes have been detached. This technique proved adequate in producing a section of artifacts from Muguruk, Member 2. The Ombo and Kisumu Phonolite raw materials, were well suited for this technique and its characteristic fracture were the norm (Figure 5.1) shows an illustration of the method.

The Arrows stand for direction of force.

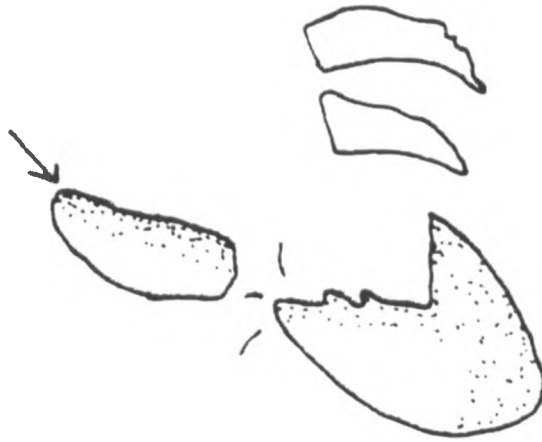


Fig 5.1: The Hard Hammer percussion

ii Bipolar Technique

This technique involves the resting of a potential core on a stationary stone (Anvil) and striking from the top with a hammerstone. The stone to be flaked is oriented with its long axis vertically to produce longer spalls (Vertical Bipolar). The technique suited the materials from Prospect Farm (Obsidian) because they fracture easily. (See Figure 5.2)

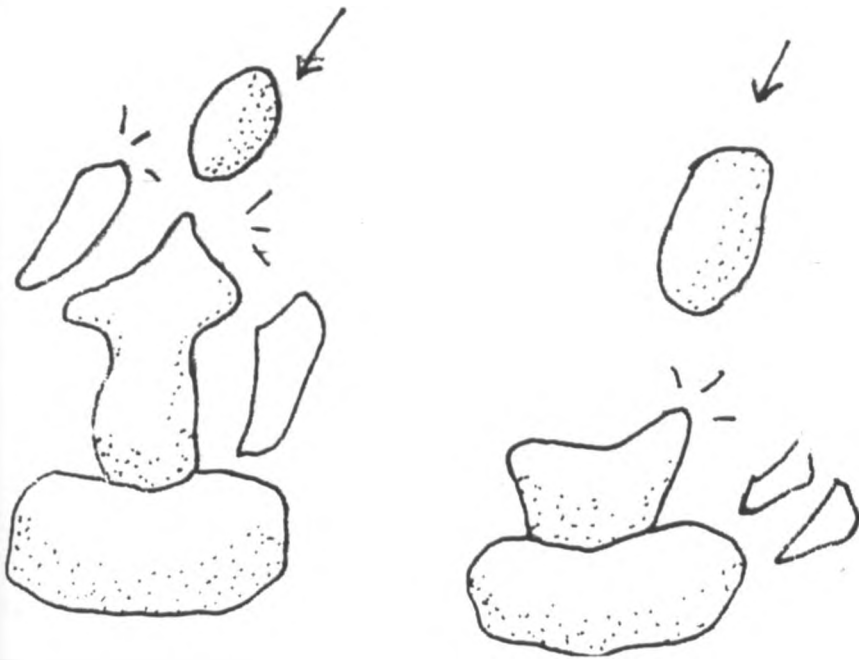


Fig 5.2: The Bipolar Technique

iii The Anvil Technique

A potential core is held in one or both hands and struck against a stationary rock or "anvil". Fracture patterns produced are similar to those produced by hard hammer percussion. Though used for general experiments in flaking, the technique was not used to produce tools for specific functional tests.

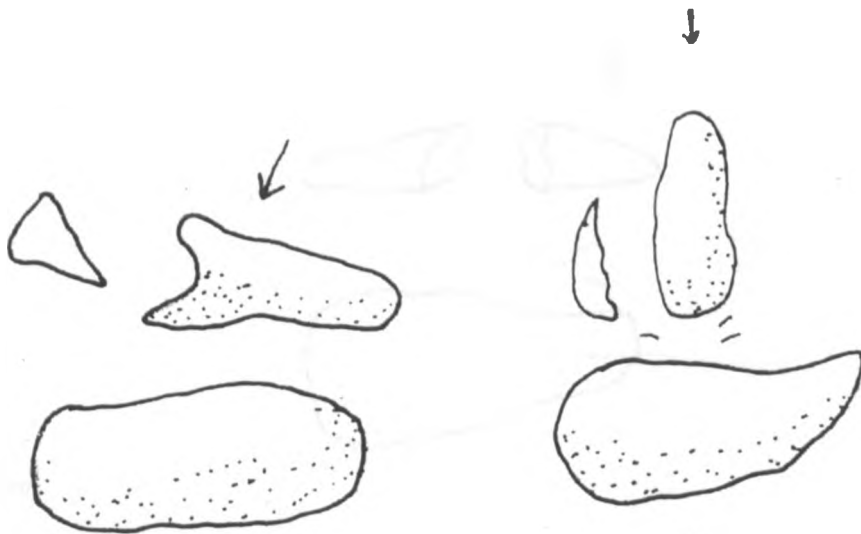


Fig 5.3: The Anvil Technique

iv Throwing

This method was particularly efficient for initiating fracture. One stone is thrown against another. Several scientists have used this method including Toth (1982) The method was found to be surprisingly efficient. Potential core may be the piece being thrown, or the stationary piece on the ground.

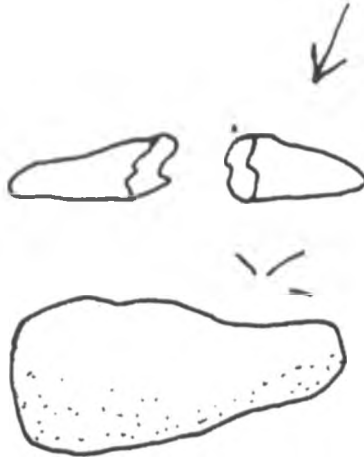


Fig 5.4: Throwing

v Disc-Core Method

The disc-core-technique involved the removal of flakes alternately from each side of the core around its entire circumference figure .(5.1.4). Flakes removed in this way, tend to be short, often triangular in plan form and sometimes resembling Levallois flakes. The technique was heavily used in this study to reproduce MSA materials from Gqcj1 and GsJi7.

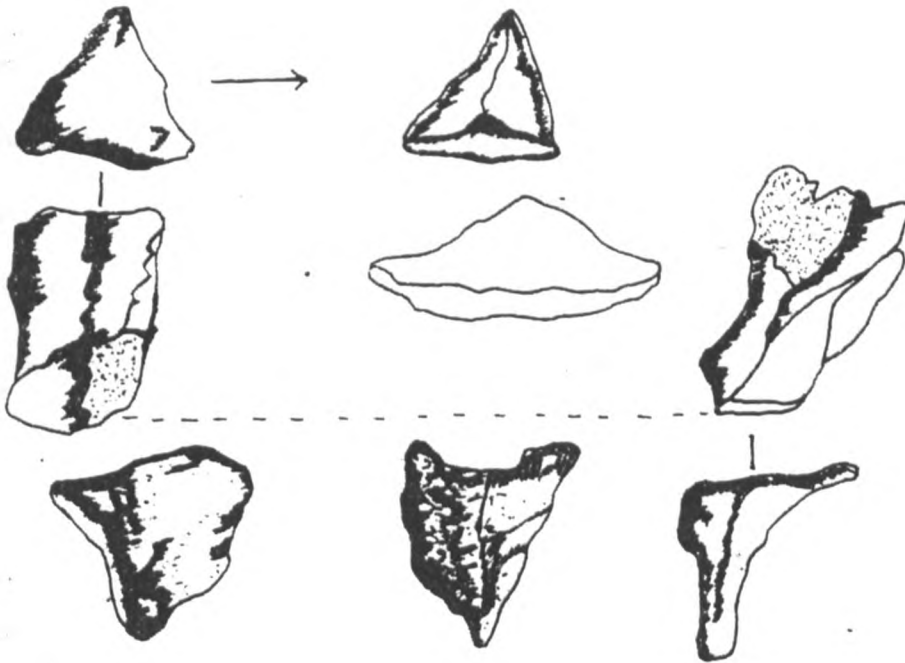


Fig 5.5: The Disc Core Method

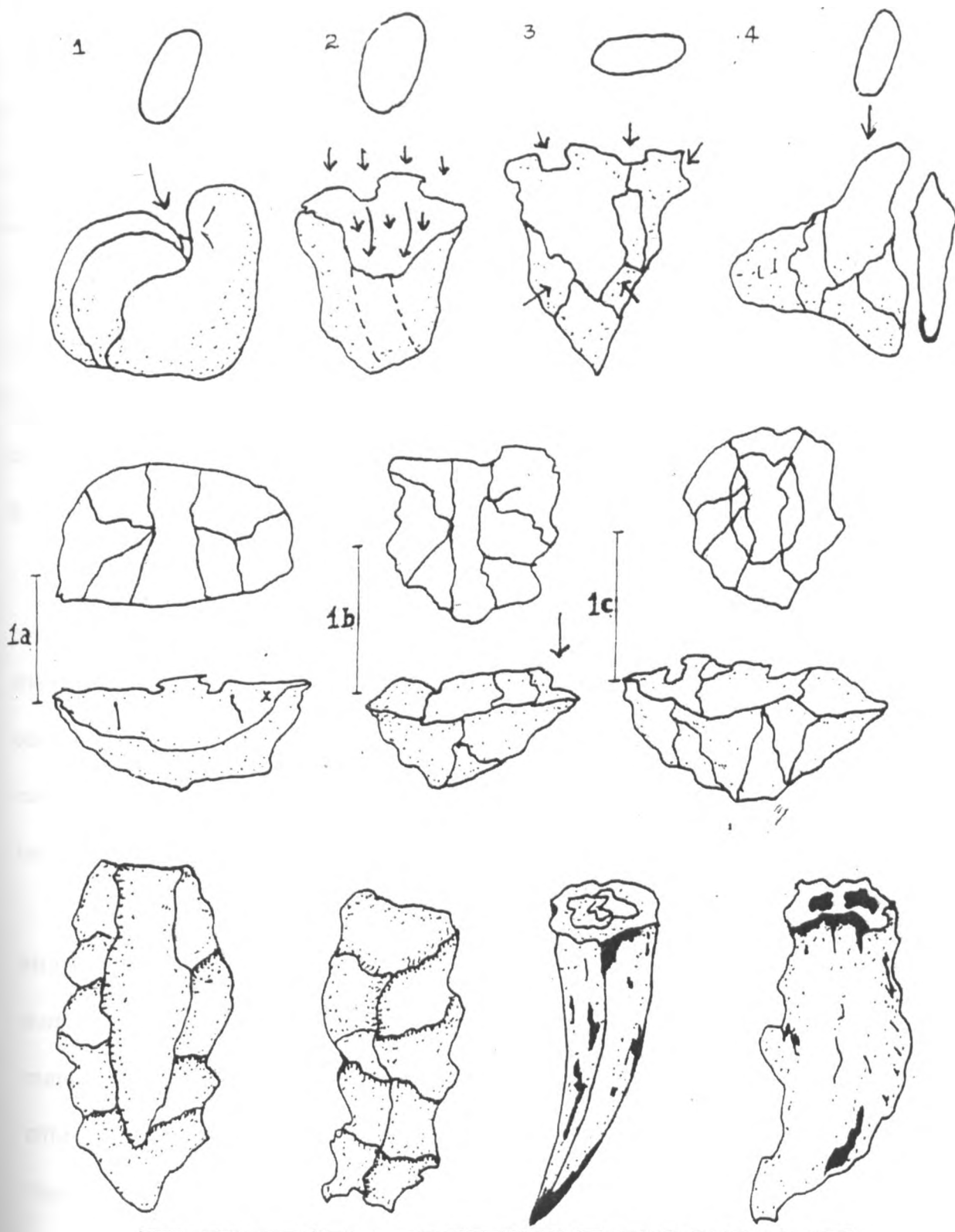
Vi Levallois Method

The Middle Stone Age in East Africa is technologically characterized by the specialized method of flake production known as Levallois technique. Most of the replicated tools for this study were prepared using this technique.

Levallois was an ingenious method of producing good serviceable flakes of pre-determined shape devoid of cortex and with clean cutting edges.

The technique involves the radial preparation of the surface of the core from which the flake was to be removed and the preparation of striking platform. A single flake is removed whose shape and size is determined by the form of the original core and its pattern of preparation. The striking platform and the core surface being worked is then re-prepared after the removal of the flake. Flakes

removed in this way can be oval or triangular in form (Levallois point) or elongate (Levallois blade). Both Levallois and disc core flakes can be retouched to be thinned and shaped for hafting or for some hand held use. Flake tools of various types dominate the two assemblages from Gqcj1 and GsJi7. Figure 5.6 is the production of Levallois from a flake of predetermined shape. The flake is struck from a prepared core. The figure is a complete illustration of the Levallois techniques starting from 1a to 1d.



10

Fig 5.6: Levallois method

In the above illustration, in 1a an oval shape is required and so, simple, hammerstone alternate flaking to an oval shape in plan prepares a core. In the second state, 1b, a striking platform is prepared at one end of the core. 1c has a well directed blow with a hammerstone, removing the flake required. 1d is the struck core the inside view resembling the carapace of a tortoise. This gives it the name, tortoise core i.e. is the Levallois flake as struck from the core. Its distinctive features are the flatish, radial flaking on its dorsal face and the facing of the striking platform. Bulbs of percussion are generally prominent.

5.3 GENERAL STUDIES OF THE ARTIFACT MANUFACTURE AND DEBITAGE PATTERNS

To gain a good intuitive appreciation of core reduction techniques, flake manufacturing techniques and tool blanks, several experiments were done and observation of the resultant debitage pattern recorded. A summary of the major core and retouched forms at Muguruk and Prospect Farm will help demonstrate how particular morphologies can be produced.

Depending upon the shape of the initial form, different forms can be attained. Bulk - breaking, as a strategy for tool manufacture became apparent during replicative and experimental studies. Huge boulders recovered from the raw material source were broken down to smaller units suitable for the manufacture of different artifacts. This reduction strategy took place in different stages as illustrated in Figure 5.7. This sub-function occurs where the original material is

large and is continuously reduced to smaller and relatively manageable sizes to produce the desired flake at each level of the production pipeline.

5.4 ARTIFACT UTILISATION

Based upon experimentation, some inferences about resource (tool) utilization and usage can be inferred. Artifacts recovered from GsJi7 have exhibited a higher level of retouch compared to those from GqJc1. In both places artifacts were recovered made from non-local raw materials showing some evidence of exchange or at least movement of the MSA people over long distances. The pattern and mode of usage illustrated in this study may not have a 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 aspects of strategic planning in GsJi7 and GqJc1 MSA sites.

It is possible that the MSA people at GsJi7 and GqJc1 manufactured their tools at the raw material base as was done with some experiments in this study and then used them in the vicinity of the factory. Another experiment done was the manufacture of the tools at the site then they were stored awaiting future use when it arose. The third experiment done mainly at Muguruk involved the manufacture of the tools, transporting the ready material to Nairobi, storing them in the lab for a few days and utilised them when their use arose. In all these approaches, the materials offered time, place, and form utility with minimum inconvenience on the part of the user. Figure (5.9) below illustrate these approaches.

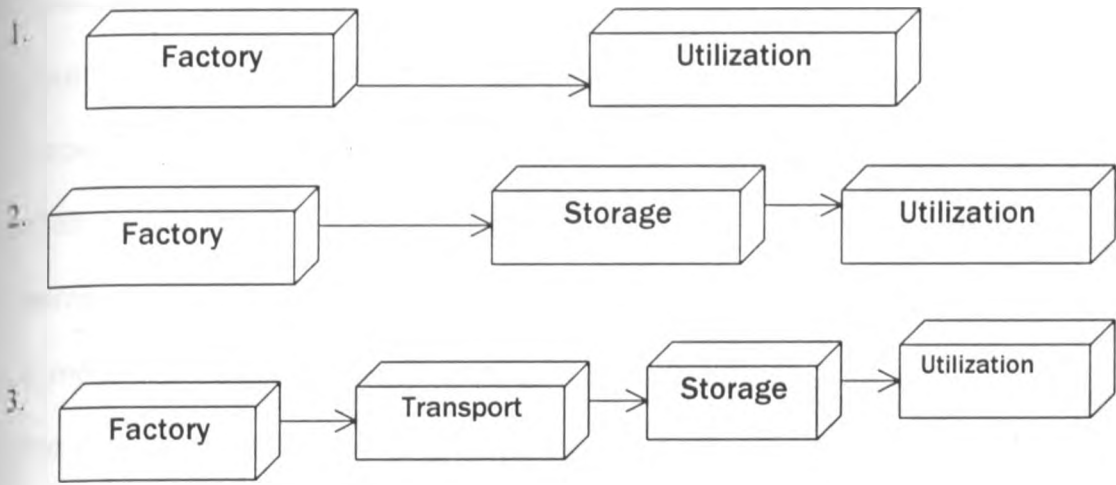


Fig 5.8 : Artifact utilization channels at GsJi7 and GqJc1

The presence of retouched materials without evidence of usage could also mean a different strategic mode was in place. After several trial experiments the procedure outlined in Table 5.9 became apparent an highly relevant.

Some tools that were originally meant to be experimented on specific areas, say digging out roots, served as effective implements elsewhere, I used scrappers in multiple ways deviating from the originally intended usage. This evidence of multiple use of tools proves that, the strategic planning might have been slightly different hence prompting the hypothesis projected in Table 5.9. I have projected the possibility of trade or some crude exchange modes due to availability of non-local raw materials (particularly obsidian) in GqJc1 as highly portable items, smaller in size and highly reduced with no trace of the manufacturing site in the vicinity.

Considering that MSA economies of GsJi7 and GqJc1 were simple, the experiments relied on the possibility of dealing fast with a self-sufficient economy

and secondly with a more advanced crudely decentralised but self-regulating economy. I thus operated from the assumption that the economy consisted of only four “players”. In experimenting the tools with the idea of a self-sufficient economy, I operated from the assumption that the MSA people of GsJi7 and GqJc1 gathered their requirements for themselves. By this, they spent most time hunting, took sometime to make tools, and gather fruits and vegetables. In the second phase, of a more decentralised economy, as a mode of adaptive strategy, each person, saw the potential of the other as a buyer (not in the monetary sense) who make up a potential market, hence the hunter possibly made up separate trips to trade his meat for tools with the specialised tool maker, fisherman and the gatherer. These two possibilities of comparative advantage are illustrated in Fig 5.10

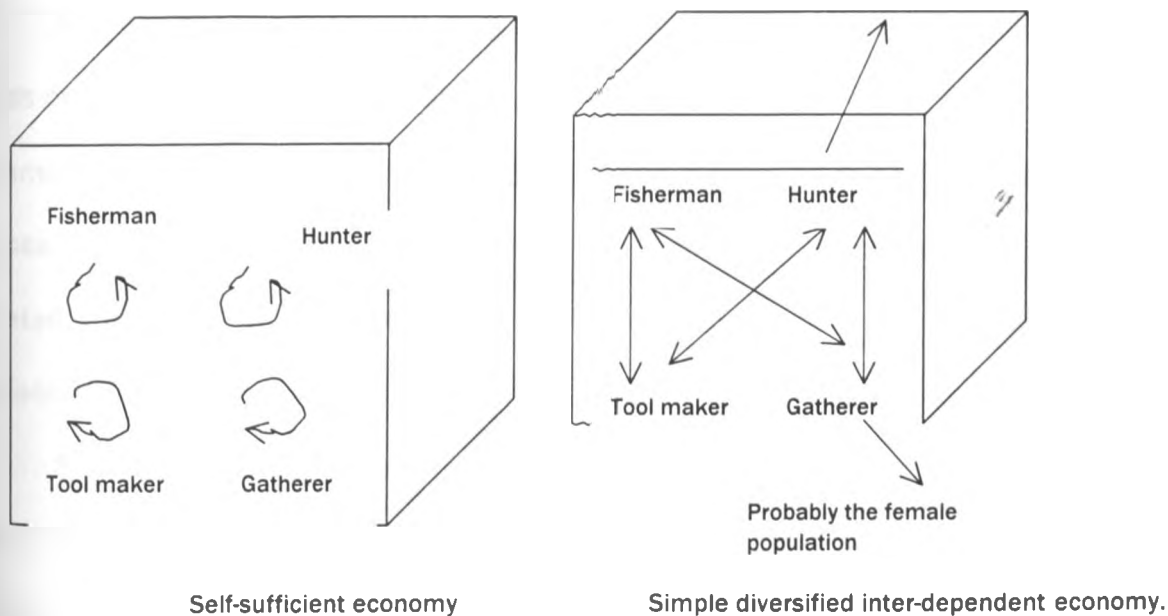


Figure 5.10: A possible MSA Life style

The above two approaches were most probably used together as time allowed.

5.5 PRODUCTION OF FORMS

Though the production of various forms is described in this study, it makes no assumption that the products were the intended end results.

CHOPPER

This tool was produced by removal of a few flakes from a clast, with wedge shaped cobbles. Side choppers proved easiest to produce especially using the rather hard to knap Ombo phonolite material from Muguruk. All that was required was flaking of one side.

SCRAPERS

Majority of tools from both Muguruk and Prospect Farm comprised of various kinds of scrapers as shown in chapter four. Core scraper showed features of steep trimming on one side with upper and lower faces formed by natural flat cleavage planes. Flaking is mostly done on the dorsal surface. To produce the forms, I created a platform or struck an already existing "natural" platform by the ventral surface of a thick flake.

Side scrapers were made from flakes with thinner bodies. Flakes were detached from the dorsal surface of a thin flake until the required shape was arrived at. This was the same for end and double end scrapers with variance emanating from edge angles. Circular scrapers were made from thin flakes and retouched all round until the desired form was realised. To arrive at a denticulate

scraper, unifacial retouch was engaged with flakes being removed from the dorsal surface with a slightly denticulate retouch.

POINTS AND "TECHNICAL" BURINS

Ability to strike large flakes off a core was the secret behind making these two tools. Once suitable flakes were produced, they were reworked down into the required forms by soft hammer percussion either by unifacial or bifacial flaking. Occasionally, the approach ended up with pointed "picks".

MORPHOLOGY OF RAW MATERIALS AND ITS EFFECTS ON END PRODUCTS

The morphology and size of cobbles and flakes had a direct bearing on the eventual piece produced during experimentation. They influenced fracture patterns and arrival at particular retouched/core forms. Wedge shaped cobbles for instance, with one massive opposite end and one flakable end often resulted in choppers (both unifacial and end). Angular cobbles with their almost spherical proportions provided easy flaking in many directions and produced unifacial and bifacial choppers, circular scrapers and side and end scappers. Hemispherical cobbles with their Plano-convex shapes, could be flaked all around its circumference and could yield nearly all the tools from MSA in Muguruk and Prospect Farm.

Thinner flakes could be made into varied kinds of scrapers, points, burins, and blades. They also produced unifacial and bifacial discoids. Thick flakes produced scappers, especially core scappers, when flakes were detached from the

dorsal surface. While the larger flakes were reduced to a varied number of characteristic Levallois tools.

Also noted was that the type of flakes generated influenced the type of artifacts produced from them. For instance, flakes from Prospect Farm were comparatively smaller compared to those from Muguruk. The flakes being produced had secondary flaking and were mainly of "flake scrapper" category. At Muguruk, thick flakes are common that can be flaked into different tools including scrapers and even "discoids". I however tend to subscribe this variance to raw material difference rather than technological preference.

5.6 REDUCTION STUDIES

To produce the major forms, replicative experiments were done in several and different ways. It gave the study an opportunity to see the debitage pattern left behind from Muguruk and Prospect Farm by various modes. In total, 71 separate experiments were performed with a total of 11 different reduction modes. A sample of 3 experiments on average was performed for each mode.

- 1) Direct percussion did flaking with phonolite hammerstones for the Muguruk materials and Obsidian for Prospect Farm.
- 2) The desired forms were manufactured after appropriate platform preparation procedures.

APPROACH TO REPLICATION

For each of the 11 distinctive reduction modes, the following procedure was followed:

- 1) Selection of suitable initial forms e.g. a large flake.
- 2) Measurement of initial form.
- 3) Flaking by direct percussion (Flaking was done in a large carton box to recover all the debitage produced).
- 4) Whole flakes were put aside after each blow and put in a sequential order as they came off the core for labeling after the experiment.
- 5) Debitage was sieved in 1.5cm mesh, and then labeled.
- 6) Attribute analysis was then done for each experiment and core.

The criterion for differentiation was the morphological starting point for the cores and retouched forms, with the variations considered being:

- 1) Flakes with 50-100% cortical dorsal surface
- 2) Flakes with 0- 50% cortical surface and
- 3) Flakes with no cortical surface

This reduction mode is illustrated in the table below

Mode	Initial Form	Flaking pattern	Extent	Type of Tool
1	Split Cobble	Dorsal Surface (unifacial)	Total	Double end Scrapper and Double side Scrapper
2	All cortical Flakes	Dorsal surface	Total	Side, convex end double and end scrapers
3	Half cortical Flake	Dorsal surface (Unifacial)	Total	All scrapers
4	None cortical Flake (thin)	Dorsal (unifacial)	Total	"Bifacial" Scrapers
5	All cortical Flake (thin)	Dorsal surface (unifacial)	Partial	Flake scrapers points, blades burins
6	None cortical flakes (thin)	Dorsal surface (unifacial)	Partial	Flakes scrapers points, blades, burins
7	Cobble	Unifacial	Partial Partial Partial	Side chopper End chopper Chopper
8	All cortical flake	Dorsal, then dorsal surface	Total	Bifacial discoids
9	Half cortical flake	Ventral then dorsal surface	Total	Bifacial scrapers, discoids
10	Non cortical flake	Dorsal, then ventral	Total	Discoids circular scrapers
11	Split cobble	Dorsal then polyfacial	—	Core scrapers

Table 5.1: Principal reduction modes at Prospect Farm and Muguruk

The extent of flaking involved total circumference of the material or partial circumference. Though the reduction modes presented here are not the final word, they are meant to represent different ways that typical cores and tools from Prospect Farm and Muguruk could be arrived at and produce practical different debitage patterns.

5.7 FUNCTIONAL STUDIES

Speculation about the intended function of stone tools in the archaeological record has a long and complicated ancestry. We must however be concerned with the distinctive and novel version of whatever arguments are brought forward. The possible function of stone tools is intimately related to other potent and beguiling notions concerning the environment, the dietary systems and the cognitive abilities of the hominids and or the first "less modern" anatomically modern human beings among others. Nevertheless, the scientific thread in those arguments can be separated out quite easily and in my opinion it makes more sense to devote more time and resources to it, than the fashionable baptising of these tools with all sorts of names that bear no direct relevance to what they really did. Besides helping in grouping of the tools into certain more often, not very relevant forms they contribute little to our knowledge of the activities at the sites under study.

Ethnographic and micro wear studies by scholars like Kuhn (1972), Lee (1979), Keeley (1974), Keeley and Toth (1980) Semnov (1976) and Rodger (1989), have provided a scientific basis for dealing with the crucial dilemma of the real function of stone tools.

Most of the interpretations arrived at during feasibility studies in this project, are guided by the experiences from the above references.

LIMITATIONS

Ethnographic studies have shown that animal butchery among hunter-gatherer societies was carried out using stone tools. Toth (1982) says that animal butchery was the major catalyst in the origins of lithic technology. It was, he says, an aid of gaining access to animal foodstuffs acquired by hunting or scavenging. To make my studies more accurate, it would have been useful to try the tools from GqJc1 and GsJi7, on both large and small animals. Possibly, an elephant, a water buck, a cow, a goat and rabbit among others. However, this was not possible as killing an animal like an elephant would be tantamount to poaching in Kenya so is the same with the waterbuck. The penalty for this offence is harsh besides the fact that it is ethically unacceptable. A cow in Kenya costs a fortune and was completely out of my reach. The cost of a goat is not any better and I had to wait for my brother's birthday to take advantage of the day and do my experiments. All the test results given in this study were thus gained from the experiments performed using the goat. The time allocated for this study was equally prohibiting and could not allow for more experiments on this area.

(a) **Butchery**

No experiment was done before the goat died. All the tests with the tools were done on the carcass. A look at the assemblage composition at GsJi7 and GqJc1 equally throws suspicion on whether those tools were used to perform a duty like severing the neck of an animal to terminate its life as is

done today. However, I think that scavenging was most probably the preferred method, and where hunting was involved, traps and snares were the logical choice rather than, a direct contact and confrontation with the victims. The range of tools is unlikely to bring an animal of say a waterbuck size down. I also suspect that tools like choppers, hammer stones and anvils could have been hulled at the animals to inflict some form of injury that eventually led to death. The smaller lighter tools served little purpose in this regard.

(b) **Skinning**

Burins and points were most successful here. Initial incisions made by points severed the skin from the body. The point was pushed between the skin and the carcass to separate the two. Thinner forms with edges less than 80 degrees were best here. They included flakes, scrappers, discoids and choppers. However, flakes and points made from obsidian kept breaking at the sharp ends and required re-targeting or replacement more frequently than the Muguruk Phonolite. Natural flakes with even edges and flat topographic features were best. Both acute and step-edged tools worked well. Scrappers worked well with acute and steep-edged tools working at varying degree of speed.

(c) **Dismembering**

This involved the division or dissection of the carcass into smaller portions. Its my feeling that animals were either, eaten on spot or carried to respective

home bases. During the dismembering and cutting of the meat, flakes dulled so first and needed re-sharpening within the first 5 - 10 minutes (obsidian faired very badly).

This dulling can be attributed to build-up of fat and tissue on the cutting edges and rounding of the edge microscopically. Acutely retouched edges lasted longer before replacement or re-sharpening. My edge wear studies, discussed later in this chapter show that scrapers with acute edges and flakes appear to have the same function. Animal butchery. Scrapers were thus more valued and less discarded. This could explain their apparent dominance of the assemblage from the two sites under study.

Tools used here included scrapers retouched flakes, and core scrapers. In cutting the meat into small pieces (thin stripes) the thinner flakes proved more efficient. Cut marks were left on the bone in most cases when removing meat from long bones.

(d) **Hunting/Defense**

I hafted points on wood and tried hurling them at a goat. It had little impact. I suppose tools could have been used to inflict bodily harm as a defense mechanism from predators, however most of the tools from the assemblage seemed unsuited for this task. Flakes and scrapers when hulled at the enemy could cause injury, but this was a major gamble. Brute force was

most probably used on small animals. Hafted points were most probably thrust on the body.

(e) **Hide working**

No experiments were conducted on this. It is however possible, that skins of animals were used as clothing, structures and containers.

(f) **Digging**

While at Koobi Fora with J.W.K Harris, in the course of this research, we dug dry sand channels popularly known as "laga" in that area to get underground water. My experimentation with picks, large scrapers and flakes yielded fruitful results. The same tools performed quite well in digging out arrow-roots, cassava and the sweet potatoes in softer grounds. Where the grounds were hard, the pick proved more effective. It provided a wider more comfortable space to hold on its butt end that limited skin splitting and cutting.

(g) **Cracking nuts**

Two varieties of nuts were opened. The San of the Kalahari, use stones to crack open the Mogongo nuts. The groundnuts can however be opened easily with free hands. Experiments with some wild hard to crack nuts showed that anvils and hammer stones were best for the job.

(h) **Food Pounding**

For Easier consumption, food might have been softened. Hard meat or hard vegetables and cereals might have been pounded on anvils and hammer

stones to make them more edible. Cores might have served the same function see figure (3).

(i) **Woodcutting and Sharpening**

I mainly worked on sharpening the end of wooden sticks into some form of an arrow head or spear. It involved a patient and slow scraping of small flaps off the main stick (wood) until the desired form was achieved. Micro flaking of the tool edge was a normal occurrence leading to blunting of the equipment. I had to continuously re-sharpen or replace the tools. Chopper, core scrapers and large flakes worked well.

(j) **Bone breaking for Marrow**

Bonnichsen (1979) after a study of bone fracture patterns in detail, managed to discriminate between those caused by stone wielding hominids and those caused by other forces like carnivore action. Spiral fractures patterns, flake scars and bone flakes, were listed as indicators of hominid impact on bones. Bonnichsen's (1979) argument fails to determine the difference between opposed flakes as both have been observed in hyena dens at FxJ50 (Koobi Fora).

(k) The Goats long bones that I crashed were done in a number of ways to arrive at the most appropriate method of marrow extraction. When rested on a rock or another wide enough clean surface, and then hit from the top, the bone broke more easily and kept dirt out of the marrow. The only implements that proved useful were picks, choppers and hammer stones.

5.7.1 INSIGHT:

In his theory of culture change, Steward (1955) emphasized the need for one to determine the behaviour patterns involved in the use of a particular technology. In carrying out these feasibility studies three factors were put forward.

- i. The floral, faunal and material resources exploited
- ii. The technology at GsJi7 and GqJc1,
- iii. And finally, how subsistence behaviour might have affected other aspects of life in these two areas.

The portrayal of the pick as a multi-functional tool emanates from the test trials. It's levels of efficiency in the different tasks that it performed brings it out as an important tool. The inclusion of hammer stones as tools in the substance economy, rather than the manufacturing sector only is equally based on the same trials. At the level of functional trials the many names accorded scrapers e.g. convergent, bifacial, convex and, side among others, had little relevance. most of them had similar edge angles and performed the same duties with very slight change in efficiency. Majority of the tools were cutting tools as will be discussed later after the edge analysis tests. Whereas the tools served multiple purposes, its not easy to know whether at the time of their manufacture, this was a pre-conceived idea or it only happened by chance. One thing however seems to come out. That there was some sort of deliberate planning before and during tools manufacture, and that the subsistence base, was fairly broad based.

5.8 EDGE WEAR STUDIES:

The value of wear traces on Paleolithic artifacts cannot be overemphasized. Pioneering works by Semnov (1964), and Tringham *et.al* (1974) gave initial criteria's that could be used to make functional interpretations. Later works by Keeley and Toth (1980) and Rodger (1989) came up with better and improved approaches to wear analysis.

Tringham *et.al* (1974) concentrated on the study of micro flaking on the edges of experimental tools. Their work has since, been criticized by Newcomer (1976) who proved that artifacts can become spontaneously retouched simply by twisting on a core or hitting the ground. Other features like water action and tramping can produce similar wear patterns. Keeley (1974) showed the difficulty of micro wear analysis on flint, chert and obsidian due to the formation of distinctive types of polishes on them and their reflective abilities under the microscope.

Rodger (1989) came up with an upgraded version of micro wear analysis. The multidimensional approach which allows studies to be conducted holistically or at any one of the three levels. One at the morphological attribute of used edges and macro wear, (also called edge analysis) second is micro edge and rounding with the use of a low power microscope (also called edge wear analysis). The third one is use of both edge analysis and edge wear analysis in conjunction with high power microscope looking at polish distribution (microwear analysis) The level of analysis taken, depends on the condition of the material and the specific Archaeological questions asked. This study embarked on the first. Edge analysis.

The approach did not depend on any single variable being diagnostic of tool use. It depended instead on the cumulative evidence from all variables that led to a consistent functional reconstruction where possible. The evidence of use were varied on different tools and interpretation was only made to the level that evidence allowed. A hierarchical structuring of interpretation was preferred to allow room for reasonable doubt. (See Chapter 3 section 3.2)

Certain aspects were very important here. The first was the determination of the used edge. In this study a used edge had to show evidence of some use-wear and polish and had to be functionally suited to some sort of task which had to be in-keeping with the total design of the tool (see Chapter 3 section 3.17)

The second was the direction of use; interpreted by the morphological attributes that could indicate their transverse, longitudinal or rotational motion. Equally important was the motion of use, inferred through the combination of variables such as edge morphology, polish distribution and edge wear.

To arrive at confident interpretations, a sample of 270 tools from prospect⁴ farm and Muguruk were analyzed.

The following is the summary of the variables recorded on the observation sheet:

Grain size: This was a visual inspection of the tool to estimate whether the flint is; fine, medium, or course grained.

Topography: a visual inspection of the ventral or the unretouched surface adjacent to the used edge. The topography can be flat, undulating or ridged

Topographic features: This recorded the presence of percussion ripples, or edge feathering or both.

Edge angle: The angle of the used edge measured in degrees (see Chapter 3).

Length: Length of used edge in MM. (see Chapter 3)

Thickness: Thickness of used piece at midpoint of used edge in MM (see Chapter 3.)

Profile: The curvature of the edge. Straight = 0, concave edge = negative scores.

Shape: The length/breath ration of the support piece (see Chapter 3)

MACRO-EDGE WEAR:

Gloss: Present or absent (See Chapter 3)

Fractures: Flakes, snaps or steps.

Rounding: Light or heavy (See Chapter 3)

Table 5.2 and 5.3 below are frequency distribution for the 12 variables examined from 90 tools in prospect farm and 180 tools and flakes from Muguruk.

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Gsj7 PROSPECT FARM

CASES

VARIABLES	1		2		3		4		5		6		7		TOTAL	
	n	%	n	%	n	%	n	%	n	n	%	n	%	n	n	%
Grain size	57	63	27	30	6	7	0	0	0	0	0	0	0	0	90	100
Topography	17	19	51	57	22	24	0	0	0	0	0	0	0	0	90	100
Topographic feature	40	44	17	19	33	37	0	0	0	0	0	0	0	0	90	100
Edge Angle	2	2.2	4	4	9	10	32	36	22	24	17	19	4	4.4	90	100
Edge length	58	64	30	33	2	2	0	0	0	0	0	0	0	0	90	100
edge thickness	18	2	56	62	16	18	0	0	0	0	0	0	0	0	90	100
Profile	41	46	45	50	4	4	0	0	0	0	0	0	0	0	90	100
Shape	40	44	45	50	5	6	0	0	0	0	0	0	0	0	90	100
Fractures	9	10	64	71	17	19	0	0	0	0	0	0	0	0	90	100
Fractures type	38	42	26	29	2	2	4	4	16	18	4	4.4	0	0	90	100
Rounding	71	79	18	20	1	1	0	0	0	0	0	0	0	0	90	100
Gloss	66	73	24	27	0	1	0	0	0	0	0	0	0	0	90	100

Table 5.2: Frequency distribution of functionally diagnostic variables at Prospect Farm.

GqJc1 MUGURUK

CASES

VARIABLES	1		2		3		4		5		6		7		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Grain Size	4	2.2	160	89	16	9	0	0	0	0	0	0	0	0	180	100
Topography	1	0.6	175	97	4	2	0	0	0	0	0	0	0	0	180	100
Topographic feature	84	47	8	4	88	49	0	0	0	0	0	0	0	0	180	100
Edge Angle	9	5	29	16	38	21	31	17	53	19	1	12	9	5	180	100
Edge Length	84	47	59	24	20	11	6	3	9	5	0	0.6	1	0.6	180	100
Edge thickness	10	5.6	24	13	45	25	85	47	16	8.9	0	0	0	0	180	100
Profile	4	2.2	3	2	13	8	150	83	10	5.6	80	0	0	0	180	100
Shape	1	0.6	0	0	31	17	35	19	23	13	0	44	5.6	5.6	180	100
Fractures	63	35	12	7	98	54	6	3	1	0.6	20	0	0	0	180	100
Fracture type	93	52	1	1	2	1	63	35	1	0.6	11	0	0	0	180	100
Rounding	180	100	0	0	0	0	0	0	0	0	0	0	0	0	180	100
Gloss	180	100	0	0	0	0	0	0	0	0	0	0	0	0	180	100

Table 5.3: Frequency distribution of functionally diagnostic variables at Muguruk

The testing of functional interpretation by experimental replication was done by checking the observed wear traces from easily identifiable tools from the two sites against an already existing experimental tool of similar type that had been used in the manner proposed. Where such a tool was not available, a replica was made and used. Two or three replicas of the tool were made and then tried on different materials for as long as it would take to arrive at the existing morphology. Hardness of worked material and the duration of use, were the important variables here.

5.9 TESTING FOR EFFICIENCY

A total of six tools, 3 from Muguruk and 3 from Prospect Farm were used for cutting across a 5-cm diameter fresh branch of acacia tree into a point. There was no attempt at controlling the contact angle, amount of pressure exerted on the tool or stroke length. The only determinant in usage was to get the most effective way possible to achieve the desired results. The maximum time each tool could be used was 10 minutes. Three of the tools were made from obsidian and the other 3 from Ombo phonolite. The tools are presented in figure 5.11 in order of efficiency as assessed by the resulting points on the wooden branch. After use for 10 minutes, the morphological variables of individual tools, angle, shape length, thickness and profile, were measured. (See Chapter 3 for definition of these variables). The tests

gave valuable insights into the effect of variables on efficiency and how they could be assessed.

The more acute angled (less than 30°) and shorter edges, achieved higher efficiency in the woodcutting. The convex edges were less effective than the concave. This means that the profile of the edges has a direct correlation with efficiency. Thickness did not have any direct bearing on efficiency.

As can be seen from the illustration of the extent of cutting after 10 minutes, tools with acute angles tended to be more effective.

Tool 5.11d tended to be ineffective in the job despite having an acute angle 24° . This could however, be attributed to the thickness of the support piece which hindered effective penetration of the wood. The most effective tool 5.11a had an acute angle edge 28° and was also thin (thickness = 1.8) showing there is a strong correlation between support piece, shape and efficiency. That is to say, the longer narrower pieces were more efficient.

Tool 5.11f, the transverse scraper proved ineffective in this task. It had an edge angle of 88° . Tool 5.11b the denticulate scraper, proved effective due to its denticulation though the increase in edge angle reduced its efficiency. The effectiveness of the side scraper tool 5.11c is attributed to its acute angle 22° a thin edge (thickness = 8) long and narrow support piece (shape = 1.9). Edge attributes hence have a bearing on the efficiency of tools used for specific tasks. This technique was applied to a sample (n=270) of the GsJi7 and GqJc1 tools and

flakes, and the correlation between variables used to cluster the tools. The interest being that clusters according to these variables is suited for specific tasks.

Tools that serve effectively in cutting fresh medium wood could serve just as effectively in a different but related activity. For instance, a tool that proved effective in sawing the fresh wood, with an acute angle, low thickness and a fine retouch that did not significantly increase the edge angle but provide a more stable edge, can also be effective in cutting meat and opening fruits. The results of these test, correspond with ones done during the experimentation with the goat carcass (See section 5.7).

5.9.1 TOOL FUNCTIONS AT GsJi7 AND GdJc1

For purposes of determining the uses of the tools from the two sites, several clusters of variables that are functionally diagnostic were brought together. These include shape, edge angle, profile, and edge thickness. All tools with less than 30° in edge angle, profiles of 0.9 and below, 10 mm thickness, and shapes 3 mm were singled out from the frequency distribution table (See Table 5.2 and 5.3). These were tools that proved effective for a variety of closely related functions; mainly, cutting, sawing, whittling and opening fruits of medium to soft materials. More often than not, the experiment revealed that tools with angles more than 50° tended to have thicker support pieces preventing the thin edge from penetrating into the wood. The efficient tools had acute angles, lying between 20° - 29° and were also thin (thickness less than 7). Other narrow pieces, for instance Figure 5.11f, though thin had decreased efficiency due to the increased edge angle (80°).

From the table 5.1, (we can see that) GsJi7 had only 6.6% (n=6) of the tools with angles less than 30°. Another 10% (n=9) had a maximum edge angle of 30°-39° (n=35.6) while 47.7% (n=43) had 40° and above. Of the 6.6 % tools with less than 30° in edge angle, up to 64.2% (n = 74) had a maximum thickness of 10 mm and 100% below 0.9 edge profile, with 0.1 -0.4 accounting for 95.6 % (n=86). The shape of tools from GsJi7 are considerably thinner with up to 94.4 % (n=85) measuring between 0.1 and 0.9. 79.9% had a significant blunting of the normally sharp obsidian edge (Rounding) while gloss was present in 73.3 % (n=64) of the tools. Majority of the tools about 63.3% (n=57) had a fine grain with an undulating topography 56.7% (n=51) and 44.4% (n=40) of the tools exhibiting percussion ripples. Another 36.7 (n =3) gave both percussion ripples and edge feathering (see Chapter 3).

In general up to 94% (n=85) of the tools from GsJi7 can be said to be suited for the general functions of cutting, whittling, sawing and opening fruits. The hardness of all these materials range from soft to medium.

At GqJc1, 3.9% (n=7) of the tools had less than 30° edge angle while 80% of them had a less than 0.4 profile. It is however interesting to note the relatively thicker shape of the Muguruk artifacts. 56.1 % (n=101) of the tools have a thickness of between 15 mm and above with only 0.6 % (n=1) tools having shapes between 0.1 -0.9. A good portion of the tools 50% (n=90) have shapes upwards of 4. All the tools from Muguruk exhibit 100% presence of gloss and rounding. This, however, cannot be correlated to function given the state of the recovered artifacts.

The high polish could be due to erosion and other weathering activities other than the effect of utilization. (Also see McBrearty 1986).

Whereas these tools do not fit comfortably in the functional bracket of the ones from GsJi7, their mode and style of manufacture are very similar. From table 5.3 it is clear that 88.9% (n=167) of these tools are medium grained while 97.2% (n=175) have, like their GsJi7 counterparts, undulating topography. Another 46.7% (n=84) and 48.9% (n=88) have percussion ripples or both percussion ripples and edge feathering, a scenario that corresponds to the GsJi7 materials.

Figure 5.12 is a sample of observations done on the tools and the eventual interpretation arrived from the observations.

5.10 DISCUSSION AND SUMMARY

INTELLIGENCE, CRAFTSMANSHIP AND ENERGY

Based on experimentation, some inferences about physical and mental abilities as determinants of adaptive strategies in GsJi7 7 and Gqci may be considered.

CRAFTSMANSHIP

Evidence from replication experiment show that the MSA people were very dexterous with the soft hammer technique used for tool manufacture. Their level of artistic coordination was amazingly high and were able to produce the required flakes with constant dimensions as was deemed convenient for the intended usage. Finesse in flaking was particularly reflected in small flakes that required adequate

time and training to master. Scrappers were held in one hand and flaked with well balanced and directed blows. It is therefore not possible to say they were produced by chance. My two novices, two grown-up adults of above average intelligence could not produce several of the artifacts uniformly even after several days of instructions. This could mean that there was certainly some form of instruction among the MSA populations in the mastery of the craftsmanship of tool manufacture.

ENERGY LEVELS

In the course of experimentation, the effort it took to come up with one tool was considered relative to time spent and its eventual importance in the circle of usage. All artifact types especially from GqJc1 were found to be difficult and challenging to replicate. The raw material (Ombo phonolite) is hard and sharp. Though obsidian from which most materials from GsJi7 7 are made can be easily replicated, most of the artifacts from the site are smaller in size and dimension and required a lot of skill to be arrived at. With my own physical abilities 6 foot one inch tall, weighing 75kg, and assuming that the MSA people were fairly stronger than me, I think it is safe to infer, that their maximum strength and energy levels is not reflected in their lithic technology. Manufacturing of tools took me a lot of effort and on the first days some strain too.

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 GsJi7 and GqC1 were capable of providing complex and more sophisticated tools if

they desired. They certainly had a cumulative program of skill management. Toth (1982) pointed out that the best gauge to assess skill or intelligence of the past populations especially ESA on the basis of stone tools is by seeing how long it takes a beginner to master the making of a single artifact.

The number of technological acts on artifacts may be a sign of complexity and more types of distinctive form, may be an indication of complexity. This argument however, reminds one of Piagets Oedipus complex theory. Like the Oedipus complex arguments, it attempts to project what was possibly happening in the minds of the makers of these stone tools before the manufacturing of the tools and possibly during their making. It is however not possible to retrieve what is happening in a persons mind (head) unless he/she verbalizes or puts into action the sentiments himself or herself. Inferring the possible sentiments from material culture with no collaborating cognitive evidence is equally not feasible. So many things including cultural norms, raw material types, the intended use of a tool, among others make an attempt at measuring intelligence from stone tools difficult.

For instance, the lanceolets of Sangoan - Lupemban are amazing. The ability to produce them in my opinion, take more strength, skill and foresight than say a Later Stone Age crescent or blade. The tools in GsJi7 7 and GqJc1 are repetitive, predictable and boring, but it is hard to say whether, these people did not produce more sophisticated tools due to lack of knowledge (low intelligence), because of lack of skill required, or due to lack of interest in variety or purpose. As much as I tried, during experimentation, I realised that it is not easy to predict and

gauge the intelligence of MSA toolmakers from stone tools without the obvious risk of creating scales to measure their intelligence. In practice these tests would turn out to produce procedures of choreographed and contrived stages of developmental milestones paged on our own development path, i.e. from the industrial age though to information age.

From the experiments, what emerged was that the MSA people created representations of their experiences from the first contact with their environment. They had some abstract of the original elements in an event, and their relation to one another. For instance, a young person's view of a core scraper would likely emphasize a raised section with one steeply trimmed side and a flat cleavage plane. After the image of scrapper is established, the young learner's attention tends to be prolonged when other materials introduced are different from, but not totally interrelated to the one that created the original image. Tool making was thus learnt by rote through time and the subjects mastered the artistry from the older members of the society.

CHAPTER SIX
COMPARATIVE ANALYSIS

6.0 INTRODUCTION:

This chapter presents the results of comparative tests and description among assemblages. It is an attempt to find similarities and differences in the assemblage composition from the two sites of GqJc1 and GsJi7. The comparison has mainly focussed on the technological aspects of the artefacts from the two sites. This is done in an attempt to address the questions raised in chapter one on the objectives and hypothesis of this study. I have restricted myself to technological aspects in comparing the assemblages because of the ease in quantification of certain distinct variables. The results presented emanate from both flake and formal tool analysis. The total number of tools in all the four assemblages of member 4, member 6 and phases I and II of Muguruk and Prospect Farm were analysed, while a sub-sample of the flakes were examined after random sampling. After selecting all the flakes with signs of retouch and edge damage, they were laid in one line on a flat table and each third member of the population picked until a sub-sample of 250 was realised for assemblages from GqJc1 and 195 for assemblages from GsJi7. This was a good representative sample of the entire population.

6.1 COMPARISON AMONG ASSEMBLAGES

The environment, which resulted in the creation of the four primary Muguruk and Prospect Farm assemblages, differed markedly. One major aspect of artefact morphology which reveals this most vividly is size. The average size of formal tools and flakes from Muguruk are comparatively larger. Table 6.1 is a comparison of the four assemblages by size class. The difference reflected in the table may be attributed to the nature of raw materials and differing proportions of debitage (1 cm in maximum dimension) and larger artefacts (greater than 10 cm). The member 4 of Muguruk shows higher values for debitage and larger pieces than any of the other three assemblages. Most of the larger pieces comprise slabs, anvils and hammer stones. Class here refers to the general size category that an individual artifact falls in. For instance, in Muguruk's member 4, 827 artifacts measured a maximum of 1mm, while another 117 measured upto 7mm in size and so on.

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Class	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
1	827	12.71	57	1.00	3700	85.52	4200	60.6
2	1244	19.11	122	2.13	420	9.71	1800	3
3	606	9.31	47	0.82	164	3.80	343	26.0
4	251	3.86	8	0.14	25	0.58	44	0
5	173	2.66	8	0.14	4	0.09	18	4.95
6	173	2.66	2	0.03	1	0.02	6	0.64
7	117	1.79	1	0.01	4	0.09	32	0.26
8	58	0.89	1	0.01	8	0.18	15	0.09
9	35	0.54	0	0.0	0	0.0	2	0.46
10	18	0.28	0	0.0	1	0.02	0	0.22
11	17	0.27	1	0.01	0	0.0	0	0.03
12	17	0.27	1	0.01	0	0.0	0	0.0
13	17	0.27	0	0.0	0	0.0	0	0.0
14	7	0.11	0	0.0	0	0.0	0	0.0
15	9	0.13	0	0.0	0	0.0	0	0.0
16	5	0.11	0	0.0	0	0.0	0	0.0
17	1	0.02	0	0.0	0	0.0	0	0.0
18	2	0.06	0	0.0	0	0.0	0	0.0
19	4	0.06	0	0.0	0	0.0	0	0.0
20	4	0.06	0	0.0	0	0.0	0	0.0
21	1	0.02	0	0.0	0	0.0	0	0.0
22	0	0	0	0.0	0	0.0	0	0.0
23	0	0	0	0.0	0	0.0	0	0.0
24	0	0	0	0.0	0	0.0	0	0.0
								0.0
								0.0
Total	6509		5726		4326		6927	

Table 6.1: Assemblage Comparison by Size-Class

The Prospect Farm and Muguruk assemblages may next be compared in terms of raw materials employed in their manufacture. These data are represented in table 6.2. While Ombo phonolite remains the preferred raw material at Muguruk

(both member 4 and 6 show this) obsidian clearly stands out at Prospect Farm. The presence of the two materials no doubt, provided an attraction to their inhabitants.

RAW MATERIAL	MUGURUK				PROSPECT FARM			
	MEMBER 4		MEMBER 6		PHASE I		PHASE II	
	n	%	n	%	n	%	n	%
Ombo phonolite	632	96.7	5508	84.6	0	0.0	0	0.0
Kisumu phonolite	5	0.5	74	1.1	0	0.0	0	0.0
Quartz	30	1.3	102	1.6	0	0.0	0	0.4
Chart	84	0.2	18	0.3	17	0.4	27	87.0
Obsidian black	13	0.1	0	0.0	4120	95.3	6020	0.0
Basement Complex	4	0.7	19	0.3	0	0.0	0	0.8
Obsidian black with coarse grain	47	0.0	0	0.0	158	3.7	52	0.0
Silified tuff	0	0.0	0	0.0	31	0.0	18	0.3
Not recorded	0	0.0	0	0.0	0	0.7	0	0.0
Total	650	100.	5726	100.0	4325	100.0	6927	100.0
	9	0						

Table 6.2: Raw material frequencies of the four principal assemblages at Prospect Farm and Muguruk.

There are a fair variety of raw materials at both areas, with Muguruk giving obsidian, a material not locally available in the area but abundant in Prospect Farm. Overall the Muguruk occupants seem to have selected the greatest variety of stones for artefact manufacture. The two major materials used in the manufacture of artefacts at the two sites are present in the immediate vicinity of the two site areas.

In examining the classification of the four assemblages, all of them exhibit a low number of formal tools with member 4 of Muguruk having the fewest. The four assemblages are composed mainly of flaking debitage with flake fragments and angular waste making up the bulk of the waste. The primary classification of the four assemblages is presented in Table 6.3. Heavy duty components of the tool

category like hammerstones, Chunks, split Cobbles, Choppers and Anvils are either missing from Prospect Farm two assemblages or their representation is negligible. Majority of retouch is exhibited mainly on flakes from both sites.

Thus, one major difference between the two sites and among the four assemblages is in the higher percentage of cores, hammerstones and slabs/anvils which are very prominent in member 4 of Muguruk. Their high frequency compared to the smaller number of formal tools could point to a possibility of direct flake production as the main stone working activity.

Category	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
Formal tool	63	0.1	139	2.4	73	1.7	64	0.9
Tool	2	0.0	40	0.7	14	0.3	11	0.2
fragment	774	12.0	608	9.3	285	6.6	657	9.5
Flake	2096	32.2	0	0.0	0	0.0	0	0.0
Flake	3220	49.5	4845	74.4	3116	72.0	4856	70.1
fragment	90	1.4	9	0.2	22	0.5	103	1.5
Angular	7	0.1	3	0.0	34	0.8	64	0.9
waste	226	0.3	12	0.2	0	0.0	0	0.0
Core	1	0.0	6	0.1	0	0.0	0	0.0
Core	25	0.4	0	0.0	0	0.0	0	0.0
fragment	2	0.0	0	0.0	0	0.0	0	0.0
Hammerston	3	0.0	5	0.1	0	0.0	0	0.0
e	0	0.0	0	0.0	782	0.0	1172	0.0
Anvil								
Pigment								
Split cobble								
Core/Choppe								
r								
Buff								
Total	6509		5726		4325		6927	

Table 6.3: Classification of the four Principal Assemblages at Prospect Farm and Muguruk

Equally of interest, is the comparison of the four assemblages in terms of the types of blanks used in tool manufacture. This data is given in table 6.4. The most preferred blank types are flakes and flake fragments. The preference for whole flakes is shown by the makers of the Muguruk assemblages. Large flakes were in a way reduced in their manufacture to smaller manageable pieces.

Blank Type	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
Flake	53	36.1	27	39.1	61	48.0	31	27.2
Flake fragment	76	51.7	23	36.3	4	3.1	14	12.3
Angular waste	9	6.1	5	7.2	48	37.8	62	54.4
Pebble/Cobble	1	0.7	8	11.6	0	0.0	0	0.0
Slab/Anvil Butt	2	1.4	1	1.4	0	0.0	0	0.0
Unknown	0	0.0	0	0.0	8	6.3	4	3.5
	6	4.1	3	4.3	6	4.7	3	2.6
Total	147	100.0	69	99.9	127	99.9	124	100.0

Table 6.4: Blank Types within the four Assemblages.

Cobbles are rarely used by makers of the Prospect Farm samples so are anvils and slabs.

6.3 FORMAL TOOLS

Typological classification of the tools within the four assemblages is presented in table 6.5. The main differences between the Muguruk and Prospect Farm assemblage can be seen easily from the table. The Muguruk assemblage has a considerable amount and variety of heavy duty tools when the typology used in this study is grouped at a higher general level of heavy duty tools, large bifaces

small bifaces and other small tools. From table 6.5, the difference stand out very clearly.

Tools	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
heavy duty tool	10	15.9	10	7.2	0	0.0	0	0.0
Large bifaces	0	0.0	0	0.0	2	2.7	0	0.0
Small bifaces	3	4.8	0	0.0	4	5.4	5	7.4
Other small tools	50	79.4	129	92.8	68	97.9	59	93.6
Total	63	100.0	139	100.0	73	100.0	64	100.0

Table 6.5: Typological Classification of the Tools within the Four Assemblages.

The difference among the four assemblages is significant

6.4 FLAKE PRODUCTION

Techniques of flake production in this study are compared at two different levels. The first is by examining the relative number of various types of cores that each assemblage contains, and the second is by metrical measurements of dimensions of individual flakes and formal tools to see how they compare and contrast.

The presence of one or more flake scars prominence on a core than the others led to separation of levallois cores from radial cores. The method was also used by McBrearty (1986) in the study of Muguruk's Lupemban-Sangoan materials.

The frequencies are given in table 6.6.

Core Type	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
Radial	26		19	36.5	8	36.4	34	33.0
Sub-radial	15		11	21.1	5	22.7	17	16.5
Levallois flake	7		4	7.7	1	4.5	7	6.8
core	11		10	19.2	7	31.8	42	40.8
Levallois point	4		2	3.8	1	4.5	3	2.9
core	6		0	0.0	0	0.0	0	0.0
Levallois blade	8		6	11.5	0	0.0	0	0.0
core								
Opposed platform								
Single platform								
Total	59		86	99.8	22	100.0	103	100.0

Table 6.6: Core Types within the Four Principal Muguruk and Prospect Farm Assemblages

Considering that Levallois cores are a sub-category of radial cores (McBrenthy, 1986), then flake production at GqJc1 and GsJi7 is mainly by radial core production and Levallois point core production.

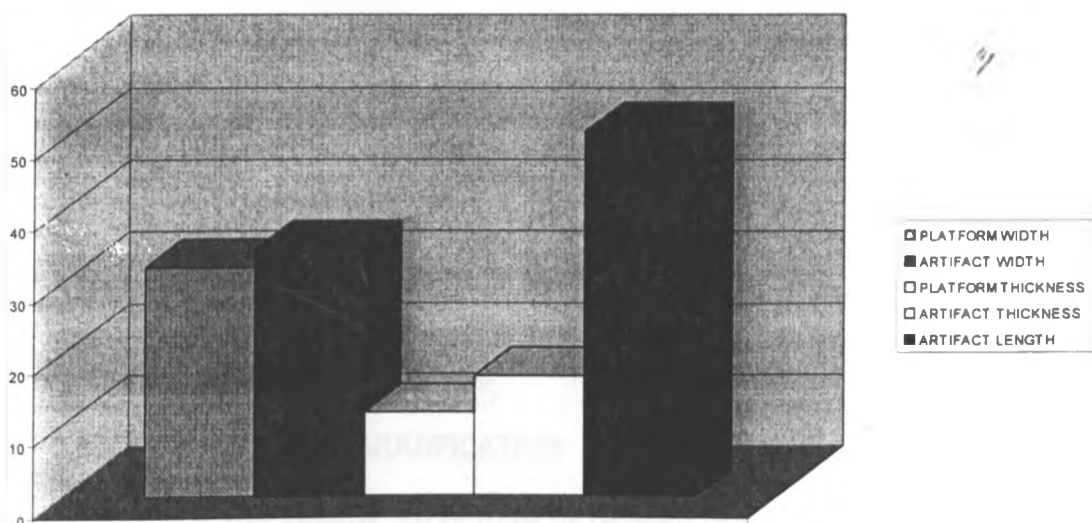
Aspects of formal tool manufacture differ fairly between the two sites. This could be explained by the fact that there is difference in environmental settings, raw materials used for tool manufacture and even the markers belonging perhaps to different ethnic groups but all still applying the same techniques in the production of flakes.

A group of metrical variables were recorded for a sample of flakes from Prospect Farm and Muguruk. What emerged from the analysis of these variables was that the flakes from the Prospect Farm assemblages were significantly smaller than those from Muguruk. The differences is expressed and reflected in a number

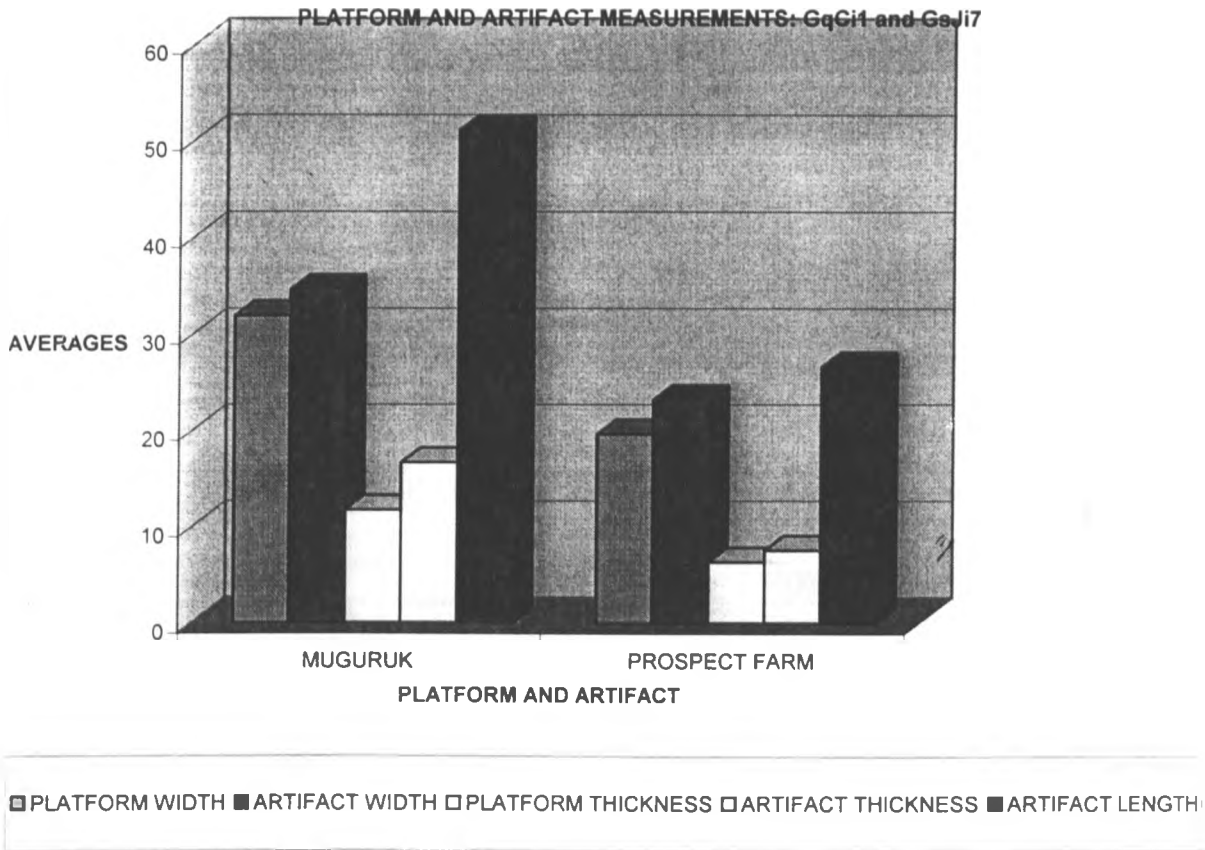
of variables including: flake length, flake width, platform width, platform thickness and flake thickness.

Flake platform dimension can reflect differences in flaking technology such as that of the production of hard hammer (McBrearty, 1986; Ambrose Pers. Comm). Flakes produced by hard hammer have larger platform size to artefact size almost 1:1. Results of analysis of these two dimensions show that at both Prospect Farm and Muguruk, the average ratio was 1:1 see figure (6.1) and (6.3). When platform area is compared to total flake area and analysis of variance performed, the difference among the four assemblages are found to be insignificant ($P = 0.162$). This shows that the technology of flake manufacture at the two sites in terms of platform area relative to gross flake dimension is similar despite the difference in flake size.

Platform and Artifact Measurements:GqCi1



Flake length is often used as an expression of total flake size measured against the size of flakes. From Muguruk, the gross flake size at Prospect Farm clearly separates from its counterpart. The average length of flakes from Muguruk stands at 31.2 mm while that of Prospect Farm is about 23.5 mm. This difference by analysis of variance is however not statistically significant ($P = 0.62$). Below is a comparative bar graph.



6.5 RETOUCH AND MODIFICATION

Table 6.5 is the general proportion of retouch, modified and utilised pieces from the four assemblages of Prospect Farm and Muguruk.

Flake samples were selected as described in chapter three and their edges divided into retouched, modified and edge damaged. Retouch is considered as an area of invasive scars, modification constitutes a number of isolated invasive or smaller areas of sub invasive and/or marginal scars. While edge damaged pieces show only marginal scars. The proportion of this category is given in table 6.6.

As can be seen from the table, most flakes were retouched or utilised along their sides, that is to say, edge of flake parallel to its flaking axis. It corresponds to the flakes long axis. Flakes utilised on both sites are present from both sites too while the sharp points as the area of utilisation is mainly dominant at Prospect Farm. There were others that proved somewhat difficult to place. It was not easy to tell the exact working edge as they were retouched all around and deciding where the markets could have handled while utilising them was not easy. I have decided to call them unidirectional in this study. I take the name basically for its descriptive characteristics and nothing more.

Material	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
Retouched one side	34	29.1	87	38.0	32	23.0	28	11.6
Retouched both sides	15	12.8	20	8.7	15	10.8	24	10.0
Retouched both sides-unidirectional	20	17.1	20	8.7	6	4.3	6	2.5
Retouched both sides -point	0	0.0	0	0.0	14	10.1	6	2.5
Modified one side	21	17.9	32	14.0	13	9.4	66	27.4
Modified both side	11	9.4	22	9.6	18	13.0	52	21.6
Modified point	0	0.0	0	0.0	20	14.4	18	7.5
Edge damaged	16	13.7	48	17.9	21	15.1	41	17.0
Total	117	100.0	209	100.	139	100.	241	100.0

Table 6.7: Retouch, Modification and Edge Damage Frequencies of the Four Assemblages.

6.6 INTENSITY OF TOOL USE AND RENEWAL

It is also interesting to compare the four assemblages in terms of the intensities or duration of tool use and renewal. Among the four assemblages, evidence for the frequency of retouched tools relative to unmodified but potentially usable flakes (greater than 2.0 cm in length) was examined.

Material	MUGURUK				PROSPECT FARM			
	Member 4		Member 6		Phase I		Phase II	
	n	%	n	%	n	%	n	%
Retouched Tool	63	26.3	139	42.51	73	25.8	64	34.1
Unmodified but potentially usable	176	73.7	188	57.50	210	74.2	124	65.9
Total	239	100.0	327	100.0	283	100.0	188	100.0
		0		0				0

Table 6.8: Retouched versus unmodified but Potentially usable Flakes from the four ssemblages.

Member 6 of Muguruk clearly contrasts its counterparts with the highest evidence of tool use and renewal

6.7 DISCUSSION AND SUMMARY

Between the two sites, formal tool and flake production seems to change little despite the distance between them and the change in the environmental setting. The architects of MSA artefacts from the two sites of GqJc1 and GsJi7 produced similar flakes though the flakes from Muguruk were thicker and much heavier. This difference is a direct outcome of the nature of the raw materials used.

Another aspect that comes out clearly is that both the occupants of GqJc1 and G6Ji7 preferred utilising raw materials within their immediate vicinity for tool

and flake manufacture. The Muguruk inhabitants utilised the abundant readily available Ombo phonolite while their Prospect Farm counterparts heavily relied on Obsidian.

Radial flaking techniques was practiced in both areas with all the four assemblages giving a heavy presence of levallois flakes on the basis of the regularity of their general outline form.

Larger flakes were preferred in both sites for use and modification purposes as opposed to heavy stones like anvils. Retouch or utilisation of flakes and formal tools occurs mainly along the flakes' sides.

Other differences are also significant. The average size and length of both formal tools and flakes are smaller at Prospect Farm as compared to Muguruk. In conclusion, it is safe to say that the technology practiced at the two sites is similar.

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CHAPTER SEVEN

SUMMARY AND CONCLUSION

7.0 THE PROBLEM

Man has always been a fable animal having to rely more on brain than brawl for his survival. As Whittaker (1994) pointed out, prehistorian Raymond Dart (1967) and journalist Robert Ardrey's (1961) assertion that our early ancestors were "killer apes" was based on wrong and faulty interpretation. Our ancestors, most probably, relied on gathering plants, foods, catching small animals and scavenging from the kills of strong and powerful predators like lions rather than killing big game themselves. They did not have the advantage of powerful claws and teeth and had to come up with a strategy to survive and procreate in an otherwise hostile environment.

Evidence available in form of fossils and genetics show that from the beginnings of Middle Stone Age (MSA) 250,000 years ago (Mehlman 1979; Manega 1994; Clark 1989; McBreaty 1994), the anatomical characteristics of humans have changed little, but evolution, especially cultural has continued. Being an orderly sequence of changes between the population and its environment (Stebbins 1971), evolution has not stopped. But since the beginning of Middle Stone Age (MSA), the human species has evolved at an exceptionally rapid pace and in an entirely new direction from that which any species population has previously taken (Whittaker 1994).

The Middle Stone Age People were most probably very much like us, but living in simple structures and most probably caves, possessed only the simplest and crudest of weapons and tools, ate only simple foods and probably suffered often from a scarcity of even these. Their numbers were tiny as compared to our large numbers today, had to continuously defend themselves against animal predators and lived at the mercy of extreme changes in their physical, inanimate environment, such as sudden storms, droughts due to aridity that was prevailing during the period and famine among others.

How did the MSA populations, manage to gain control over their inanimate environment and animal predators? They must have devised a method (s) by which their own could have lived in peace, safety and prosperity for an indefinite period.

The thrust of this study then, was to find out how MSA people in East Africa, might have adjusted their own technology to make their potential ways of achieving their ultimate goals become a reality.

Many Archaeologists and paleoanthropologists (Stiner and Kuhn 1992; Alvard and Kaplan 1991; Short 1986) have tried to grapple with these questions. Those who have chosen lithic analysis (Chase and Dibble 1987; Rolland 1981; Nelson 1991; McBrearty 1988, 1989) as a possible route to the truth have however been entangled in a rather embarrassing pathological desire to classify everything into neat little pigeonholes and infer their interpretations from the same. Huge amounts of data, running into thousands of specimen are normally analyzed and used to argue cases for certain interpretations. But knowledge is not data. Knowledge is not the

quantity of data recovered and analyzed. Knowledge is the certainty that you know. Though classification is important in helping us condense information from the huge data we recover, so that we can talk of specific numbers and provide a common vocabulary for communication, it all boils down to discussing mere data. We need to do more than observe the obvious and deduce.

The assumptions and pre-requisites necessary for this study are believed to have been realised. In trying to reach logical and plausible conclusions in a study of this nature problems do arise due to:

- (i) Differential preservation and recovery of artefacts and faunals;
- (ii) Lack of precise and/or reliable dates; and
- (iii) Nature of the recovered materials at Muguruk and Prospect Farm.

Phonolite and Obsidian, the principal raw materials from which artifacts were made at the two sites renders the potential for the study of traces of microwear impractical.

The first problem is beyond anyone's control and its effects on the outcome of this study have been assessed. The second problem is bound to be solved when Stanley Ambrose dates the site of Prospect Farm (Ambrose per. comm.). However, the volcanic soils of Eburru destroy organic matter making dating of the assemblage problematic volcanic ash may perhaps be used to get Potassium/Argon readings. It is however important to note that Anthony (1978)

tried even this but claims failure. As for the applicability of micro wear tests, edge wear and experimental studies used in this study has thrown some light.

Despite the problems, this study has succeeded in raising a number of interesting points. Several issues have come up that deserves some mention:

- (i) Occupation and habitation of sites during the MSA in East Africa was determined by availability of water and raw materials for tool manufacture. In this light, the readily available Ombo phonolite at Muguruk and obsidian at Prospect Farm, the presence of the ancient Muguruk River and lakes Elementaita and Nakuru, provided attraction for repeated occupation of the two sites.
- (ii) As a time and energy saving strategy artefacts were manufactured at the source of raw materials and then carried away. This is to say, that the manufacture of tools was a centralised activity.
- (iii) There is little evidence of diversity in raw materials used for artefacts manufacture at both sites. Most tools are made from the locally available raw materials. However at Muguruk, Kisumu phonolite and obsidian were obtained 15 and 190 km away respectively. The amount is however negligible compared to the locally available Ombo Phonolite.
- (iv) At a comparative level, both sites functioned as factory sites during their occupation. The bulk of all the four assemblages at the two sites are made up of the debris of flake production, flake fragments and angular waste.
- (v) A large proportion of tools at the two sites comprise small tools.

- (vi) Flake production at both sites is by radial core reduction. Nearly 60% of the cores in the assemblage are levallois. On the basis of their outline forms most cores pass as levallois giving the impression of a high level of regularity of pattern.
- (vii) The majority of tools, about 67% at both sites are scrapers and there is a persistent and repeated making of other tool forms from large flakes and flake fragments.
- (viii) The heavy duty tools from Muguruk, particularly the anvils and the slabs were used for other purposes besides tool manufacture. This is backed by functional experiments conducted during this study.
- (ix) The repeated appearance of scrapers as the dominant tool type and core reduction by radial points, to a certain extent points to some element of conservatism over time.
- (x) The principal differences between the Prospect Farm and Muguruk stone Age technologies is reflected not in how they are produced, but in what material they are made from. The approach to tool manufacture represented in the four assemblages is similar. It can be said, that when a flake was selected for tool production at both sites, there appears to have been a targeted size in mind. Flakes were mostly retouched along their axis although distal end was equally retouched.
- (xi) A conspicuous similarity between Prospect Farm and Muguruk in the artefacts assemblage lies in the basic similarity exhibited by all the

assemblages. The tools from the four assemblages are infinitely variable within the tradition of levallois. They do not vary significantly except in proportions and sizes at the two sites. The variability in tool-kit and sizes observed here could be attributed to the nature of raw material.

7.1 CONCLUSION

Experimental manufacture and functional studies of MSA stone tools has brought up several issues in this study.

Which approach did the MSA people of prospect farm and Mugeruk take in terms of subsistence strategy? Are the data presented in chapter 4, 5 and 6 consistent with specialization as a subsistence strategy or with a more general response to local availability of resources? As noted earlier, the behavioural correlates of specialization type of approach would include decision-making based on the cost and benefit of a specific tool. The second situation is more consistent with a general and opportunistic approach.

In light of the Mugeruk and prospect farm data I now return to the set of hypotheses pertaining to specialized and general but versatile hunters and foragers. As earlier said, we would expect that for specialized approach, the technology and substance techniques would be reliable i.e. overly specialized with redundant part capable of being renewed and failure free. That such a technology would be recognized by the presence of special purpose tools. If a general opportunistic

approach were taken, then we would expect technology to be maintainable and versatile with general application to a variety of circumstances. Spare or interchangeable parts that would be recognized archaeologically by morphological standardization will characterize them.

I do recognized that to ultimately isolate the adaptive approaches to subsistence and accurately point out the function of MSA tools other relevant site data must be considered. Of interest are faunal remains to help in the construction of the paleoenvironment, estimate of group size and micro ware analysis. My purpose however is to offer a preliminary assessment of the data in hand and to suggest a viable methodology for future research.

In sum, my preliminary conclusion concerning the Muguruk and Prospect farm data is: -

- 1) Based on the analysis of wear edges and patterns on different tools, the levallois technology appears quite adequate to accommodate the notion of fairly skilled tool makers. Several characteristics of levallois points, scrapers and knives including standardization of tool angle and evidence from experimentation of re-sharpening successfully of blunted tool edges, suggest a portable serviceable tool system.

There is no evidence of special purpose tools for special purpose functions. In sum, the Muguruk and prospect farm levallois technology seem to be maintainable

and therefore indicative of a versatile and opportunistic approach to subsistence strategy.

In conclusion, my data regarding levallois technology and substance strategy at Muguruk and prospect Farm do not appear to be consistent with a specialized approach to subsistence strategy. At least as concerns the manufacture, use and discard of stone tools in the reduction process.

7.3 IMPLICATIONS FOR ADAPTATION

The behaviour, which can be inferred from the manufacture of stone tools at Muguruk and Prospect Farm, contains a strong element of centralised behaviour. The sites have shown evidence of a centralised state of affairs from evidence of factory manufacture of tools in one site. This means that there was some agreement on best location, timing and need for tools during MSA.

There existed a form of albeit crude planning for the needs and requirements of the society. This form of planning possibly helped the MSA people manage to gain control over their inanimate environment. Though no evidence of food storage has been found so far in any MSA site, its possibility cannot be disqualified. The quantities of debitage found at the two sites from the four assemblages points to the manufacture of many tools that were not necessarily required for immediate use.

The method of producing radial core reduction was widespread during the MSA. The numberless repetition of the production of this single but successful type

is a pointer to preference for the best approach in the manufacture of tools. A preference that bordered on conservatism.

The function of the tools at the two sites can only be inferred. Despite the experimental and functional studies carried out in this project, the projected functions of these tools were derived from the author's personal experiences. An experience shaped by the modern environment.

MSA people possibly lived in small bands but as families. The presence for Obsidian, an exotic material in Muguruk, act as evidence for migratory life. Movement was thus used as a strategy in locating good sources of raw materials for tool manufacture, food and water.

Events seen as related and cumulative in an intensification model can be seen as local short term adaptations to specific changes in the immediate environment. Thus the persistence of the single mode of tool production at the two sites can be in this case seen as a response to certain changes in the immediate environment of MSA people at Prospect Farm and Muguruk.

Besides the diversity in raw materials and tool types at both sites, technological development seem to have followed roughly parallel courses at the two sites, even though the evidence for movement could bring in the aspect of diffusion.

From the evidence given by this study, it is safe to assert that during MSA, the choice and technical ability to produce the scraper as the most preferable and

possibly versatile form of blank, stem from the perception of its advantage and the learned skills that lay within the brain of the producers.

It is impossible to bring to light a single principle from which every possible way of living and thinking could be said to have derived during MSA.

There is the hypothesis according to which one sector or reality of human activity could be said to determine the other sectors and activities. The relations of production constituting the sub-structure on which social ideologies are abased. On the level of the theory of cultural ecology, such a hypothesis would be unthinkable if it implied that economic facts determined ideas during MSA without being influenced by them in return. It would be either contradictory or outright incompatible with basic observation of the data in the study.

Economic facts cannot be disqualified as such. They embody the means of production and therefore technology. But the interaction of the elements inside the economic facts makes it impossible to conceive of technology being able to determine without being partially determined itself.

It is thus not easy to attach any Archaeological significance to the role of technology alone without an in-depth understanding of the social ideas. One cannot justifiably affirm that the MSA peoples' view of their world was determined by the form of their technology but that the later is not affected by the idea of the world which they formed for themselves. To survive, the MSA people had to struggle against nature and draw their livelihood from it. Because of this, the economic function acquires a sort of priority. But since even the hominids never fulfilled this

function without organizing themselves in the light of some beliefs (as yet unknown to us) which cannot be judged in terms of efficiency, this priority does not mount to a unilateral causality.

The MSA was not some ship held by one anchor in the storm, technology.

7.3 STUDY LIMITATIONS AND RECOMMENDATION

Some of the issues raised in this study could not be investigated satisfactorily due to a number of problems and limitations.

The data used in this study had no faunal remains. This made the reconstruction of the palaeoenvironment of the MSA at Prospect Farm and Muguruk difficult. A reconstruction of the palaeoenvironment would have strengthened the validity of the experiments conducted during this study. Examined in conjunction with controlled experiments in the technological reduction process, a good idea of the nature of the prevailing environment can enable us identify more exactly the times and nature of human and/or hominid behaviour. In light of this problem, it is [?] necessary that other sites be explored that can yield faunal remains.

Explanation of adaptive strategies is not an easy task and especially where no faunal remains are available to throw some light on the nature of subsistence ecology. It may not be impossible to explain adaptation in terms of the available means of production (technology). Archaeology is only ready to subscribe to a conception of this kind since its practitioners classify periods according to the tools employed and the principle forms of activity. As regards adaptive strategies during MSA in this study, all I was required to do was to establish the inevitable

consequences of the then prevailing state of technology, and then trace the framework within which social and ideological variations play their part.

But there is no proof that technological factors dominate during MSA or any other period in pre-history for that matter. There are other factors that are not reflected in the archaeological record. Factors like, the supremacy of power and the supremacy of blood that cement and confine small communities together during hard and happy times. Factors that invoke and dictate the nature and time of change.

My inability to carry out micro-wear tests on the artefacts from the two sites limited the information this study would have yielded on the outcome of my functional studies. A study of micro-wear traces on the tools can give a lot of information on the practice and exact functions of the tools. Sites with materials that can be studied for micro-wear traces should be explored. This can give a deeper insight into the real activities that took place during MSA

Lack of reliable dates of the two sites made comparative studies difficult, forcing the study to rely mostly on similarity and differences in technology alone. This study suffered time and financial limitations, a situation that affected experimental studies. It would have been more profitable to do experiments with several carcasses, most probably wild game in their natural settings. This was hampered by legislative and financial implications.

In light of the above problems, it is necessary that more research be done at the two sites to not only recover the materials that are now threatened with

destruction, but also attempt a detailed analysis of stone artefacts made in relation to their vertical and horizontal stratigraphic context, and examined in conjunction with controlled experiments to precisely reconstruct technological reduction process. This should be done together with refitting and use wear studies.

A landscape approach to the study of East African MSA sites is likely to yield better results than our present trench studies approach. This approach will take into consideration more details by virtue of its inclusive but expansive outlook. It will take into account, technology and resource exploitation and the relationship among the immediate interrelating ecosystems. I propose landscape archaeology as designed by Blumenshine and Masao (1991), and used to study early Pleistocene hominids in the Olduvai Gorge Basin, Tanzania (Peters, *et al.*, 1995) as the most appropriate approach in adding more information on the understanding of the adaptive strategies during MSA in East Africa. The approach is more productive. Intelligently applied it in no way diminishes an appreciation of the unique characteristics of the human mind that can only be inferred from the archaeological record.

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7

FIGURES



Fig 1.1 : The East African MSA Sites.

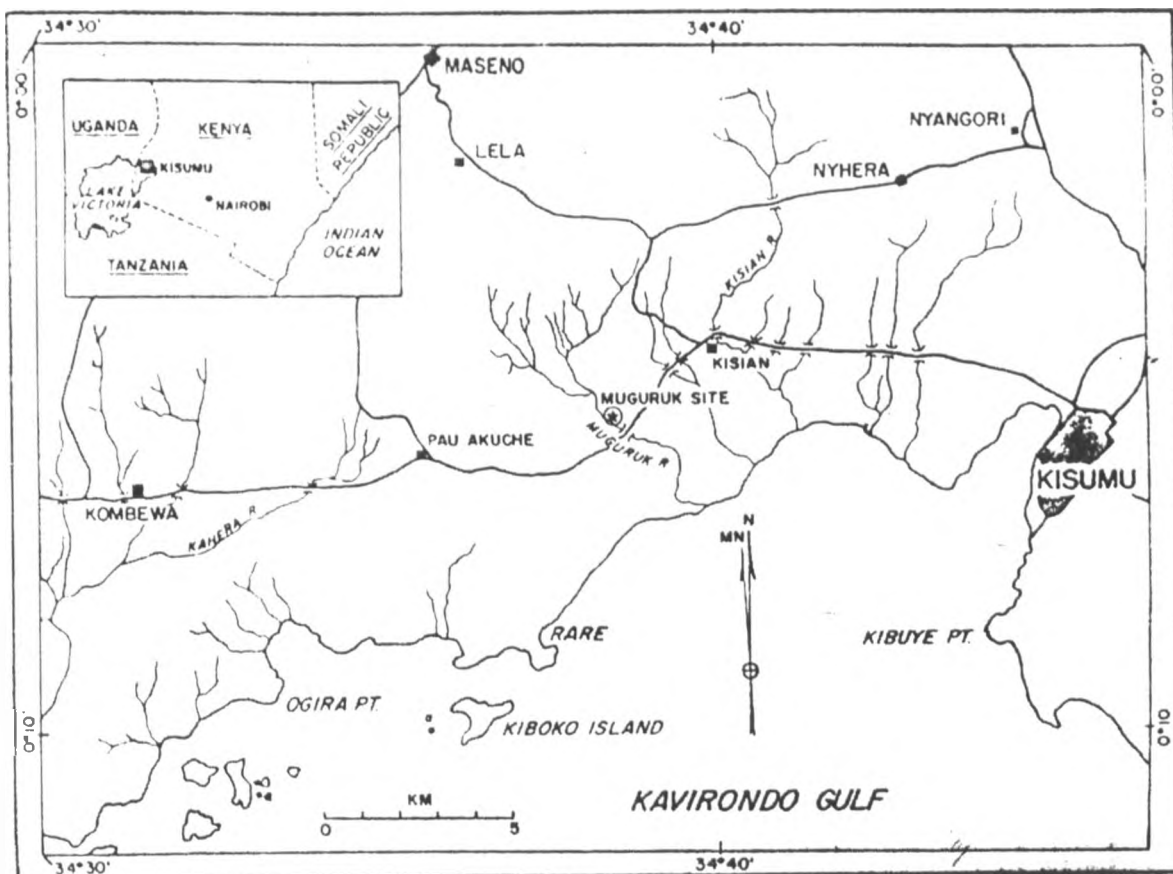
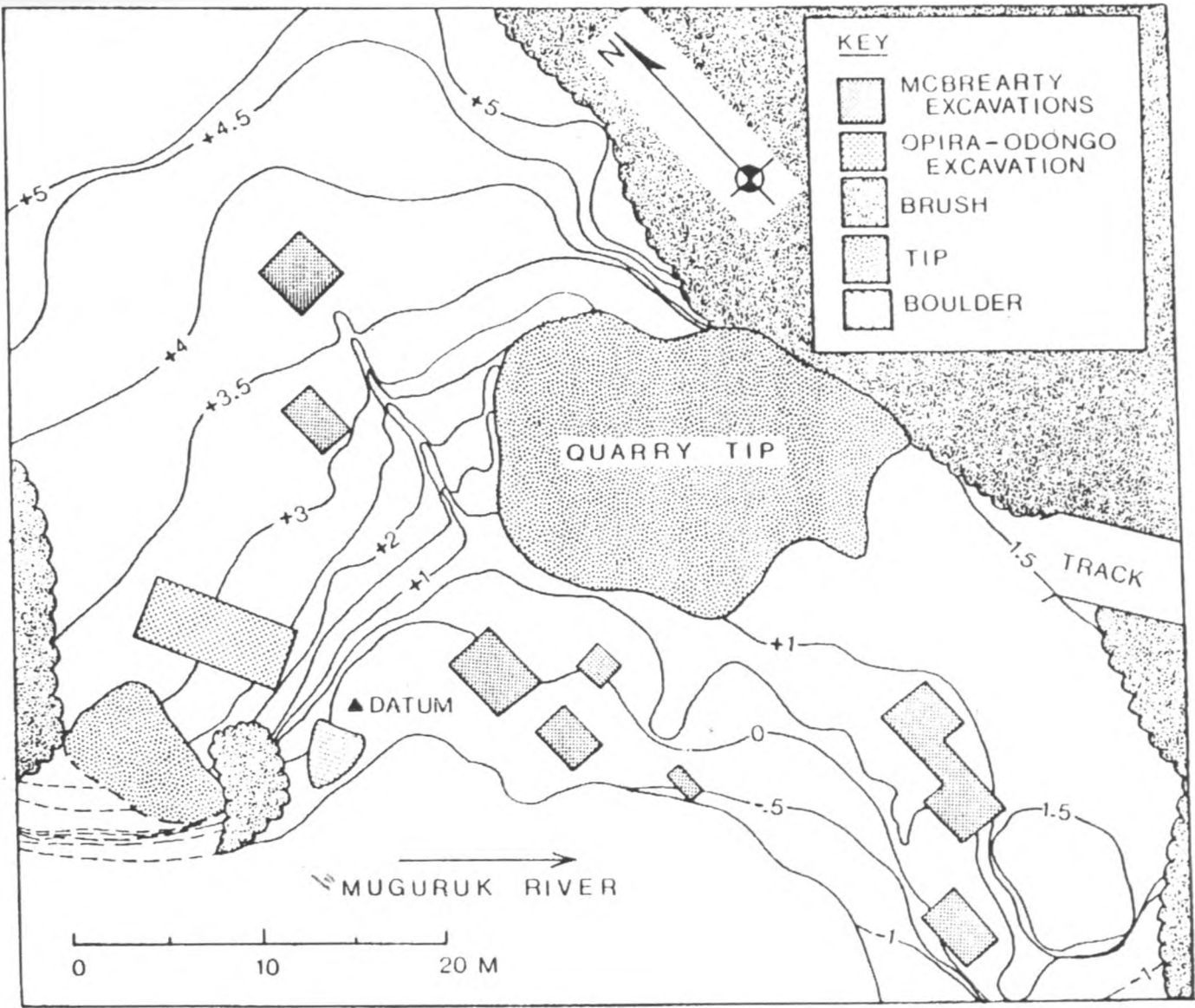


Fig 2.1: Muguruk (After McBrearty 1986)

Fig 2.2: McBrearty's excavation Site at Muguruk (After McBrearty 1986)



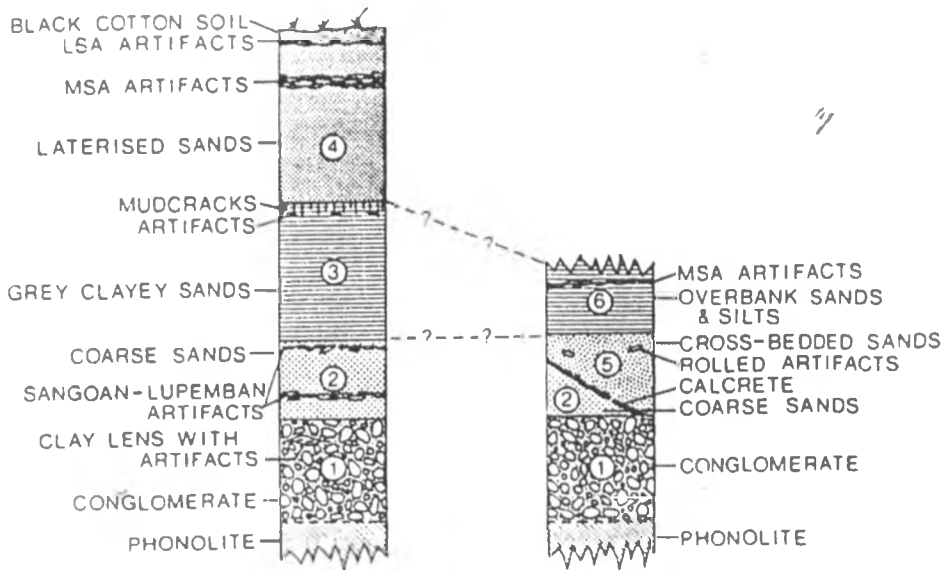
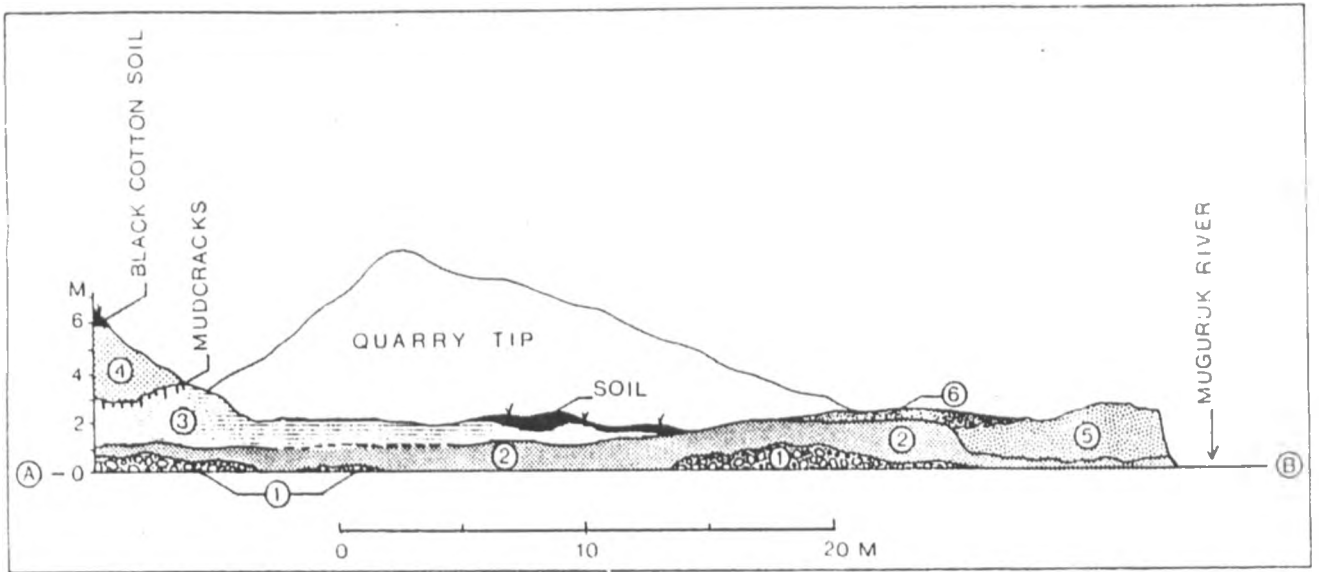


Fig. 2.3: The Muguruk Formation (After McBreaty 1978)

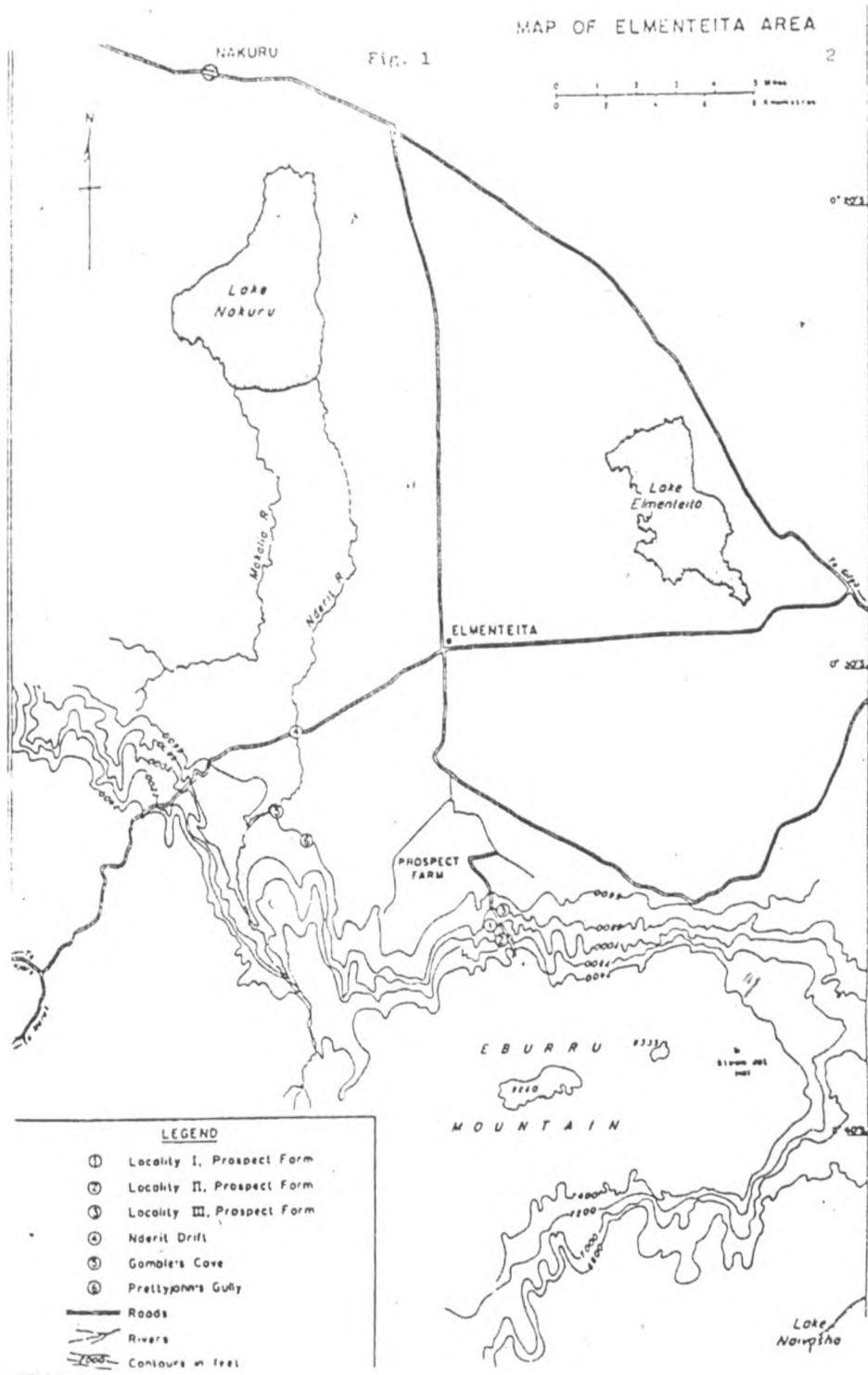
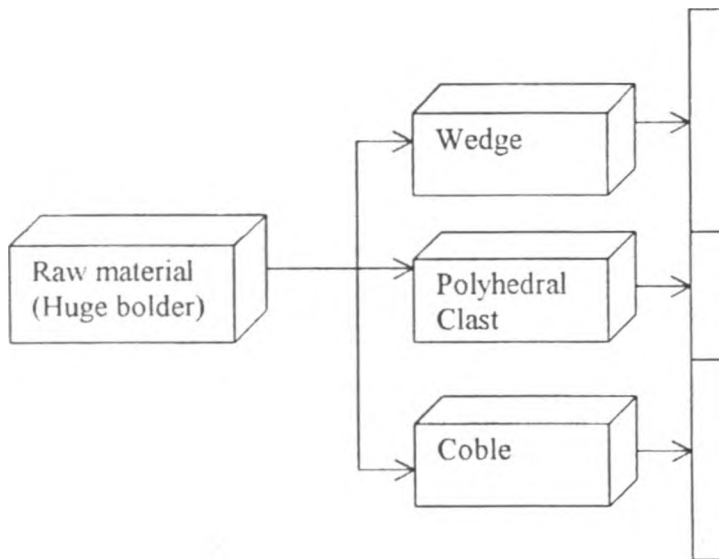


Fig 2.4: Prospect Farm after (Anthony 1978)



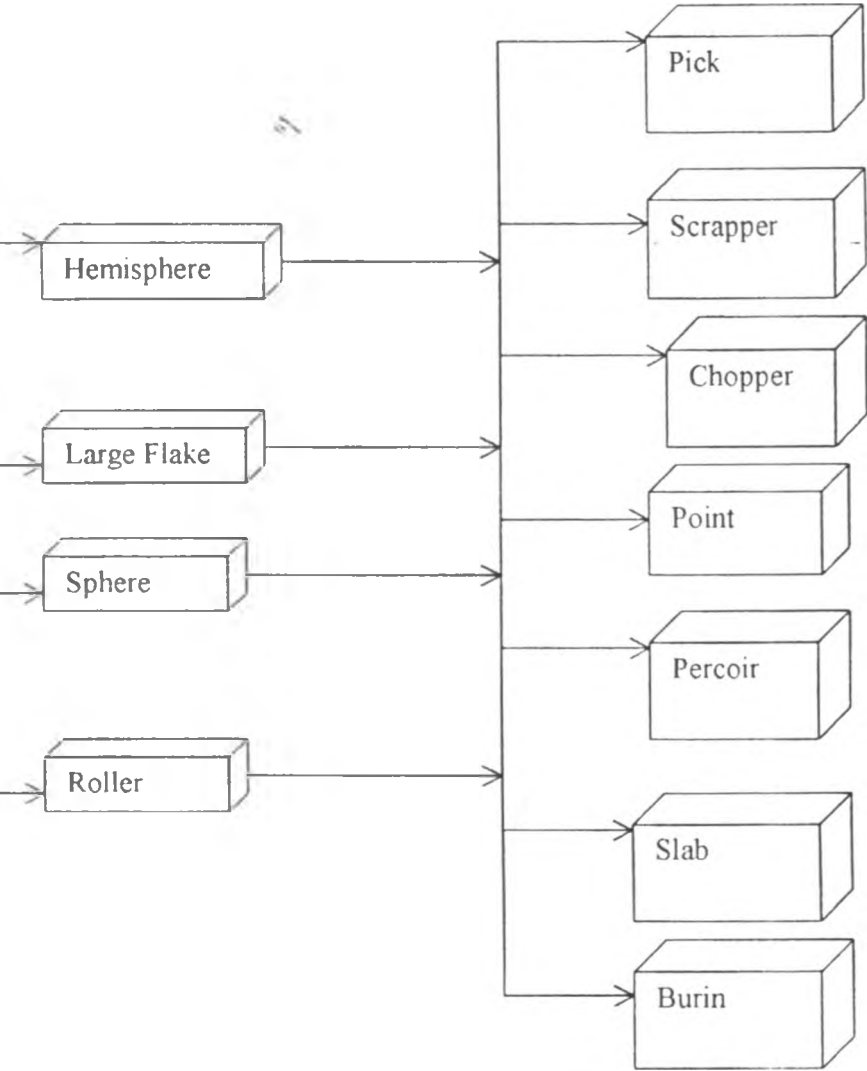
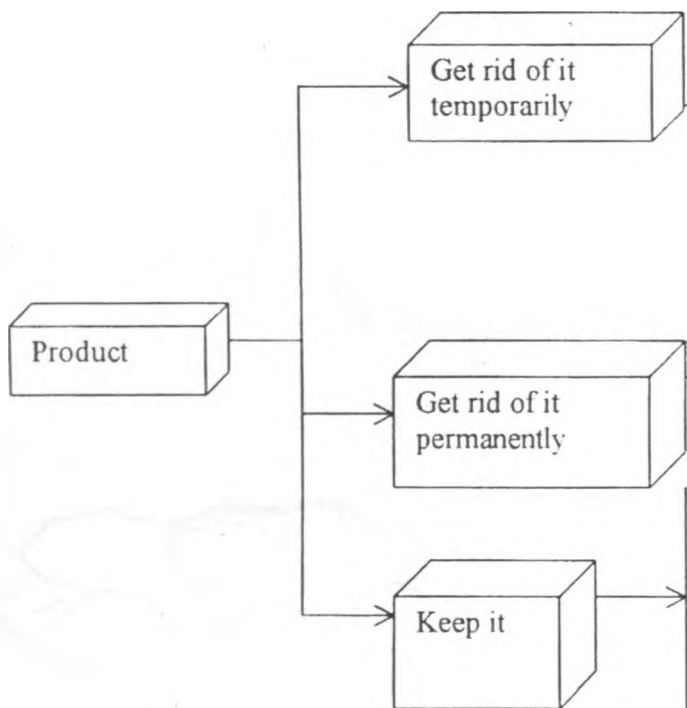


Fig 5.1.11: Bulk breaking as a strategy for tool manufacture



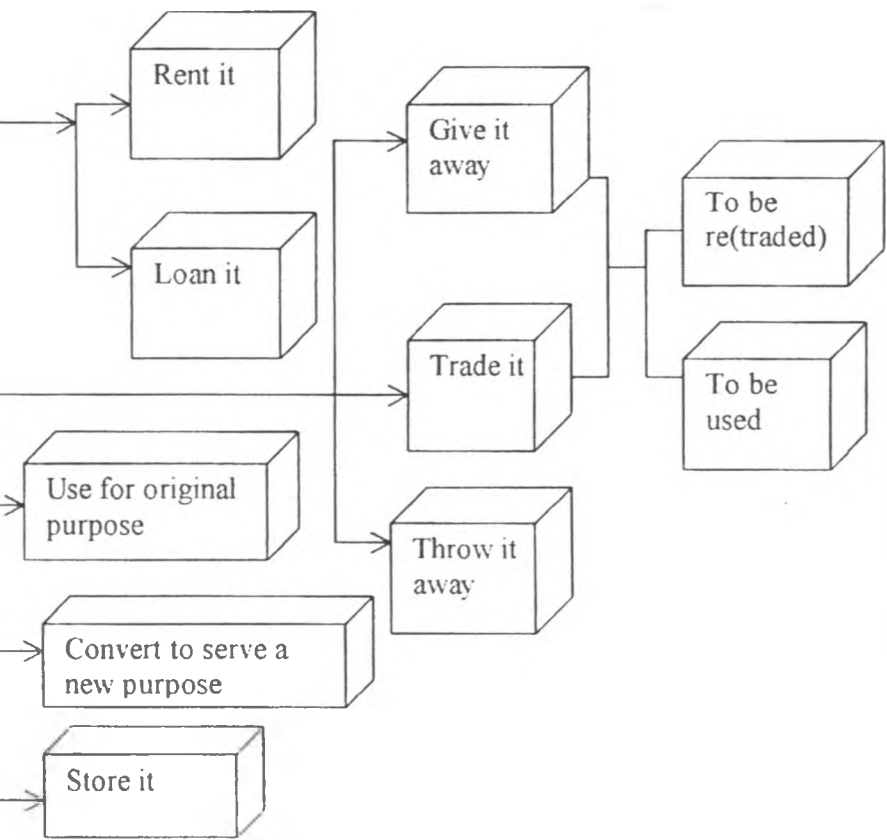
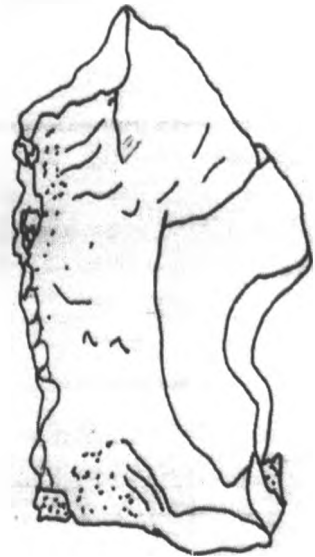
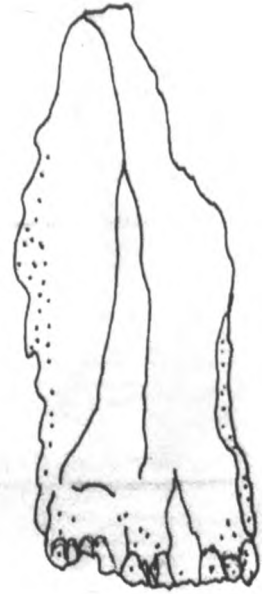


Fig 5.12: How MSA People used and disposed off tools at GsJi7 and GqCi1



Top, from right to left: Fig. 5.11a, 5.11b, 5.11c: Bottom from left to right: 5.11d
5.11e, 5.11f. Fig. 5.13: Different artifacts tested for Cutting.

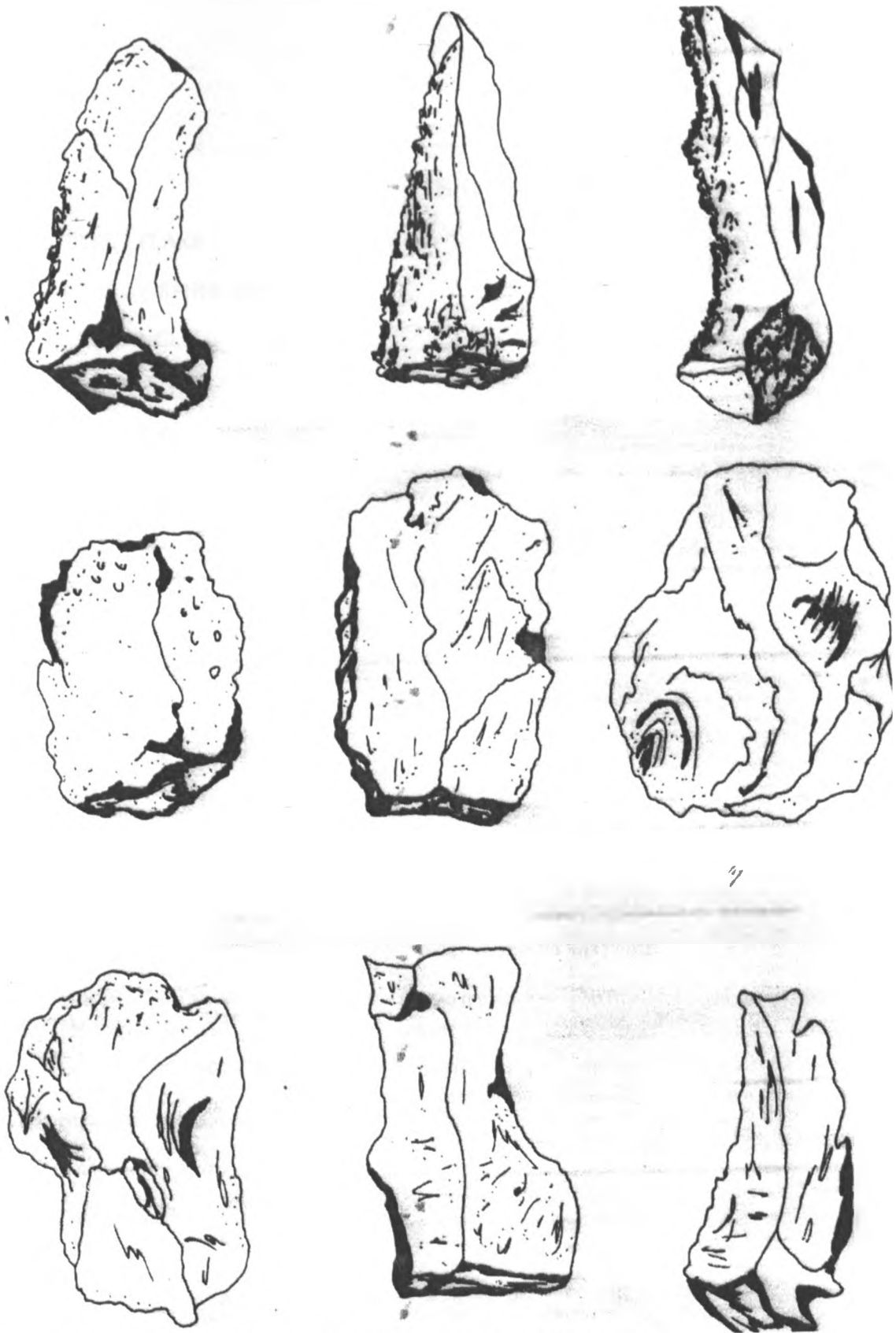
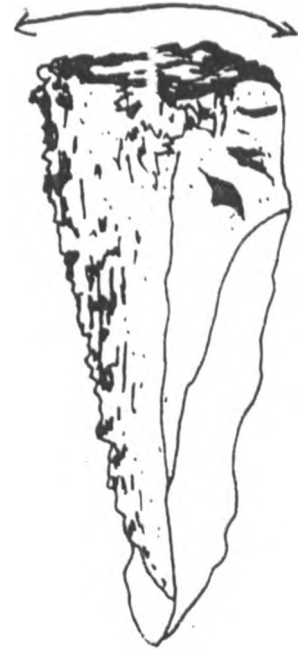


Fig. 5.14: Some Replicated Middle Stone Age tools in this study.



OBSERVATION

TYPE : FLAKE

EDGE MORPHOLOGY:

EDGE ANGLE 28

EDGE LENGTH 32

THICKNESS 4

PROFILE 0.18

SHAPE 3.2

MACRO EDGE WEAR

Fracture types:	ventral	Dorsal
Fractures	absent	absent
Fracture type	Snap	Snap
Rounding	Absent	Absent
Gloss	Present	Present

TYPE : FLAKE

USED AREA: Right lateral edge – Morphology Edge wear and polish

DIRECTION OF USE : Longitudinal – Due to presence of snap fractures often associated with lateral movement.

MOTION OF USE : Cutting- due to the delicate edge angle =28° and thickness = 4

HARDNESS OF MATERIAL : soft to medium due to delicate edge and amount of edge wear. Macro edge wear is less than 5

NAMED MATERIAL : Wood

PROBABLE FUNCTION : cutting wood

Fig. 5.16 Test result of a flake on different materials

ANGLE: LENGTH: THICK: SHAPE: PROFILE

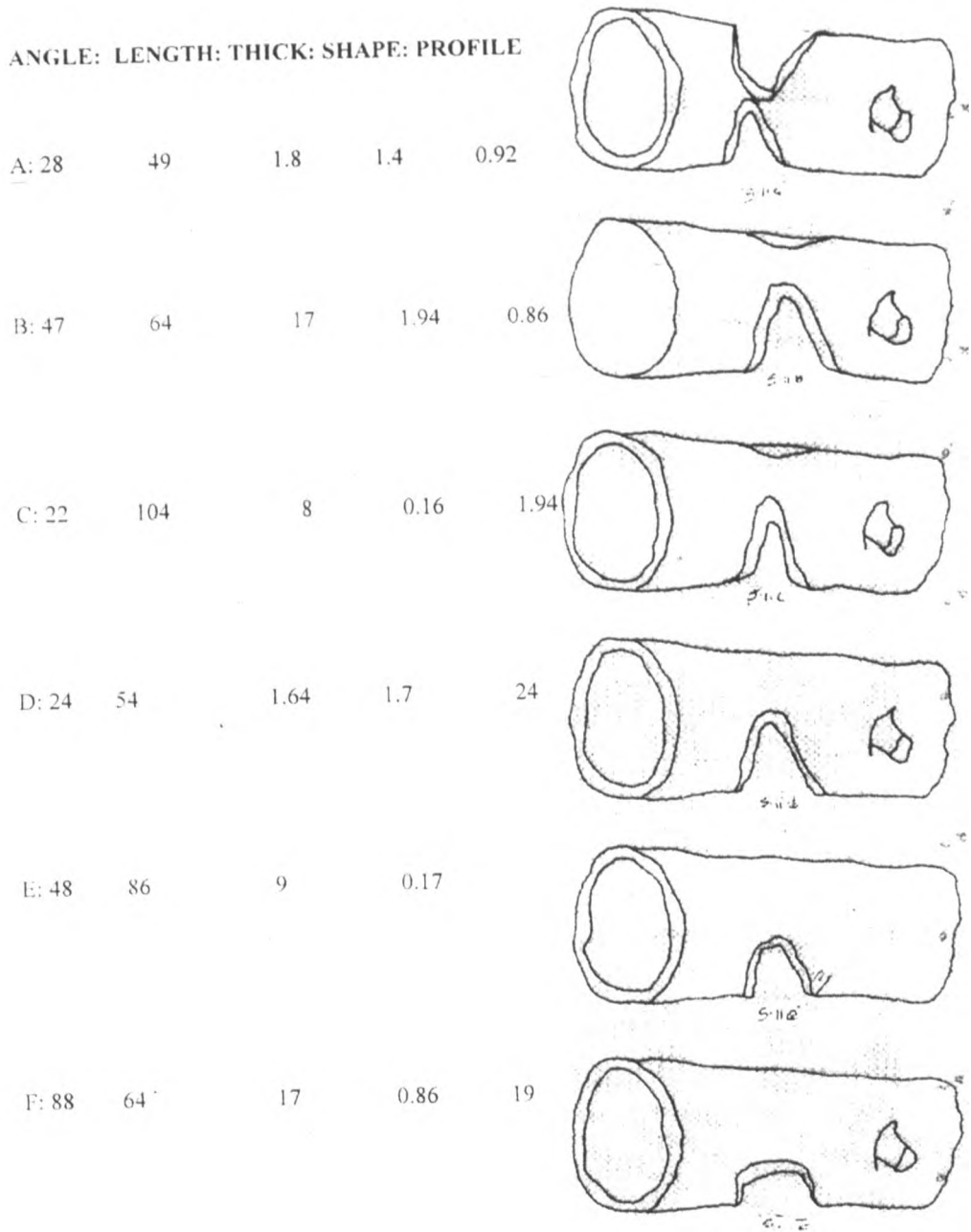


Fig. 5.15 Rate of tool success on wood after ten minutes

APPENDIX

DEFINITIONS

ASSEMBLAGE

A group of artifacts, including tools, potsherds, waste flakes, bones and others that are found together, in one layer/stratigraphic context at a site that reflects the shared activities of a large group of People. The assumption is that the components of the assemblage are associated, and therefore in some way, related.

ARCHAEOLOGICAL CULTURE

A collection of assemblages or an associated group of artifacts limited in space and time, and that can be attributed to a group of people. It refers to those items that have been recovered and recorded by use of archaeological Methods. Each Archaeological culture unit is defined on the basis of cultural content.

ATTRIBUTE

A recognizable feature, or, an independent variation in any of the elements, in which artifacts are composed. For example, raw material, size, shape, and colour

among others. A group of artifacts possessing a unique combination of attributes can be said to be associated.

ASSOCIATION

Any group of artifacts found together in the same stratum or the same Tomb. The association may either be open or closed. An open association may be a stratigraphic question. Association here is considered, possible or probable. In a closed one, the association is certain, since the artifacts are found in a scaled stratum.

ARTIFACT

Anything constructed or modified by man.

CUTTING

An uni- or bi- directional longitudinal motion with the edge, parallel to the direction of use and approximately vertical to the worked material. Both surfaces being in contact with the worked material.

CHOPPING

A percussive motion of use transverse to the working edge, where both surfaces are in equal contact with the worked material. Contact angle is approximately 90 degrees.

EDGE

Edge in this study refers to the working section of the tool.

FACIES

A geographical variant of an industry.

HARDNESS OF WORKED MATERIAL

The following classification is used in this study.

Soft Materials: Meat, Plants, Woody plants, Backs, Fresh skin, and fresh softwood.

Medium Materials: Other wood, Fish, soaked antler, dry hide, soft stone (like cortex) and horn.

Hard Materials: Dry antler, Bone, Shale, and stone.

INDUSTRY

Consists of an assemblage, mostly with artifacts of one kind of material that are generally limited in content. Artifacts in the same industry, have similar

typological configurations, and are made using the same technology. Similar assemblages belonging to one industry can be found located on different sites, as is the case in this study.

MOST PROBABLE USE

This term is used here because, Use wear analysis is an interpretive technique and it is unsound to make deterministic statements.

PHASE

This is the minimum period of time that can be recognized from changes in a tradition.

PIERCING

As used in this study, it refers to a rotational or transverse motion designed to penetrate the material. The motion is transverse when pushing the tool through penetrates a soft material. For instance, piercing the skin of the goat used in this study involved no rotational motion.

SCRAPING

A transverse motion which can be uni- or bi- directional. If bi- directional, it can be away or towards the user.

SUB- ASSEMBLAGE

Represented by artifacts used by sub groups in community. For example, one industry may represent a sub assemblage within the same large community.

SAWING

A bi- directional longitudinal motion with the edge parallel to the direction of use and approximately at the right angles with the worked material.

TRADITION

Archaeologically defined, traditions consist of the persistence of a series of cultural forms or types through time. They evolve out of one another over a given period of time. The important thing in the definition of a tradition is the persistence through time and not size and complexity. Different traditions vary in complexity in their rate of change and in the direction in which they change.

TYPE

A homogeneous group of artifacts that share a large percentage of attributes and or contrast with other similarly defined groups.

TYOLOGY

A system of classification based on attribute similarities and differences. It arranges artifacts into different categories according to such attributes as shape, style function among others. The system has got a representative number called type series.